

PODCAST EPISODE TRANSCRIPTS

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**Episode 1: Welcome to the NERRS**

**Kaitlyn Dirr 0:19**

Hey there, my name is Kaitlyn Dirr and welcome to the NERR or Far podcast. In today's introductory episode we're going to be going through the basics, starting with: what are the NERRs?

NERR is actually an acronym. NERR stands for National Estuarine Research Reserve and the reserve system is a network of 30 coastal sites created to protect and study estuarine ecosystems. The word estuarine describes an environment where freshwater meets saltwater, most often an area where a river meets the sea. In this series, we will be looking at seven of these sites in the southeastern United States. To help get us started is Keith Laakkonen, Director of the Rookery Bay Reserve in Naples, Florida and the current president of a nonprofit NERRA.

**Keith Laakkonen 1:16**

Research reserves are an amazing resource and today, the NERRs protect over 1.4 million acres of really important coastal estuarine lands in 24 states and Puerto Rico. The reserves have really been known for delivering really critical science to communities and how this science can impact those communities and how they can adapt to changes over time. And so, what we say with reserves: we're "locally significant, nationally impactful". And all of us together are really moving the needle on national science and policy needs. I think people might hear all those letters and words and wonder exactly what a National Estuarine Research Reserve is. It's- it can sound really confusing, but basically, we just want people to know that these are your places. These are places that you have the ability to visit, enjoy and protect. And everyone there always says that these are sort of the best kept secrets on our coastline. We want to change that. We don't want these to be secrets anymore. We want the nation to really understand that these are their shorelines. These are there because local, state and national conservation organizations have protected these lands so that they'll be here for generations to explore and enjoy.

**Kaitlyn Dirr 2:32**

Like Keith said, these are your places. The reserves exist as spaces to protect and study nature. What makes the NERRs unique is their strong partnership with the community. A partner program between the National Oceanic and Atmospheric Administration, also known as NOAA, and the coastal states, the reserves have four pillars, or focuses. These pillars include stewardship, research, coastal training and education. Sometimes the best way to learn more about something is by exploring and having hands-on experiences. Here to talk more about the value of hands-on learning is Lori Davis, Education Coordinator for the North Carolina NERR.

**Lori Davis 3:14**

I totally see a difference if a kid is able to experience something firsthand. So like I said, you know, these sites have been set aside for a reason. Yes, we want to have the general public come visit them, but having young scientists... and I consider all the students that come visit me as scientists because by the time they leave, I want them thinking about something that they learned new, whether it's about the water quality, whether it's about the environment around them, a plant or an animal or something that they saw. I want them to continue thinking about that. And I think that in a world that has become more virtual, that we get used to watching a video and then we talk about something or we hear somebody talk about it

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and show pictures or they might bring in an item and then we talk about it. We have to get people out into the environment. It doesn't have to be an estuary, it could be a rainforest, it could just be in the backyard exploring, and I just feel like we need to get outside more. It's really important for kids to be out there. They need to feel stuff, they need to smell it. They need to see it. They could- it's just it's just a magical place, I think.

### **Kaitlyn Dirr 4:46**

Another way to learn about our estuaries firsthand is by taking advantage of recreational opportunities at the NERRs. The NERRs aren't just places for staff and scientists to use and enjoy. Their goal is to be accessible to the people who live there, as well as visitors to the reserve from around the country. Push any ideas of researchers in stuffy lab coats out of your mind because it is much more likely to find these coastal scientists getting their hands dirty out in the field. You too can get out into the estuary and use reserve lands to go kayaking, bird watching, fishing; the options are seemingly endless what you can do recreationally within the NERRs. The NERRs want you to know that they are here for you to visit, enjoy and protect.

### **Lori Davis 5:33**

I do think the public sometimes thinks since our sites are very different from state parks or federal parks that we don't want the public or just visitors over there that can come on their own. So I think they get a little confused there. Which- which is understandable because we are different than the park system, both state and federal. We have different missions. Our missions aren't just to get people over there, we have other missions too, of the research and the education.

### **Kaitlyn Dirr 6:06**

So let's look at those missions and some of the differences between the NERRs and the National Park Service. According to the NERRS Science Collaborative, the mission of the National Estuarine Research Reserve System is "to practice and promote stewardship of coasts and estuaries through innovative research, education and training using a place-based system of protected areas". The mission of the National Park Service is "to preserve unimpaired the natural and cultural resources and values of the national park system for the enjoyment, education and inspiration of this and future generations". Though they may seem similar, what sets the NERRs apart from parks at the national and state level is this focus on place and the idea of a strong working relationship with the local community. There isn't as much of a focus on preserving the sites exactly as they are. Instead, these reserves are a sort of living laboratory where scientists can study and monitor estuarine systems, students and visitors can learn hands-on, and all kinds of coastal decision makers can discover ways to better manage coastal resources through various trainings. Both parks and the NERRs have numerous programs to help foster environmental stewardship and to manage protected lands. When it comes to the NERRs though, goals and initiatives, whether they be stewardship related or more research-focused, are crafted specifically with coastal areas and estuaries in mind, as well as the associated local economies. The NERR system truly earns the title "locally significant, nationally impactful" through its work to address priority issues unique to the reserve coastal communities as well as common threats across the National Reserve System. Eric Smith, manager of the North Inlet-Winyah Bay Reserve in Georgetown, South Carolina is here to detail some of those local priority issues as well as factors that threaten reserves throughout the southeast.

### **Erik Smith 8:13**

Well, I think we have two that are really at the top of the list. South Carolina is one of the fastest growing states in the Southeast. In fact, we have Charleston just to our south and Myrtle Beach just to our north. Both of those are on the top 10 fastest growing metropolitan areas in the country. And... well, everybody likes to live on the coast. But that comes with some consequences and the impacts of coastal development, and how to balance developing the coast and maintaining coastal economies with the nature and the important ecosystems and habitats that support all of that economy and development is a real

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priority for us. And then of course, layered on top of coastal growth and rapid development is a changing climate. The seas are rising, the temperatures are warming, things are shifting as a result of climate change, and how that is going to affect the coastal zone, the important ecosystems that support our economies is really our other big priority. So, coastal development and climate change.

### **Kaitlyn Dirr 9:39**

How the NERRs across the Southeast are addressing coastal development and climate change is something we'll dig a little deeper into later in the series. These are some big issues that even government agencies beyond NOAA and the NERRs are currently exploring and will continue to explore in the years to come.

### **Erik Smith 9:58**

And then of course, sort of underpinning all of that is understanding and maintaining the biodiversity of the coastal zone. That includes threats like invasive species, changes in biodiversity as a result of development, climate change, the moving of species due to commerce and ships and things like that.

### **Kaitlyn Dirr 10:29**

Through stewardship, research, coastal training and education, the NERRs are working to create more resilient and better informed communities on our coasts in the face of a changing world and climate. Throughout the series, we will dive deeper into each of these four reserve focuses and learn more about the importance of estuarine habitats and the organisms within them. Until next time, I'm Kaitlyn and this is NERR or Far: The Reserves Are Where You Are.

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## **Episode 2: Effectively Communicating Science**

### **Kaitlyn Dirr 0:19**

Hey there, my name is Kaitlyn Dirr and this is the NERR or Far podcast. On today's episode, we are going to be talking about some of the legislation and policy related to the NERRs, as well as the Coastal Training Program and the importance of effectively communicating science to those beyond the field.

Before we get into some of the legislation that led to the creation of the NERRs, let's review what the reserve system is and introduce NERRA, an organization that plays a big role in the success of the reserve system not only here in the southeast, but also nationwide. Here to speak on the importance of the National Estuarine Research Reserve Association is Keith Laakkonen, NERRA president and the Director of the Rookery Bay Reserve in Florida.

### **Keith Laakkonen 1:13**

So, the research reserves are an amazing resource and today, the NERRs protect over 1.4 million acres of really important coastal estuarine lands in 24 states and Puerto Rico. The reserves have really been known for delivering really critical science to communities and how- and how this science can impact those communities and how they can adapt to changes over time. And so, what we say with reserves: we're "locally significant, nationally impactful", and all of us together are really moving the needle on national science and policy needs. And NERRA, of course, is what is supporting the research reserves. NERRA was created to advance the work and mission of the reserves and raise the profile of the NERRs. I said nerds, did you catch that? That's actually sort of sort of a slip there, that we talk about people at the reserves being nerds, and we actually are NERRs. But as far as NERRA goes, we really are a collective voice, and we can speak to Congress, we can speak to NOAA, we can speak to our partners all over the country on the important work that the reserves are doing, and really raise the bar in advocacy.

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### **Kaitlyn Dirr 2:25**

One very important thing that NERRA advocates to protect is the Coastal Zone Management Act, or CZMA. The CZMA was passed by the US Congress in 1972, and is an act administered by NOAA, the National Oceanic and Atmospheric Administration. According to NOAA's Office for Coastal Management, the CZMA is designed "to preserve, protect, develop, enhance and restore the nation's coastal resources". The Coastal Zone Management Act outlines three national programs, the National Coastal Zone Management Program, the Coastal and Estuarine Land Conservation Program, and the National Estuarine Research Reserve System (the NERRS). 2022 is the 50th anniversary of the Coastal Zone Management Act. Let's see how NERRA is celebrating this milestone.

### **Keith Laakkonen 3:19**

So the Coastal Zone Management Act, or CZMA, (another one of those acronyms) is really, like you said, a cornerstone of what we do. And NERRA has been supporting and helping celebrate the CZMA on social media, but we've also been working with our members of Congress to advance the reauthorization of the CZMA itself. And some of the challenges that we're facing around the nation: we do need a stronger CZMA, one that enhances successful programs like the NERRs, delivers effective coastal management, improves community resilience in a changing climate, and benefits communities and economic sectors dependent on these healthy natural resources. So there's several national congressional efforts which are going forward, and all this is definitely amplifying the importance of the CZMA in its 50th anniversary.

### **Kaitlyn Dirr 4:09**

Beyond the Coastal Zone Management Act, there has been a number of other efforts, both globally and within the United States, to protect valuable ecosystems like estuaries. An example of this is the US Biosphere Network and the World Network of Biosphere Regions. In 1983, the United Nations Educational, Scientific and Cultural Organization, or UNESCO, designated the Apalachicola Biosphere Region. Here to tell us more about biosphere regions is Anita Grove, the Coastal Training Program Coordinator from the Apalachicola Reserve in Florida.

### **Anita Grove 4:47**

[Biosphere regions] are special places that in the US that are kind of set aside to preserve biodiversity, culture, and economic value. So they're a little bit different from a marine sanctuary. They want to work with the traditional economy to enhance it and enhance the kind of sustainable economy like oystering. It's a framework and it- it's projects that preserve biodiversity and nature but also enhance people's livelihood and the environment. They see humans as being part of that living community. It's just a little bit different way to look at it. And they also are learning places and places that science is done. But they also want to include- and I think the reserves try to do this too, so it works very well with our reserve designation- they want to bring the local people into the reserve or the biosphere region to help with the decisions that are made. There's 28 biospheres throughout the United States, and we are currently working together to build the biosphere network within the US and make it more well known.

### **Kaitlyn Dirr 6:09**

Biosphere regions are nominated and maintained by national governments, but the great thing about them and what connects them to their purpose is that they're run by local organizations. Through the designation of these regions and partnerships between community members and public land managers to come up with practical solutions, the US and World Networks are achieving great strides towards a more harmonious relationship between humans and the natural environment. In summary, biosphere regions aim to: 1) promote biodiversity and healthy ecosystems, 2) inform local decision-making through a combination of education, research and open dialogue with the community, 3) create a balance between the needs of people and nature, taking local culture and economies into consideration and 4) truly work as a network where regions globally can share knowledge and learn from the experiences of other regions.

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As Anita said, it is easy to see how the goals of these regions go hand-in-hand with the designations of the local reserves. Getting back to the NERRs, let's talk about one of the reserve focuses: coastal training. The coastal training program offers diverse training opportunities to the community, including courses as unique as "An Introduction to Shorebirds for Ecotour Guides". But how can these reserve programs help improve decisions about coastal resources in the Southeast and spark better relationships with local businesses?

### **Keith Laakkonen 7:42**

That's a really great question and the coastal training program or CTP, as we call it, is a really unique piece of the National Estuarine Research Reserves. And we're really geared towards coastal decisionmakers. So we say the difference between coastal training program and education is people in the education program, they sort of pay to be there right? They pay admission to go to the ELC, whereas coastal training folks are paid to be there. They're actually learning skills to help them be better coastal decisionmakers as part of their jobs. So, what's a coastal decisionmaker? Well, that involves anybody of course from elected officials, city and local planners, folks from the water management district, people who issue permits... realtors are very important coastal decisionmakers because they understand what's going on. And as you said, even people like the ecotour operators. And so, by hosting these programs at the reserve, the CTP program is able to get information in professionals' hands that will make them better understand how they also have the ability to protect places like Rookery Bay and our coastline.

### **Kaitlyn Dirr 8:47**

The Coastal Training Program works to promote scientific understanding amongst a variety of different decision-making audiences in coastal communities. Erik Smith, the manager of the North Inlet- Winyah Bay Reserve in South Carolina, is here with more on the importance of effectively communicating science to those beyond the field.

### **Erik Smith 9:07**

Effective science translation and communication is really central to what we do. Sure, we like to do research and train students and publish papers and get it out there in the scientific literature. But science in a vacuum, science just published in those journals that only scientists read is not enough. We need to get that scientific knowledge and understanding into the hands of the public, into the hands of the decision makers as we like to call them (that's the primary audience of the Coastal Training Program) so that they can use the best available information to make decisions on coastal management issues. We don't as reserves, as scientists advocate (push one position or another). But we've- really important to make sure that the decisions that affect all of us who live in the coastal zone are informed by the best available information. And so, the Coastal Training Program is really so important in being the vehicle to translate, disseminate, communicate science and our current understanding, facts to the decisionmakers so we collectively as a society and as communities can make the best decisions for the coastal zone that we call home.

### **Kaitlyn Dirr 11:03**

The ability to communicate science to those be on the field is crucial to informing coastal decision-making. It also plays an important role in fostering stewardship and a love for the environment in others. Here with more on being a good communicator and educator is Josephine Spearman, Education Coordinator for the GTM Reserve in Florida.

### **Josephine Spearman 11:26**

I think it's really important because it helps your audience to- to actually not just get an understanding of what it is that you do and why it's important, but to feel connected. So I think a good communicator or educator not only informs but connects their audience to what they're trying to teach so that they care. So you know, when we bring students out here, we want to teach them about what an estuary is, what are the

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functions of it, but get them excited and like you know, get them holding that fish and they're like, "wow, that's so cool!" and "this is in my backyard?" and "I really, you know, felt connected with the animal ambassador, that the diamondback terrapin that we got to meet today". And so then they feel like almost like an ownership and then they want to protect this place. So I think- I think those are good things to keep in mind when communicating.

### **Kaitlyn Dirr 12:12**

One of the most important questions that we have to answer in science is why should we care? Why should we care about the coastal zone? Why should we care about estuaries? Providing the answers to these questions, whether it be through coastal training courses, forming connections through experiences on the estuary, or drafting policy to conserve our coastlines, is what keeps these places beautiful and communities engaged in their protection. The NERRs play a priceless role in informing communities on the coast, and in the next episode, we will explore a number of coastal estuarine habitats and their benefits. Benefits we could lose without their study and protection. Until next time, I'm Kaitlyn, and this is NERR or Far: The Reserves Are Where You Are.

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### **Episode 3: Exploring Estuarine Habitats**

#### **Kaitlyn Dirr 0:19**

Hey there, my name is Kaitlyn Dirr and this is the NERR or Far podcast. On today's episode we are going to be talking about estuaries and the benefits of estuarine habitats.

First things first, what is an estuary? According to National Geographic, an estuary is "an area where a freshwater river or stream meets the ocean". When fresh water and sea water combine, the water becomes brackish or slightly salty. The saltiness, or salinity, of these estuaries can vary from season to season. In a rainy season, there's more freshwater so it'll be less salty, also known as less saline. In a dry season, when there's less freshwater, it will be more salty. There are a number of estuarine habitats on our southeastern coast. A few that we'll be focusing on today are salt marshes, oyster reefs, maritime forests, and mangroves. Before we dig deeper into the benefits of estuaries, let's look at the differences between each of these individual estuarine habitats. Salt marshes are a type of coastal wetland that is flooded and drained by saltwater that comes from tides. The soil within salt marshes is made up of a deep mud and peat. Now, peat is a very thick, spongy material that is made of a decomposing plant matter. Because the peat in marshes is usually underwater and decomposition is taking place, the amount of oxygen in this material can be super low. This state is known as hypoxia. "Hypo-" meaning under or beneath, and "-oxia" connects the word to oxygen. There are certain types of bacteria that love these hypoxic conditions, so they grow within the marsh soil. These bacteria produce hydrogen sulfide, which gives salt marshes a characteristic rotten egg smell. Now, there are a lot of different types of marsh grasses and different foliage that you can find in the salt marsh, but the most common salt marsh plant species in the southeast is *Spartina* (specifically, *Spartina alterniflora*, or smooth cordgrass). *Spartina* helps with erosion control, acting as a stabilizer as well as a wind and wave buffer. It can also help remove pollutants, and when it dies, it forms what is called "wrack" and decomposes, returning nutrients to the system. This is a big reason why salt marshes are the second most productive ecosystem on the planet. Another important habitat in estuaries is an oyster reef. Oysters like to live in brackish to salty coastal waters, making estuaries a perfect place to call home. Oysters often cluster on hard submerged surfaces and then fuse together as they grow, forming hard, rock-like reefs. That can then become a habitat for a wide range of other marine species. They'll make reefs on anything from piers to old discarded shells. Here with more on oyster reefs is Anita Grove, the Coastal Training Program Coordinator at the Apalachicola reserve in Florida.

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### **Anita Grove 3:35**

Oyster reefs provide a huge- ecosystem services, they're like little apartment complexes, oyster reefs, subtidal oyster reefs tend to be, you know, they can be six to eight feet high, and you know, that wide and they're like a reef or a bar. So when waves get churned up in the bay, they buffer those waves so that when they hit the shoreline, they're not as strong and they're not eroding away the shoreline. So that's a big service. Also that, that idea of a little apartment complex. It's for species. Oysters are keystone species, and they basically provide habitat and shelter for crabs and worms and just all sorts of marine creatures. So it's quite an interrelated, connected ecosystem.

### **Kaitlyn Dirr 4:24**

Anita called oysters a keystone species. In case you're unfamiliar with this term, a keystone species is any organism, whether it be an animal, bacteria or fungi, or a plant that sort of serves as the glue holding the habitat together. If it were to disappear or be removed, the biodiversity and structure of that habitat could completely change. The Apalachicola reserve is supporting these keystone species through a shell recycling program as well as a new oyster aquaculture collaboration.

### **Anita Grove 4:56**

Yeah, so it was a great project that started during COVID We've had a relationship with the Forgotten Coast of- the Conservation Corps of the Forgotten Coast. And that is a group of young people who are... it's modeled after the 1930 version of the CCC, which is the conservation organization. They built trails, they built launches, all sorts of things around the country in the 1930s. This is modeled after that, it's to take high school-aged and young adults and train them in environmental management, learning trail maintenance, all sorts of things. So I've always had the idea that we have so many oyster shells that we don't know what to do with them. Paved roads, alleys, all sorts of things for years, but now we find ourselves in an oyster shell deficit. So I started a recycling shell program with them in which they go to the restaurants that serve the oysters and they recover the shell and then we can clean it, dry it and then put it back out into the bay.

### **Kaitlyn Dirr 6:03**

Next up is the maritime forest. Maritime forests, a type of shoreline estuary along coastal barrier islands, are constantly changing and moving with a changing shoreline. These forests are typically surrounded by a layer of dunes on one side and salt marsh on the other, but don't completely escape the impacts of ocean winds and salt spray. For this reason, there's a canopy of shrub-like foliage to protect less tolerant interior trees. One state in the southeast that has a lot of maritime forest habitat is North Carolina. Here to talk more about these forests and the diversity of the state's coastline is Lori Davis, Education Coordinator of the NC NERR.

### **Lori Davis 6:43**

So, as you know, North Carolina is very diverse already. You can go from the coast to the mountains in one day and cross through the piedmont there in the sandhills. And so even though just looking at our coastline, it's different already. If you start up north, we have a lot of plants that we don't want down south. And then one of our sites is mostly maritime forest, which is a great place that's kind of hidden between the estuary and the ocean that people forget about sometimes is the maritime forest. And then as you go on down, you know, beaches, the marsh areas, and people just don't realize that you can go study a mammal in the maritime forest, and it might or might not travel over to the estuaries or the beach. And you can trap- you can actually do experiments on different types of marshes, you know, ones that are very, very salty and ones that have more of a freshwater influence. And so I think because of our diverse coastline, that scientists can pick and choose where they want to, and always tell kids, you know, very different what's happening here in Beaufort, and what's happening up north in Kitty Hawk. And you know, they're getting a lot of different types of water coming in, their tides are different. And it's just neat

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to pull up a map so they can see the differences in our coastline.

### **Kaitlyn Dirr 8:17**

Lastly, mangroves are a type of tropical tree or shrub that live in the coastal intertidal zone. They're able to survive and thrive in conditions that many other trees could not. This hardy group tolerates brackish to salty coastal waters, and the never-ending ebb and flow of ocean tides. Their roots even create incredible underwater nursing environments for many marine species. So what value do marshes and oyster reefs and these other estuarine habitats bring to states here in the southeast? Here to tell us more is Josephine Spearman, the Education Coordinator at the GTM NERR in Florida.

### **Josephine Spearman 8:58**

An incredible amount of value actually. So our oyster reefs and our salt marshes are part of the protection and stabilization of our coastline. They act as buffers, absorbing floodwaters during hurricanes and excess energy from boat wakes. They also act as carbon sinks, they act as nursery grounds and also a huge part of like the filtration process of the estuary. So it's so funny, when I teach kids in our program we talk about the three main functions of an estuary: storm protection, filtration and nursery and these two habitats do all that.

### **Kaitlyn Dirr 9:36**

Storm protection, filtration and nursery. These are the three main benefits or ecosystem services of estuarine habitats. Let's look at storm protection. Estuaries have an incredible ability to serve as important buffer zones. These habitats soak up excess water during flooding and stabilize shorelines, absorbing wave energy, protecting streams and shores from excessive erosion. In the event of a hurricane or tropical storm, estuaries are a line of defense for inland habitats and communities. And it's not just flooding from hurricanes that estuaries can help control. It's any kind of flooding.

### **Anita Grove 10:16**

So when we have and the towns above us have, which are many, all the way up past Atlanta, when those two states get a lot of water, it can go into the river and it's not really going to affect us because the water can spread out onto the floodplain and it spreads out and goes in all these sloughs and swamps and then is absorbed. It's also a carbon sink you know, it absorbs a lot of carbon.

### **Kaitlyn Dirr 10:45**

This is another benefit of estuaries, they're carbon sinks. A carbon sink is anything natural or unnatural that collects and stores some carbon containing compounds for an indefinite period of time. By doing this, they remove CO<sub>2</sub> from the atmosphere! Our next benefit is filtration. Salt marshes and mangroves, with their spongy peat and marsh grasses or complex matrices of tree roots, are like the Brita filters of coastal communities. They filter out all sorts of things, from herbicides and pesticides, heavy metals from industry, to excess sediments and nutrients from runoff. This is an incredible benefit, but not something to be taken advantage of. Declines in estuarine water quality can endanger aquatic life and impact human health. The NERRs do an incredible job of monitoring water quality through their System-Wide Monitoring Program (also known as SWMP). This is something that we'll explore in a later episode. Lastly, estuaries serve as a nursery for many species, creating a unique space for reproduction and early life. The mud and food particles brought in by the tide settle in some parts of estuaries where the water is more still, and hard structures like mangrove roots provide a degree of protection. These safe conditions are ideal for organisms to grow, feed and have young. Estuaries provide such great benefits to our coastal communities. It's important to study and protect these habitats. That's the purpose of the NERRs, and it's something that we can also help out with. Our activities on land can have a big impact on the health of our estuaries. We'll talk a little bit more about ways to be a good environmental steward and to protect the health of estuarine habitats in a later episode. For now, I'm Kaitlyn, and this is NERR or Far: The Reserves Are Where You Are.



### **Episode 4: Protecting Cultural Resources**

#### **Kaitlyn Dirr 0:18**

Hey there, my name is Kaitlyn Dirr and welcome to the NERR or Far podcast. On today's episode, we are going to be talking about the significance of archaeological sites across the NERRs, as well as the importance of protecting cultural resources.

People have been living along our coastlines and in estuaries for a very, very long time. Because of this, the National Estuarine Research Reserves, or the NERRs, have an important role in protecting archaeological sites and other cultural resources on their lands. Here to tell us more about the history of one of these NERR sites is Keith Laakonen, Director of the Rookery Bay Reserve in Florida.

#### **Keith Laakonen 1:06**

People have been part of the story of Rookery Bay going back over actually 4000 years, going back to Late Archaic period. And people have really lived with the environment for a long time. And you can see a lot of numerous... prehistoric shell mounds is what we call them. And these are dotted throughout the landscape, and they're now covered with tropical hardwood hammocks and a lot of other species which, basically, we have a lot of confidence that would not exist anywhere else except for these, for these shell mounds. And one of the reasons that these exist is because the diet of the Calusa Indians, who unfortunately no longer with us, was really high in protein, and they got a lot of their protein from the bountifulness of the estuary. Things like clams, and the gastropods and the fish really supplied them a very high protein diet. In fact, their diet was so good that the average Calusa male in the 1700s was, 16-1700s at the time of contact with Europeans, was about six foot tall. And unfortunately, European diets back then weren't as good. And so the Spanish, when they came over, describe the Calusa as being giants, as these six foot tall giants and- but it was basically because of the richness of the estuary that the Calusa were able to exist, not only exist but do successfully. And were actually one of the few non-agricultural Native American tribes in America. Basically, they had enough going on that they didn't have to farm, although there is pretty good evidence that they used aquaculture. There's also a lot of other history at the reserve, including some of the first people who settled Rookery Bay after the Calusa were gone were actually some of the, some of the veterans of the Civil War period. So folks coming out in the 1800s you know, who settled onto Rookery Bay and surrounding areas, just gotta imagine how tough those folks were but again, they came here for the same reason the Calusas existed so successfully for so long, it's the bountifulness of the estuary.

#### **Kaitlyn Dirr 3:25**

We can travel nearly 500 miles from Rookery Bay Reserve in Naples, Florida, to the ACE Basin Reserve near Charleston, South Carolina, and we will still find Native American shell mounds and rings in the estuaries. One thing that these sites across the southeast have in common is that they're currently threatened by storms and sea level rise. Here to tell us more about the importance of these sites and what we can learn from them is Julie Binz, manager of the ACE Basin Reserve.

#### **Julie Binz 3:54**

Yeah, we have done a lot of work with our state archaeologists about our Native American sites. They have worked as quickly as they can to understand and document the shell rings you know, shell mittens and other types of evidence of human settlements that go back 1000s of years that are severely eroding due to all of these original factors you talked about before. We've learned a lot of things about the abundance of our oyster populations 4000 years ago or other different species that were used for food, we

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can tell how people moved around based on the availability of different resources, how they really lived in connection with the environment, right, how they use it to their advantage, and were so resilient in the face of the different environmental threats that we can face. And so it's really interesting. I was so surprised to learn how many sites are along the southeastern coast and how many of them are in danger of being inundated in the near future. So it's kind of this race against time to learn what we can about these civilizations before they're underwater.

### **Kaitlyn Dirr 5:17**

Native American archaeological sites give us a glimpse into the history of estuaries and coastal communities in the southeast. Sadly, as our planet warms, sea level rises, and storms become a greater issue, scientists and archaeologists are in a race against time to study and gather all that they can from these incredible cultural resources. In our introductory episode, we introduced two priority issues that the NERRs of the southeast are working to address. One was a changing climate, and the other was determining the impacts of coastal development. Another community that has had a big role in the history of our southeastern estuaries and a community that is dealing with the impacts of coastal development is the Gullah-Geechee community. The Gullah-Geechee are descendants of enslaved West African people who worked on coastal plantations from North Carolina to northern Florida. The Geechee people still maintain many unique West African traditions and elements of their language and culture. Some historians believe that the historic Hog Hammock community on Sapelo Island in Georgia is one of the last intact island-based Geechee communities in America. According to the island's Cultural and Revitalization Society, about 96% of the island surrounding the community is owned by the state of Georgia and cannot be purchased for development. This, in tandem with the fact that the islands can only be accessed by ferry or private boat, creates an environment that makes those who have called Sapelo home for generations subject to stress and fracturing from land loss, speculative developers, a lack of job opportunities and racism. Here to tell us more about the human history of Sapelo Island and the NERR's partnership with the Geechee community at Hog Hammock is Adam MacKinnon, Education Coordinator for the Sapelo Island NERR.

### **Adam Mackinnon 7:12**

You know, we have, I mean, we have this human history out here. It's unique. So I always say Sapelo's one place, it has evolved, you can go to different places to find a little bit of everything, but we have all the research history from Odum, you know, basically establishing modern ecology out here to you know, we had the Native American shell ring on north end that dates back 4500 years... this is, shell ring. We had the Spanish, the French, English were all out here. You have the Gullah-Geechee community. So you have this whole human element to this place. It's just a pretty unique merging of many different things that, so you don't have to- you go one place you get all these different experiences, you just choose and that's often one of the hardest things is choosing which one to focus on. There's so many things out here that are worth looking at. I mean just going to that little community is this is, as I said, it's probably the last intact Gullah Geechee community on the East Coast. That's on a barrier island. Most of the ones that are off barrier islands, they kind of, I won't say they've... it's more of a homogeneity over there so they really preserve more here. Although I will say there's not many people that can speak fluent Geechee or Gullah anymore. But it's- the culture is still alive. We have a culture day out here, where we sit, we help the community put this event on where they do the native, regular, the storytelling, the dances, the food to try and keep this alive out here. So these are pretty neat things...that Sapelo has. We try to partner whenever we can. So we also- I mean we have the labs open for- we have a lot of private vendors that do tours and so we allow them to come in here because we really spruce up the lab, made it kind of really exciting, you know, with new creative exhibits, touch tanks and you know all my years are not a game I got a ton of artifacts I've collected over the years. So it's just a resource for them. We hire from the community where we can, plus you know, on the side we have DNR, they help us too. We have a park, National Park and a state park. So- with a big mansion on it. So they try to hire locals whenever we can. And we we used to have interns a lot, but there's not many kids left on the island. So that kind of fell by the wayside. They all

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have to go to school on the mainland and so you don't see them a lot. But we also support, there's nonprofits out here, one is Save Our Legacy Ourselves. They have an intern, so we pay for that intern for them. And then we have SICAR, the South Island Cultural and Revitalization Society. We pay for an interpreter there. So we're trying to help them without kind of getting in their business. We're giving them the freedom to make their own decisions. But we're just gonna support them where we can when we can. They're a wonderful group of people. That said, I'm an endangered species guy, but I can look at that community over there just like an endangered species. They used to be sore of about 700 of them in like the 1910s and now there's like 30. As being... Sapelo's slowly transformed into kind of a vacation weekend place and because it's private property, they can do whatever they want. And we can't really say oh, you shouldn't sell it, but that's basically all they have. So we try to work with them and make good management decisions and you know, there's flooding in the community. So we're, we're trying to work with them through their one of their interns to help solve this flooding problem, you know we had Irma, which basically flood most of the island, helping with assistance for that kind of stuff. So whenever we can, we partner because they're essential to what we do out here. They're, they're... we have to be partners because we're neighbors.

### **Kaitlyn Durr 10:38**

As Adam said, the Sapelo Island NERR works closely with the Sapelo Island Cultural and Revitalization Society or SICARS. SICARS is a local society whose mission is "to preserve and revitalize the Geechee community on Sapelo Island". They have initiatives related to community education, land use planning and sustainable development. To learn more, please check out their website. More cultural resources and reminders of the history of our southeastern estuaries are the horses at the Rachel Carson and Currituck sites of the North Carolina NERR. Lori Davis, the reserve's Education Coordinator, is here to tell us more.

### **Lori Davis 11:18**

So back long ago 1920s ,1930s around Beaufort, the body of water that separates town proper and what is known as the Rachel Carson reserve now, that body of water was really shallow and so people from the town would bring their animals over there to graze. It was free grazing for them. And so a gentleman who brought his horses over there to graze, he ended up passing away so they became feral. So when the state of North Carolina took over the management of the reserve, we decided to leave the horses on there because they're a cultural resource to our community. And we just love seeing them. Of course, the site was bought for the estuary and not for the horses. But, you know, growing up in seeing those horses, you know, we have stories that they're descendants of Blackbeard and of course they're just stories we know that's not true, but we like to tell them, I still tell them to this day, you know, but it's just nice to see them over there. It's a hard environment for them. They do have to struggle to survive. But it's nice seeing- I mean it is kind of like a game, especially when I'm with students. Are we gonna see a horse today or not? Because there's not many on the island. So it's kind of fun to see.

### **Kaitlyn Durr 12:39**

The creation of many of the NERRs in the southeast was made possible by a number of conservation organizations and government agencies. But in the case of the North Inlet-Winyah Bay Reserve in South Carolina, there was an important environmental steward who paved the way: Belle W Baruch. Erik Smith, Reserve Manager, has more on her connections to North Inlet.

### **Erik Smith 13:02**

It's a shame that Belle did not live long enough to see the establishment of the reserve because I think she would- I think the mission of the reserve is exactly what Belle was thinking about when she left this property in trust for the purposes of research and education. Who was Belle? She was this amazing woman who happened to be the daughter of Bernard Baruch, a wealthy New York City financier who bought the property shortly after Civil War and the collapse of the rice plantations, and he bought it as a hunting property and enjoyed it as a winter retreat. His daughter Belle came down here and realized what

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an amazing piece of property, what an unusual piece of property this was. And she saw how the other plantations, and this is in the late 60s, were getting developed and how the coast of, the coast of South Carolina was starting to be developed and she realized she needed to or wanted to leave this property intact and set up a trust that made this property available for research and education. And that that's so very much in line with the mission of the reserve, which is protecting and wise coastal stewardship of the estuaries through research and education. Unfortunately, she died a little bit young of cancer and never got to see the creation of the reserve, but I'm pretty sure she knows about it is really happy that it's here.

### **Kaitlyn Durr 15:07**

The National Estuarine Research Reserve System doesn't just study and protect our natural resources on the coast, they also play a role in protecting cultural resources and keeping the rich history of southeastern coastal communities alive. Whether it's an archaeological site, herds of feral horses, a community teeming with important culture and tradition, or hunting land turned living laboratory, reserves are committed to lending a hand and learning more. Julie Binz from the ACE Basin reserve mentioned something in our interview that I think best encapsulates what we've discussed in this episode.

“We have had people here for 1000s of years and they've been shaping the land and the water and the water has- and land has been shaping them and how they live. So we have just amazing stories about people: how they've survived in this place for so long and overcome storms and development and hardship and living in some of these really remote places.”

There's a lot that we can learn from these people and these sites. Storms, sea level rise, coastal development, and a number of other threats have created a race against time for those studying at the reserves, but hopefully we can learn more about the history of our estuaries before it's too late. Until next time, I'm Kaitlyn and this is NERR or Far: The Reserves Are Where You Are.

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## **Episode 5: A Glimpse Inside the Reserve Toolbelt**

### **Kaitlyn Durr 0:18**

Hey there, my name is Kaitlyn Durr and welcome to the NERR or Far podcast. On today's episode, we are learning more about living shorelines and the various management techniques used by the National Estuarine Research Reserve System.

Before we get started, what are living shorelines? NOAA, the National Oceanic and Atmospheric Administration, says that living shorelines "connect the land and water to stabilize shorelines, reduce erosion, and provide valuable habitat that enhances coastal resilience". Living shorelines utilize natural elements like plants, rocks and sand to stabilize estuarine coasts, sometimes in combination with existing harder shoreline structures, like bulkheads or sea walls. Living shorelines are a creative and cost-effective way to add resilience to communities on the water as well as provide valuable habitat for wildlife. They are also beautiful green space! Living shorelines can replace aging structures like old boat launches or docks. Another benefit is that they will grow over time, unlike hard structures, which may end up hindering the growth of aquatic life. Living shoreline treatments lie on the spectrum from green to gray. Green shorelines are designed using more natural, softer techniques, whereas gray shorelines are less natural, using what's considered harder techniques. An example of a more green living shoreline is a vegetation-only shoreline. This type of living shoreline would be useful in low wave energy environments to provide a buffer to upland areas. This type is considered a non-structural method. An example of a gray shoreline technique would be installing a bulkhead: a vertical wall parallel to the shoreline. Areas highly vulnerable to storm surge and powerful waves use bulkheads to hold soil in place. This is considered a

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coastal structure, not a living shoreline. A technique in the middle of the spectrum is sills. Sills are a hybrid type of living shoreline where a structure made of rock, concrete or oyster shell lies parallel against an existing vegetated shoreline. This technique reduces wave energy and prevents erosion in areas that don't commonly receive high wave energy. NOAA encourages using the softest, or greenest, approaches to shoreline stabilization that are feasible based on site conditions. Studies have found that during major storms, living natural shorelines perform better than a hardened shoreline and are less costly. The National Estuarine Research Reserves, or the NERRs, are doing a lot of neat work with living shorelines. Here to tell us how this management strategy has expanded from a habitat enhancement tool to use by coastal property owners in the southeast is Julie Binz, Manager of the ACE Basin Reserve in South Carolina.

### **Julie Binz 3:25**

Yeah, I love this story. So we have been working on living shorelines for years and this has been a great opportunity in the ACE Basin region but really all along the South Carolina coast. Our researchers have investigated different materials and methods that are the most effective to build living shorelines. Combinations of oyster reefs and marsh grass planting, other natural materials based on what that site looks like. So what would be the most effective for that particular area? So our researchers have done extensive testing and monitoring of living shorelines. Then some of our other staff have worked with the community in how community members, say you live on... your house is on the marsh, how you would go about installing a living shoreline instead of a seawall to help prevent erosion, and how that mechanism would work, along with other partners, permitting agencies and all those kinds of things that need to happen to build more living shorelines on our coast. Our education section has gotten into it where we have a school-based program, "From Seeds to Shoreline", where kids grow marsh grass at school and then plant it in those areas as living shorelines. Our stewardship sector does that as well with adult groups and with different community organizations. So it really has gotten all of us in the reserve involved in furthering living shorelines in our state and now people of other places and other organizations kind of look to us for that kind of expertise.

### **Kaitlyn Dirr 5:03**

Another living shoreline project is in the works at the Apalachicola Reserve in Florida. Here to tell us more about a neat new NERR partnership is Anita Grove, Coastal Training Program Coordinator at the reserve.

### **Anita Grove 5:15**

There's a large living shoreline project that's going to take place starting in the fall and it is with several partners in the region and it is to protect the highway between Apalachicola and Carabelle, which is the the two towns in the county that are right against the water. And what happens during a hurricane or even winter storms, just normal shoreline erosion, the water is now right at the edge of the highway. So every time you have a hurricane, it takes out these little chunks of the road and you have to detour around it and it's kind of our only road. So what they're going to try and do is plant Spartina and other plants into the water and recreate a marsh in front of it, hoping to create a barrier that absorbs those waves. We- we call them living shorelines and we've had quite a few here in our area that the reserves started many, many years ago. So they've been very successful. And now the Federal Highway Administration and the Florida Highway Department of Transportation have given a grant to let this happen. And we're really excited to see how it how it works. Hopefully, our route out of town will be preserved by that. So we're excited to see and- they've done a lot of they've done about five years of studies. They really think it's going to work well.

### **Kaitlyn Dirr 6:51**

Some of the NERR staff that take care of estuarine lands are referred to as reserve land managers. What are reserve land managers, and what are some ways in which land managers foster sustainable natural

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ecosystems in the southeast?

### **Anita Grove 7:06**

Reserves have four main sections that we divide ourselves into: one is research, which is the foundation of the reserve system, and then stewardship, education and coastal training and that's what- what area I oversee. And the stewardship section is the section that over- does land management and they actually manage that area between the land and the water because you know what you do on land impacts the water, and they also manage our public access so they all develop kiosks and maps that people can use to hike on these places that we manage and maintain a place where you can get out, leave your car safely and they also do burning. We do prescribed burning in Florida which is we believe helps manage the land so that when if you have a lightning strike or something like that the fire doesn't burn uncontrollably. So they burn periodically to reduce the vegetation and things that wash up from the water that are highly combustible. So they burn that so it's less fuel for a fire if it was to start. They also manage for invasive species, which can overtake a natural habitat, so they try to get out, cut them down, maintain trails so that people can actually access the lands we have.

### **Kaitlyn Dirr 8:35**

One term that Anita mentioned was invasive species. An invasive species is any type of organism that is not native to a particular environment, and can cause harm to this area. Some invasive species are brought to a new area on purpose to serve as a method of pest control or as pets, but in many cases, their introduction is actually accidental. Maybe they traveled in the ballast water of ships, or they were transported cross country with a crop harvest, or they were even just a bug that hitched a ride in a car. Since these species are not native to their new environment, there are often no predators to hunt them, and they can even outcompete many native species for food. Unchecked, these organisms can cause a lot of harm to the environment, as well as the economy, damaging property and hurting yields from a variety of industries. Anita also mentioned prescribed or controlled burning. What is controlled burning and how is it used by biologists for land conservation at the reserves? Here to answer that question is Julie Binz from the ACE Basin Reserve in South Carolina

### **Julie Binz 9:42**

We have a long history of controlled burning in this part of the country, in the southeast. Our pine forests grew adapted to fire, that's a very natural occurrence to them. It's usually by lightning. We've even seen evidence of some of our Native American tribes using burning to flush game or to clear the landscape or other types of habitat management a lot in the way we do now. Our biologists use controlled burning to mimic that natural process. So if we can burn areas of our pine forests, we can clear the brush and the understory and leave that open expanse of pine, ideally longleaf pine that was common in this area before there were large settlements of people. And our biologists also use it to manage invasive species, invasive plants so that helps keep those down as well and kind of reverts the habitat back to the way it would have been maybe a few 100 years ago.

### **Kaitlyn Dirr 10:48**

Controlled burns, as ironic as it sounds, help prevent destructive wildfires by ridding the forest floor of flammable debris like dead leaves in a more controlled, monitored setting. As Julie said, these burns can also destroy invasive plant species. Additional benefits include returning nutrients to the soil through the ashes of vegetation, clearing space to give young trees more sunlight for growth and reducing insect populations. Some species of pine even have cones that need fire to germinate, or to begin growing the seeds within them. Another management technique is beach renourishment. In beach renourishment, sand is moved from areas offshore to resupply eroded beach areas. But where does the sand move over time? Where does it go after a storm? These are questions that the North Carolina NERR and partners at the University of North Carolina at Wilmington are investigating. Andrea Hawks and Joe Long have been investigating long-term effects from Hurricane Florence on Masonboro Island, as well as the impacts of

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beach renourishment in this area. Sand was deposited along portions of the southern end of the island, and since then, they have been tracking changes to the beach profile and sediment composition. The goal is to develop long-term predictive models to help folks understand how the sand will move and what the island might look like in the future. The NERRs do an incredible job of managing reserve lands through a variety of management techniques, from living shorelines to controlled burns. Through careful stewardship of our estuaries and coasts, reserves of the southeast are helping to improve coastal resiliency and preserve biodiversity. On the next episode, we'll have a chance to learn more about all the great things going on related to stewardship at the reserves, as well as how you can be a good environmental steward. Until next time, I'm Kaitlyn and this is NERR or Far: The Reserves Are Where You Are.

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### **Episode 6: Environmental Stewardship 101**

#### **Kaitlyn Dirr 0:19**

Hey there, my name is Kaitlyn Dirr and welcome to the NERR or Far podcast. Today's episode is all about environmental stewardship.

So what does it mean to be an environmental steward? Here to tell us more about stewardship and how the National Estuarine Research Reserves play a role as stewards in the southeast is Erik Smith, manager of the North Inlet-Winyah Bay Reserve in South Carolina.

#### **Erik Smith 0:52**

I think stewardship is probably the most important thing we do and it embodies every aspect of what the reserve does. There are a lot of different definitions of stewardship. I think the one that I like that sort embodies this notion of careful and responsible management of something that has been entrusted in your care. The coastal zone has been entrusted to us and we need to responsibly care for and manage it because it is so very important to us.

#### **Kaitlyn Dirr 1:35**

The coastal zone is important to us. You don't need to work at a reserve to be a steward of the coastal zone. We can all be caretakers of our environment. Keith Laakkonen, Director of the Rookery Bay Reserve in Florida is here with some ways to be good environmental stewards at the reserves and also in our own communities.

#### **Keith Laakkonen 1:55**

Yeah, so you definitely don't have to go to college or work at a research reserve to be a, to be a steward, as you said. There's a lot of stuff that you can do in your house and everyday life. You know, it's a small thing but native plants in your yard is very important for pollinators, for migratory birds, for wildlife moving through the area and your landscape, you know, make sure that you're putting down the proper and appropriate amount of fertilizer at the right time. Fertilizer is great for your yard, but if it washes off, it can be very harmful for the estuary by putting too many nutrients out there. When you're fishing, make sure you understand that if you're going to catch these fish that you understand how to exercise proper catch and release, that you're really protecting these fish because you just have an opportunity to engage with this animal for a short time and we certainly don't want to harm it after we release them. And also really respecting the space of wildlife. You know, we've talked about these nesting areas that are really important: when those birds are nesting or sitting on a beach, they're conserving their energy, and if people are disturbing them or impacting them, it's really going to impact their health and their fitness. So I really think that anyone just coexisting with wildlife in the environment is probably the best thing you can do to help protect these areas and be a good steward.

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### **Kaitlyn Dirr 3:16**

There are many small ways to have a big positive impact on our environment. The same thing holds true at the ACE Basin Reserve in South Carolina. Here's reserve manager Julie Binz to tell us more.

### **Julie Binz 3:30**

Ways that people can help protect the reserve? If you do come visit, we definitely want you to come visit, we definitely want you to share your experience with others and let everyone else know what you thought about the place, but then also, please remember to try to minimize your impact on the environment. We're trying to balance people being there and enjoying it but also allowing a safe space for wildlife and nice healthy habitat. So if there are signs or rules, please make sure you're following them. Don't go past the shorebird signs. When the shorebirds aren't nesting, don't bring dogs if it says no dogs, all of those things. All the rules are easily displayed easy to find on the website and we just ask that people minimize their impact and "leave no trace" when you're enjoying these places.

### **Kaitlyn Dirr 4:23**

What does it mean to "leave no trace" at the reserves? Here to answer that question is Anita Grove, the Coastal Training Program Coordinator for the Apalachicola Reserve in Florida.

### **Anita Grove 4:35**

Just have that mindset that you're going to take all the- try to leave only footprints as they say and take trash with you, put out fires that you start if you're camping, don't- you know we have a lot of artifacts that wash up on the beach from earlier peoples and you're not supposed to take that, and just you know, try to leave only your footprints and observe nature and observe what you're seeing and you will you'll do fine.

### **Kaitlyn Dirr 5:06**

Leave only your footprints whenever you're out in nature. Taking responsibility and being aware of the impacts that your actions can have on the environment is important to the health and future of these systems. The Apalachicola Reserve's Coastal Training Program offers a course called the "Stewardship Series", an ecosystem studies program for residents and visitors to the reserve. Let's learn more!

### **Anita Grove 5:30**

Well, we decided to offer some programs to residents, especially- we get a lot of new residents here and they might be from a, you know, the interior part of the country and not know about how to live on a coast. So we offer courses: oyster ecology, what is an estuary, the Apalachicola River and floodplain, the whole ecosystem of the river and the floodplain and how they work together. We also offer living shorelines to help people to understand the need to not put in a concrete seawall but to have a connection between the shoreline, the shoreline and the land. We also offer a course on bay-friendly landscaping because people who move here, it's an entirely different world. We don't have soil here, we have sand, so these courses are to help people understand the environment they come to because it's very different. Generally everywhere surrounded by water they have sandy soil, so it's to help give them an understanding of what they've come into and the value of it essentially and then they hopefully will become better stewards because they're able to understand that something they may not initially. For the bay friendly one... we have a lot of people who come and they want to put in grass and grasses from Asia. It's difficult to grow, especially on sand and it takes a lot of water. So it's sort of a losing proposition that I personally learned. And I want to share that with other people and people thank me a lot, but some people don't think me for 10 years after they've struggled with it for a long time. And we used to have what the local people call kind of a natural lawn and it's, it's a mix of dollar weed and weeds and... but it's natural, and now we have a lot of people moving here from suburbs where they have manicured lawns and they spray to keep the lawns, they spray and fertilize, which can impact the bay.



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And so we're trying to discourage some of that and as many parts of Florida are trying to discourage that so that it's more of a natural environment, especially when we have species landing here, looking for sources of food and those types of things.

### **Kaitlyn Durr 7:55**

Another way to get involved and make a difference no matter where you are is by participating in citizen science projects. If you're near a reserve, you can help out with projects like the oyster monitoring and butterfly monitoring network at the GTM Reserve in Florida, the new saltwater adopt-a-stream program at the North Inlet-Winyah Bay Reserve in South Carolina, or volunteer or intern any of these reserves sites in the southeast. More information on the different site opportunities can be found on the NERR or Far podcast web page or the websites of any of these reserves. Here with more information on some programs that allow you to be a part of citizen science no matter where you are, is Keith Laakkonen.

### **Keith Laakkonen 8:36**

There's a ton of other citizen science programs out there. Literal programs such as things you can get on your phone. As a birder, of course, eBird is something that is really important to me, but it also gives scientists an understanding of how birds are using these habitats and how that may be changing over time. There's also things such as iNaturalist where people can not only record birds but they can record things such as reptiles, amphibians, plants, and so all these go into larger databases, which are going to give all scientists better understanding of what the landscape truly looks like. And citizens being involved in this is very important. It's not just scientists who can do this work. Anybody can participate.

### **Kaitlyn Durr 9:17**

Apps like iNaturalist and eBird are great because they really build this huge database that then becomes very powerful in understanding the distributions and the timing of different species at broad scales. This data is super useful for scientists not only at the NERRs, but also scientists across the country. In addition to being active collecting data that will help us better understand plant and wildlife distributions, you are also becoming more familiar with identifying species, which personally I think is super fun. The NERRs of the southeast are incredible stewards of the coastal zone. You too can be an environmental steward at the reserves and in your communities by getting involved in conservation outreach, as well as by remembering to "leave no trace" when you're out in nature. In our next episode, we'll explore what creatures live in the estuary, as well as introduce the practice of birding. Until next time, I'm Kaitlyn and this is NERR or Far: The Reserves Are Where You Are.

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## **Episode 7: Estuarine Creature Feature**

### **Kaitlyn Durr 0:19**

Hey there, my name is Kaitlyn Durr and this is the NERR or Far podcast. Today's episode is an "Estuarine Creature Feature" as well as an introduction to birding.

Our first estuarine creature is a hermit crab. Hermit crabs are Lori Davis's favorite animal at the North Carolina NERR. Let's hear from Lori, the reserve's education coordinator about what makes these crabs so great

### **Lori Davis 0:53**

My favorite animal, people probably think that this is kind of silly, but I love hermit crabs and the reason hermit crabs are my absolute favorite is because...multiple reasons... they get to change homes. Kids love that. I talk about if it's your birthday you get new clothes, you might not want new clothes, but you have

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to have them. Hermit crabs have to get a new shell every time it's their birthday. I love how hermit crabs can do that. I also love that we have teeny tiny ones on the Rachel Carson reserve, that the littlest kid can just pick up and put in their hand and not be scared of being pinched. I like other crabs too, fiddler crabs ghost crabs, blue crabs, but those'll pinch you. Hermit crabs, the little ones won't. And so I like hermit crabs because they're usually the first thing we encounter on a field trip. And that's the first thing they put in their hands, I make them do it like, "it's not gonna hurt you, it won't pinch you, it's not gonna bite you, just put it in your hand". So I like hermit crabs for multiple reasons because they're just cool animals. And plus it gets the conversation started about estuaries with kids.

### **Kaitlyn Dirr 2:07**

Another important crab you might see in the southeastern estuaries is the fiddler crab. Fiddler crabs can be seen commonly in slightly salty or brackish intertidal mudflats in salt marshes, as well as various other types of brackish or saltwater wetlands. They're called fiddler crabs because the male crabs have one claw much larger than the other that they hold somewhat like a violin. This is a sexually dimorphic trait. Sexual dimorphism is a difference in appearance between males and females of the same species, whether it's color, shape, size, or a unique structure. My favorite example is lions. Males have manes while females do not. In fiddler crabs, the males have a major claw that is much larger than their minor claw and females have claws of equal size. Males will wave this big claw in a display as a form of female courtship. Females choose mates not only based on claw size, they also note the quality of the waving display. Research suggests that claw size is correlated with burrow width, which influences incubation temperature. This means that females will choose a male mate whose burrow size will provide the best environment for her eggs, and the vigorous waving display will show that he is a strong, healthy crab. Males also fight with this large claw. If they lose it, the lost claw will become the new small claw and his minor claw will grow bigger. Fiddler crabs are detritivores, which means that they obtain nutrition by feeding on organic matter made up of dead plant and animal material or detritus. They obtain this by using their mouth to sift through chunks of sand. Anything they can't use, they roll up into a little ball and replace what they took from the ground. This feeding habit plays a very important role in preserving coastal wetlands like salt marshes. By sifting through the sand, fiddler crabs aerate the substrate and prevent anaerobic conditions. It's kind of like how worms help plants grow by aerating and breaking up the soil. Fiddler crabs have a pretty cool name that they earn for the way they look and how they move. Some other creatures in the estuary are named for how they sound. Adam Mackinnon, the Education Coordinator for the Sapelo Island NERR, has recently been listening to the estuary using a hydrophone. A hydrophone is a type of microphone that detects sound waves underwater. So Adam, have you heard anything cool on it so far?

### **Adam Mackinnon 4:41**

Oh, god. Yeah. Yeah. So, you know, fish make some really awesome sounds. Course you know, if you get a manatee, manatees make cool little sounds, little squeaks and whistles. So...dolphins of course, we don't hear any right whales, they're too far offshore, but it's cool because you know, no one really realizes these things when you can have that... I've said that looking-glass moment, you see, and I love technology when it's used appropriately. I love using those little Dynalite microscopes in the field so you can see a little Palmetto Tortoise Beetle on your iPad. But that hydrophone is just you know... you take something, like you look at water and that's okay. But when you can actually essentially take them underwater through this hydrophone, it's something- it's a pretty cool experience. And you realize that all fish are named after- by their sound, like a toadfish, croaker, drums, ya know? Not very original in some common names but makes sense after you listen to them.

### **Kaitlyn Dirr 5:37**

Adam mentioned dolphins. Did you know that there are dolphins in estuaries? Estuaries are great nursing habitats for dolphins and they are also a great source of food. Some of these dolphins actually have a really unique way of catching this food. Here to tell us more about this method, one of her favorite things

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to spot in the South Carolina estuaries, is Julie Binz, manager of the ACE Basin Reserve

### **Julie Binz 6:03**

It's still, even though I have seen it a lot of times, it still is pretty exciting during low tide on a mud flat to see dolphin strand feeding. That is a pretty unique thing to see. Dolphins throwing themselves up on the mud after fish to try to eat them and it's cool where they work together and have learned this behavior through generations that some people think they are intentionally beaching themselves but it is a really cool thing to see them do this, so.

### **Kaitlyn Durr 6:36**

During strand feeding dolphins herd and trap fish by forcing them up onto mud banks, shorelines or sandbars. It's called "strand" feeding because of the way dolphins beach themselves momentarily, pushing prey ashore before sliding back into the water. Strand feeding is a learned behavior passed down from mother to calf, which means that not all dolphins are able to perform this behavior. Learning strand feeding typically occurs in the calf stage, so many dolphins learn somewhere between six to eight years old. Watching strand feeding is a favorite pastime of another reserve manager: Erik Smith from the North Inlet - Winyah Bay Reserve in South Carolina.

### **Erik Smith 7:20**

I never get tired of seeing the dolphins strand feed, I never get tired of seeing the black skimmers skim the creeks, I- you know, I never get tired of the the annual migrations of the shorebirds that come through and depend on these marshes, the oystercatchers raising young out at the mouth of the estuary, you know, they're all special.

### **Kaitlyn Durr 7:45**

Erik is giving us a perfect segue into our next portion of our episode: birding. So what is birding? Birding is a hobby in which you observe birds in their natural habitat. Someone who birds is called a birder, and guess what? Anyone can be one. You can bird anytime, anywhere, whether it's in your backyard, at a reserve, or out in the street. There's no right or wrong way to observe birds, and getting started is easy and low cost. Binoculars and a bird ID guide are helpful, but not required. There are lots of ways to learn more about our feathered friends. You can join a club or attend a program at a local park or reserve, you can download mobile apps like iNaturalist or eBird to help with identification, you can learn more about your local birds from sites and organizations like the National Audubon Society, or you can simply sit in nature and familiarize yourself with the calls and behaviors of different local species. Keith Laakkonen, the director of the Rookery Bay Reserve in Florida is another avid birder. So Keith, how did you become interested in birding?

### **Keith Laakkonen 8:53**

So as a biologist, I think I've always been interested in birds and I just considered myself sort of a general biologist. But birders have what we call a spark bird, and mine of all things was a snow bunting in Florida. We were on vacation on the East Coast and I heard a snow bunting at Cape Canaveral National Seashore, and went to a couple places, and after looking up and down, I found hopping through a parking lot. And I got- and I got hooked on it, this beautiful snow bunting, it's still the only one I've seen. And this was back in the mid 2010s. And ever since then I've just been hooked on birding it's a- it's a lifelong treasure hunt.

### **Kaitlyn Durr 9:36**

Do you have any favorite Florida bird species to spot within the Rookery Bay NERR?

### **Keith Laakkonen 9:40**

Oh, that's always asking a mother- like asking a mother which kid is their favorite. I have lots of... lots of

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favorite birds. But you know I really do have a place in my heart for the beach-nesting birds, for the least terns and for the black skimmers, these species that come here to nest on our beaches and really, their survival depends on being able to have, you know, a relatively short amount of time in the summer where they can lay their eggs they can rear their chicks and move on. And it's important that we are able to provide that habitat at Rookery Bay. So really great spots to see these things include Second Chance, but you have to do it from a distance in the summertime because it is close protect the species, but also the northern end of Tiger Tail Beach, it's actually in reserve and a phenomenal opportunity to see really wonderful behavior from nesting black skimmers every summer.

### **Kaitlyn Dirr 10:38**

Both Keith and Erik mentioned black skimmers. Let's talk about this incredible seabird! Black skimmers are a medium-sized seabird with long wings and a unique bill that is longer on the bottom half than the upper half. If you've ever seen a gull on your trip to the beach, they're slightly larger than gulls. Black skimmers earn their name for the way that they feed. Skimmers use their unique bill to skim the water for food as they fly over, dropping the long, narrow bottom beak to help them feel for fish as they go along. Because they feed mostly by touch, they can even forage at night. These birds are black on top and white underneath, with a reddish-orange and black beak and red-orange legs. I think they look like the lovechild of a penguin and a toucan. If I haven't sold you yet on why these things are super cool, just listen to their little yips.

Black skimmers lay their eggs directly in the sand and shells of beaches and the higher parts of some salt marshes in what are called scrapes. They make these cone-like depressions themselves using their beaks and feet to carve away at the sand. Do you like sandy beaches? Me too. I mean, who doesn't? Sadly though, because of the popularity of suitable seabird nesting habitat, skimmers are threatened by development and can experience a lot of human disturbance. Skimmer nests can be hard to spot by beachgoers and can be destroyed by anything from roaming dogs to vehicles driving on the beach. Storms and sea level rise also threaten black skimmer nests as high waters can swamp and wash out eggs and hatchlings. Because of these factors and the declining skimmer population, black skimmers are listed as a species of high concern. You can help do your part by keeping your distance around seabird nesting colonies, obeying shorebird signs and refraining from flushing or scaring off birds that you see in coastal areas. Together we can help conserve black skimmers and other bird species on our southeastern coast. If you want to get out and see some cool coastal birds and learn more, there are lots of places to go birding at the reserves. St. George Island is a site at the Apalachicola NERR that sits along the Great Florida Birding and Wildlife Trail. Here to tell us more about this trail and its importance to environmental education is Anita Grove, the Coastal Training Program Coordinator at the reserve.

### **Anita Grove 13:15**

The Florida Birding Trail is managed by the Florida Fish and Wildlife Commission and it is a statewide trail highlighting places where people who were traveling around the state could pull off and actually would be a good birding site. And we have several locations within our reserve footprint. One is on St. George Island, and it's an undeveloped part of that barrier island on the bay side where migrating species can land, get some food because they're coming from thousands of miles away, and St. George Island is one of the first places and- well coastal, the coastal US in many cases are the first place they land so they are exhausted, they're needing water, they're needing food, and we've actually had studies done where they weigh them so that- it's an important stop and also for butterflies. They land... the migrating species are beautiful to see too, they're, some are quite, quite colorful. And so those stops we have two here in town, and one on St. George Island, one in Apalachicola that's under our management. And both of those are great areas to see any birds but especially when the migrating birds come through.

### **Kaitlyn Dirr 14:33**

In addition to self-guided opportunities like the Great Florida Birding and Wildlife Trail, many National

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Estuarine Research Reserves also offer kayak and boat tours. Regardless of method, there's some pretty cool and unexpected animals that you can spot in estuarine habitats here in the southeast.

### **Anita Grove 14:52**

Well, we see all sorts of things. I think things that interest people that are from not from here are bears. We have a lot of bears, and you know, East Coast and southern bears are not nearly as big as Western bears, but we have, we have a lot of bears. We have otters, and we have wading birds.... we have, of course, all sorts of sea creatures, hermit crabs and fish, you know, sheepshead, and redfish. Just all types of fish. And we have alligators and deer. I actually saw a deer when I was headed out of town the other day and it'd come down to the bay, which is unusual, but I guess it needed some of the saltwater for for some reason, maybe it was rinsing off, and it was quite wonderful to see it there.

### **Kaitlyn Dirr 15:42**

Josephine Spearman, Education Coordinator for the GTM NERR in Florida, also has a favorite creature to spot that you might find rather unexpected.

### **Josephine Spearman 15:52**

The wild turkeys! Like when I get to see the wild turkeys on the trails, it's just like these majestic... you wouldn't think that they're like super majestic, but they're like, you know, iridescent and walking through so silently and just with this whole troop of them and they're just so beautiful. And you know, when I get a chance to see them, it's like wow, this is this is a beautiful piece of nature.

### **Kaitlyn Dirr 16:13**

There are a multitude of unique and interesting creatures in our estuaries, from crabs, to dolphins, to seabirds and beyond. The National Estuarine Research Reserves are working to better understand and protect these species through research, stewardship, coastal training and education. You too can learn more about these species by visiting a reserve near you. You never know what you might find and experience in one of the world's most productive ecosystems. Until next time, I'm Kaitlyn and this is NERR or Far: The Reserves Are Where You Are.

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## **Episode 8: SWMP(Y) Science**

### **Kaitlyn Dirr 0:18**

Hey there, my name is Kaitlyn Dirr and welcome to the NERR or Far podcast. Today's episode is on research at the National Estuarine Research Reserves, also known as the NERRs.

We have a special focus today on SWMP, the System-Wide Monitoring Program. Here to get us started and tell us more about SWMP is Keith Laakkonen, Director of the Rookery Bay NERR in Florida.

### **Keith Laakkonen 0:51**

So research reserves and anyone who works with NOAA, we love our acronyms. And so SWMP is one of my favorites. As you said, System-Wide Monitoring Program. Which is a small way of saying that we are part of a national network and program that helps us understand how water quality and weather conditions change over time, and how it impacts the environment. We have data sondes, which are basically computerized devices, which are taking water quality readings every 15 minutes, 24/7. The only constraint on these things is battery life. We actually have a couple of these hooked up to satellites, so that anyone on their computer can see with a small delay what's going on in the water and the weather: the temperature, the salinity, what the depth is going on, what the turbidity is, so you can have an

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understanding of what's going on in the environment. The SWMP program helps us understand how it impacts other things such as fish, fisheries community and sharks as well. For example, Rookery Bay has been doing all the downstream monitoring for the first and largest of the Everglades restoration projects. That's Picayune Strand Restoration. So combining this water quality with his fish and shark information helps us really understand how these estuaries are behaving ecologically and how they're going to change over time due to restoration.

### **Kaitlyn Dirr 2:09**

The ACE Basin Reserve in South Carolina is finding creative ways to use water quality and meteorological data for research as well as environmental education. Here to tell us more is Julie Binz, reserve manager.

### **Julie Binz 2:24**

Our weather station collects basic weather meteorological data like air temperature, wind speed, barometric pressure, and precipitation. And our water quality sites are stationed at different creeks and various places in the reserve; we have four of them set up the Edisto river so that we can really monitor how the saltwater- freshwater interaction is moving with tides and storms and different types of variations in weather. So, water quality stations also measure water temperature, and salinity, pH, dissolved oxygen, we also monitor nutrients in the water. So because these are long-term sites, they're great to observe trends over time in our weather and in our water quality, especially as storms come, which has been really cool. We've just been working with a group of other reserves to create a educational product called "Storm Stories". So we can take our data before, during and after certain large storm events that we had that affected our reserve and see what changes throughout the storm and directly after the storm in our water and weather. So that's been really cool. So it allows us to look at how our environment is changing over time both over long periods of time and then with discrete incidents. Some of our other researchers that we're partners with, with the Department of Natural Resource biologists can look at it in relation to their species data. So if they're looking at fish populations or crab populations, they can use our water quality data to look at how those factors impact all our different marine species.

### **Kaitlyn Dirr 4:16**

Adam MacKinnon, Education Coordinator at the Sapelo Island NERR in Georgia, call SWMP a sort of "canary in the coal mine".

### **Adam Mackinnon 4:25**

SWMP is essential to everything we do out here, whether you know it or not. So, so we have about 19, 17-19 different institutions come here to do research. So it's a place-based place to research. It's not like you go here and go out, you come here to do research, it's, this is one of the hallmarks of estuarine science. It's where modern ecology was invented out here. So SWMP, all these people come, you know, they have research projects, you know whether that be short-term, long-term, they don't need to go and collect that data, you know SWMP already has that data. And it's kind of like a... SWMP can be a great canary in the coalmine. It can tell you things are happening before you actually physically see them happening to the environment. Just incredibly powerful tool. And I always tell students, you know, all this life here, all these parameters you can look at in SWMP dictate not only what life is here, but the abundance and distribution all this stuff is dictated by those things in SWMP. So, even though I always say it's not the sexiest part of science here, it's one of the most essential parts of science out here because I say it.. all life here hinges on those parameters, right? And, you know, when we talk about pH as being logarithmic, those little tiny changes matter a great deal.

### **Kaitlyn Dirr 5:47**

There are a variety of ways that SWMP data can be used. The North Carolina NERR has been collecting standardized water quality and climate data on the coast since 2002 as a part of this program. This data

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proved invaluable in the wake of Hurricane Florence when used to assess public health risks related to a climate-sensitive bacteria. So how can long-term environmental data be used to inform decisions related to public health? According to researchers at the reserve, understanding how storm surges and floodwaters change salinity can inform the medical community when and where increases in *Vibrio vulnificus* infections are likely to increase. *V. vulnificus* is the bacteria we were mentioning earlier. The SWMP data allowed researchers to see how long salinities were changed by surge waters and stormwater runoff, important drivers behind broadening the area where *Vibrio* proliferates, or multiplies. The bacteria can double every 20 minutes and thus adapt to rapidly changing conditions. Warming temperatures also increased the speed with which microbes can multiply (their doubling time). We can see where areas are warming and how much or for how long. Changes in coastal land use can also change how stormwater moves through coastal watersheds. Increases in impervious surface area that go with urbanization, for example, sidewalks and roads, typically drive stormwater runoff into waterways faster, rather than percolating through soils. This can bring with it surface pollutants like microbial loads, petrochemicals from roads, and yard debris along with fertilizers and pesticides. Researchers can see how this alters salinity patterns in the waterways. Along with pollutants, it increases the volatility of salinity changes following storm events, which can be burdensome on habitats and their occupants. Also, increased urbanization and intensive agriculture increases nutrient loading in waterways, which increases the biological oxygen demand, contributing to low dissolved oxygen in the water and harmful algal blooms. SWMP data helps capture these effects over time. Improving algal bloom detection is a focus of the GTM NERR in Florida. Making strides towards this goal, this reserve is working to create the country's most comprehensive chlorophyll monitoring network. Josephine Spearman, Education Coordinator at the reserve, is here to tell us more about the important uses and applications that SWMP data and technology have for this project and others at the GTM Reserve.

### **Josephine Spearman 8:34**

So the background explanation is: chlorophyll found in plants, including algae and phytoplankton, helps plants to photosynthesize, you know, it's associated with that green chlorophyll color. And chlorophyll...with it, there can be an abundance of light. And when that happens that chlorophyll will actually release light back out, or fluoresce. So that's a huge part of what this new method of sampling or analyzing does. So previously, scientists would monitor that, they would take a chlorophyll sample, they would filter out the chlorophyll and they would be limited by the amount of time it took to do that process. I think it happened about once a month. But it was very beneficial because they could take a look at historical data and compare it and then understand long-term changes. So with this method, it actually takes a high-frequency sensor which takes that light emission or that fluorescing and reads that. The benefits to this include that they can collect it about every 15 minutes, so a lot more frequently than once a month. And then also they can take a look at short-term changes, changes with tide, changes in a day versus night, seasonally and after storm. So there's, it's not that one's better than the other. They're kind of looking at different ways of looking at it. And so one of the big things with this project is seeing multiple reserves are working on it to see if the entire reserve system can use this method or could maybe it needs to be done more individually, depending on the reserve. And so your question is about how that- how they want to use that data. So hopefully using it for decision-makers that, you know, make decisions on water quality, also the aquaculture industry, you know, taking a look at those little clams and oysters and mussels, they're eating that plankton that has that chlorophyll in it. So helping to understand those processes better. And then also supporting educators. So for teachers to be able to use this in a classroom, to show students how to be more data-literate, but not just like, you know, look at these graphs. It's like, "hey, look at these graphs that have to do with stuff that's happening in your backyard". So it's very engaging and relatable to what's going on with them.

### **Kaitlyn Dirr 10:48**

There's some other neat projects going on at the reserve, too. Let's see what else is in the works.

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### **Josephine Spearman 10:53**

eDNA or environmental DNA is one of the things that's going on, we're taking a look at nuclear or mitochondrial DNA that organisms release into the environment. So being able to get more information based on what kind of DNA they're finding. There's a couple of plankton-based projects that are ongoing. And I think what they're doing is building a catalogue of what type of plankton is present. So it's kind of amazing to see that you can go and get your sample of water and then determine what organisms are there from the DNA that they're finding from it and just kind of like well wait a minute, wow! So those are some of the big things that are going on right now.

### **Kaitlyn Dirr 11:30**

We can detect species, even invasive and cryptic or rare species, in water or terrestrial habitats using eDNA from cellular material. Isn't that crazy? You might not see the organism but you can tell that it was there at some point because of skin, hair, or other eDNA sources that it's left behind. Very cool. Let's look at some other research projects across the reserves here in the southeast. One of the current research topics at the North Inlet-Winyah Bay Reserve in South Carolina is stormwater ponds and their impact on coastal water quality. What current projects are underway related to these ponds? And why are they important? Here to help us dive into this research is Erik Smith, reserve manager.

### **Erik Smith 12:18**

Well, stormwater research has been a focus of our research outside the boundaries of the reserve for quite a while because one of the priority areas focus areas of the reserve is impacts of coastal development. And in the southeast, when developers develop the landscape to create houses and subdivisions, big residential areas, they're required to manage the stormwater runoff. As we put up homes and parking lots and roads, we create a lot of runoff every time it rains. Stormwater runoff is a, stormwater runoff can be very significant contributor of pollution to the coastal environment impacting the water quality. I think one of the projects that is going on right now that I'm very excited about is a collaboration between the reserve and researchers at the University of South Carolina looking at the role of stormwater ponds and ways to redesign ponds and find more green infrastructure, more vegetation to help improve the nitrogen removal efficiency of these ponds. Nitrogen is a plant nutrient and in small amounts, it's very important for growing plants. Anybody who's grown a garden, fertilized a lawn knows you need some nutrients, the problem is too much good thing becomes a problem and lots of nitrogen runoff into the waterways creates unhealthy growth of algae and other water quality problems. And so we're working to try and figure out if we can use vegetation in the ponds and redesigned ponds so that they capture and retain more of the nitrogen before it gets exported to the estuarine waters in the coastal receiving waters.

### **Kaitlyn Dirr 14:30**

Interested in technology? Another project at the reserve is aimed at using drones for saltmarsh mapping.

### **Erik Smith 14:37**

We've started to use drones or uncrewed aerial systems, UAS, as they're more officially called, but we all know them as drones, small quadcopters and sometimes big quad copters, that are flying very sophisticated sensors over the marsh that are now really allowing us to do a much more accurate job of mapping and measuring the growth of the marsh grasses and how they respond to storm events like the recent hurricane we just had, how they're adapting and responding to rising sea level. And all of these data are allowing us to build better models of the vulnerability or resilience of the marshes to climate change. That was a really neat project that started actually as a collaboration between many, actually, in fact, all the reserves in the southeast, we got together and got some money from NOAA to sort of figure out how to develop standard protocols for the use of drones in salt marsh mapping. And that has really opened the door for all sorts of new and additional work on understanding the health of salt marshes around the southeast.



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### **Kaitlyn Dirr 16:17**

An important mapping tool that the reserves utilize is GIS, short for geographic information system. GIS is a system that helps you create, manage, analyze, and map a wide variety of data. Here to tell us more about how the NERRs use this tool is Adam MacKinnon from the Sapelo Island Reserve in Georgia.

### **Adam Mackinnon 16:40**

I mean, we use GIS, basically, for everything we do in science now, and that was pretty new when I came on board, I actually had to take a GIS from NOAA in Charleston a long time ago. But it's such a, first of all, from education point of view, it helps you tell a story. A very, you know, picture's worth a thousand words kind of thing. And we have kind of really cool things, like we have a Georgia Coastal Hazards Portal that people go on to see things like sea level rise and how it's gonna affect the marshes, we have something called SLAMM, Sea Levels Affecting Marsh Model, and in this GIS interaction on the web, they can click on different scenarios, and see how the vegetation changes, how well that Spartina gets pushed up into the rivers. We have, we have something called Georgia Coastal and Marine Planner that you know, where you live, how that sea level is gonna change. So it tells that great story visually, even like, sea turtles, you know, I was really involved early on with seaturtle.org with Michael Coyne when he created that. And so it's cool, you can see like, I take my, track my turtles from our GPS satellite tags we put on and I can take all my satellite and that trawler data, some aerial surveys for shrimp trawlers, overlay that then I can overlay the stranded sea turtles, which will be- you can really see how all those things interact, graphically, and it makes sense. It makes sense. It makes it easier to explain to people. Oh, yeah, makes sense now, you could talk about it, but if you can see the picture it's great. And of course, you know it has a lot of great analytical tools to it as well. But for what I use it for these days, it's just a great way to tell a story quickly and efficiently.

### **Kaitlyn Dirr 18:27**

All of these projects are just a glimpse into the research happening at the National Estuarine Research Reserves. Scientists at these reserves do work with countless estuarine species, and through SWMP and other monitoring efforts are able to learn more about the impacts of a changing climate and coastal development on the health of our estuaries. We can even use SWMP data to predict public health risks. All of this information is crucial to making management and policy decisions on our southeastern coast. Until next time, I'm Kaitlyn and this is NERR or Far: The Reserves Are Where You Are. Thank you for listening.