S2E7: Watersheds: The Dying Fields

The Gulf Podcast

Introduction

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[Alyssa Lucas]: My name is Alyssa Lucas, and you're listening to The Gulf, a podcast that shares stories of people and nature on the Texas Gulf Coast. I was going to start this episode with a joke about grass, but with so much to get into today, I decided to weed it out. Seagrasses, they are just like the grass in your yard or whatever makes it through the cracks of the sidewalk, but as the name entails, it just so happens to grow underwater. And like the other topics in our Watersheds series, seagrasses rely on freshwater inflow and clean water coming to the coast. Most of us probably encounter some form of grass every single day. Due to our familiarity with grass, seagrasses likely seem unimportant and even a bit boring. Why should we care about seagrasses when they can't compare to the beauty of crystal green waters or colorful coral reefs? However, on closer inspection these grassy fields must remain for us to keep our beautiful Gulf Coast waters. On this episode of The Gulf Podcast, we are going to discuss the overlooked ecosystem that are future depends on. Weed love for you to stick around and learn more. Let's dig into it.

Before we start, I'd like to let you know that the Watersheds series of The Gulf Podcast is supported by the Harte Research Institute for Gulf of Mexico Studies at Texas A&M University-Corpus Christi. HRI integrates marine science with expertise in policy, social sciences, and economics and brings together leading minds across the United States, Mexico, and Cuba. The views and opinions expressed on this podcast, however, may not represent the views and opinions of the Harte Research Institute or Texas A&M University-Corpus Christi.

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[Ken Dunton]: Yeah, well, seagrasses, that's a good question. Um, it's fun to talk about seagrasses.[2]

[Lucas]: Meet Dr. Ken Dunton, an avid swimmer, ocean-lover, and an expert on seagrasses and marine plants in general. When he isn't in the Arctic near the polar bears working on his other projects, he is here in Texas unlocking the mysteries of the seagrasses and working as a Professor at the University of Texas Marine Science Institute in the Department of Marine

[1] Plasterbrain, "(Loop) By the Sea," March 29, 2019, https://freesound.org/people/plasterbrain/sounds/464918/. This song is licensed under the Creative Commons 0 License.
[2] Oral History Interview with Dr. Ken Dunton by Alyssa Lucas, May 18, 2023, to be placed on The Gulf Podcast digital archives.

Sciences. When it comes to these kinds of plants, he's the one to ask. As simple as seagrasses may seem, there were a lot of things scientist didn't know when he began.

[Dunton]: I did a lot of reading and started figuring out how to work with these plants and some of the big questions surrounding them. So, some of the big questions about seagrasses at the time especially here in Texas was there was a lot of concern about where they are and what caused their losses and also recoveries. People didn't really understand what their requirements were in terms of their physiological requirements.

[Lucas]: With so much unknown, Dr. Dunton set out to learn what was needed for the continued survival of seagrasses. After all, how can you preserve something, when you don't even know what it needs to thrive?

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Introduction to Seagrasses

[Lucas]: Before diving into the numerous questions behind seagrasses and the fight for their survival, it is first important to understand what seagrasses are.

[Dunton]: So, in the world right now there is about a quarter of a million flowering plants, 250,000 flowering plants, species, of that quarter of a million plants, flowering plants, how many do you think have invaded the marine environment and live under water? It's not very many. It's about fifty to sixty total. And those plants in the ocean are called seagrasses. Now, we do have plants that grow in freshwater environments that live under water, but they're not seagrasses, and there's not very many species of those either. Plants that can truly live deep under water, rooted, and are mostly in the marine environment or a lot of them are in the marine environment and those are seagrasses. So, seagrass have roots, they have leaves, they have short stems even but mostly they're grasses, just like grasses that grow in your front lawn.

[Lucas]: And of those species, there are only about five in Texas. So, why do so few flowering plants, also known as endosperms, call the ocean home?

[Dunton]: Because they grow in the marine environment, they have to have some major adaptations. How'd they get there? First of all, they have to be able to be rooted, right? They have to somehow root to the marine sediments. They have to tolerate salt. That's a big deal, to tolerate salt. They have to somehow produce oxygen and get it down to the roots and rhizomes because the roots and rhizomes have to respire. They're not photosynthetic so how do you keep the roots and rhizomes that are in an anoxic environment, a low oxygen sediments. Sexual reproduction is another challenge that these plants have to overcome, and so that's why there's only fifty, sixty species.

[Lucas]: Besides these unique needs that seagrasses have to meet, they also have to meet the regular needs of every plant, with one of the most important being light. However, the main

question was just how much light do these plants need? Not even the Texas State Aquarium knew.

[Dunton]: The Texas State Aquarium was being built at the time. They wanted to have live seagrasses. They didn't know how much light to give them, and that was one of the things that they came to me and said, "How much light do we need to have?" I said, "They need a lot of light. Probably so much light that it's going to be a problem."

[Lucas]: While light is plentiful above the surface due to water quality and other factors, it is becoming increasingly difficult for the light to reach down to the depths of the seagrass beds.

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Gathering Information on Seagrasses

[Lucas]: So, how did Dr. Dunton learn about the needs of seagrasses and their light requirements? Well, it didn't just happen in a lab.

[Dunton]: So that meant having equipment that I could deploy underwater, right? I had to build chambers. I had to run a lot of wires from the chambers to the surface on a boat that was well anchored. I had to have pumps circulating water in the chambers. I had to make sure that I could measure oxygen, dissolved oxygen, which is a product of photosynthesis in the chambers, and I had to purge those chambers every so often with nitrogen because the oxygen values would get so high, super saturated, that I would have to let the oxygen out, drop the oxygen concentrations again, so I could measure what was going on. I had to measure respiration at night, and I wanted to do this, as I said, in C2, in other words, not in the lab. And so that led to some pretty fun projects because we would take a boat down to the Lower Laguna Madre, a big boat, and we would anchor it up and just set up a very sophisticated experiment over several days, and storms would come, storms would go, the winds would blow, the rains would come, and we would just sit out there dutifully collecting data, diving all night long, collecting, you know, watching these chambers.

[Lucas]: By gathering this information throughout the year, camping out multiple days at a time, Dr. Dunton was able to get data that painted a clearer picture of their needs and more specifically what was preventing them from being met.

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Challenges of Seagrasses

[Lucas]: Throughout the season, we have discussed the importance of water quality and how this must be maintained so that the ecosystem remains healthy for all the life within it. While

there are a couple reasons why seagrass ecosystems are dying out, the main one is because they can't get enough light and a big reason for why this is, is due to water quality issues.

[Dunton]: We have those types of anthropogenic activities. We have nutrient loading and algal blooms and other anthropogenic man-caused perturbation, but we also have our natural system though, it's also by its very nature turbid because we have rivers coming into the ocean, rivers are carrying suspended particular matter so the water becomes turbid, it's high in organic matter and inorganic matter that's suspended in the water column, and when you have that suspended organic matter, it attenuates light. So, as the light is attenuated in the water column, less reaches the bottom depending on how much is suspended in the water so obviously when you have deeper water depths, the less lights reaching the bottom and at some point, there's not enough for seagrasses.

[Lucas]: When it comes to understanding the impacts of algal blooms and nutrient loading, it is first important to understand the role freshwater inflow plays into those things. Freshwater inflow usually goes up in rainy periods and decreases in seasons of drought. While more freshwater inflow can be a good thing, in areas that have a lot of agriculture, it can carry fertilizers which leads to nutrient loading and causes seagrasses to struggle to obtain the correct amounts of ammonium and properly grow roots. On the other hand, phytoplankton thrive on these nutrients and then grow to such a degree it shades out other plants growing beneath and prevents them from getting light. Considering all the human activity along Baffin Bay, nutrient loading is common and these phytoplankton blooms and brown tides happen quite regularly which is why it is one of the areas where we are seeing a loss of seagrasses. However, a lack of freshwater inflow isn't much better. This leads to high levels of salinity which affects the overall productivity of sea vegetation. So, when it comes to freshwater inflow, there needs to be a balance.[3] On the other hand, dredging is another major reason why plants aren't getting the light that they need.

[Dunton]: We have lost grasses especially with dredging activities, so we may maintain the ICWW, the Intracoastal Waterway. Corps of Engineers dredges the ICWW on a regular basis and that causes seagrass loss because they dredge, they deposit their dredge materials along the side of the ICWW, and those materials end up in the water column, they get eroded, and they decrease the light penetration of the water column. The dredging itself doesn't take very long but the problem is that when they deposit the dredge materials, it constantly erodes, it erodes over a long period of time and creates extended periods of low water column transparency, so it's different places in the state, but there's a lot of loss in, like I said, up north, and there's some loss down here at the deeper waters and there's losses along the ICWW, which is the Laguna Madre mostly.

[Lucas]: However, even clear waters doesn't necessarily mean that the seagrasses are able to get enough light.

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[3] Ken Dunton, Kyle Capistrant-Fossa, and Berit Batterton, "Marshes, Mangroves, and Submerged Aquatic Vegetation," (unpublished manuscript).

[Dunton]: More recently, with climate change, sea level rise so what we've discovered is that we're losing grass beds in Texas because the depths of the water levels are rising. When water levels rise, that means grasses that are growing in a depth that is safe now, it has sufficient light, now in depths that there's not sufficient light because the water has gotten deeper so less light is penetrating to the seabed, and so that is something that we didn't anticipate happening so quickly, but it is happening now. Sea level rise has accelerated on the Texas Gulf Coast and on the Gulf Coast in general for a variety of reasons but we're seeing the impacts of that now. So, the question is where are they going to go? If you are losing seagrasses, can they migrate shoreward and into water, into areas that were once dry now becoming wet? Maybe, maybe not. It all depends on what we refer to as hardened shoreline. So, because of urbanization, we built bulk heads and we built walls to protect streets and roads and houses. That means that there's no place for them to migrate inland. They can't because of those hardened shorelines, so the net is a net loss of grass beds because they have nowhere to go.

[Lucas]: Due to the consequences of hardened shorelines, this is why it is more ideal to have something known as living shorelines. This means that instead of seagrasses meeting concrete or urbanization when they try to spread, they can meet areas where there is still room for them to grow into even as sea levels rise.[4]

Importance of Seagrasses

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[Lucas]: The depletion of the seagrasses may not sound severe, but this is a crucial part of the ecosystem. And it doesn't take a scientist to notice what is happening. You may remember from past episodes, that fishermen of Baffin Bay have talked about how the waters just aren't what they used to be. They note that where there used to be grasses, there are now either none or just some leftover mush and that it's really affecting the fishery. Seagrasses act as an important ecosystem and food source. They are also extremely helpful in providing fish a way to hide from predators.

[Dunton]: So, if you're a small larval, larvae or larva or you're a small fish, and you need to hide from predators, you're going to go to a seagrass bed, and seagrass beds are quiet because the grasses have so much air in them because they are photosynthesizing. They produce a lot of bubbles. Bubbles attenuate sound, and so one of my grad students pointed out, seagrass beds are like libraries. They're really quiet and you know what else? Because they are like libraries and have all those bubbles in their blades, it's very difficult for predators like dolphins that use sonar to locate fish to hunt.

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[4]Rachel K. Gittman, Charles H. Peterson, Carolyn A. Currin, etc, "Living shorelines can enhance the nursery role of threatened estuarine habitats," *Ecological Applications* 26, no. 1: 249-263.

[Lucas]: And just like trees, seagrasses play an important part in storing carbon that helps prevent the greenhouse effect.

[Dunton]: So, in a sense, seagrasses do their part in a high CO2 atmosphere where we try to sequester carbon and reduce the CO2 concentration in the atmosphere. Having seagrasses capture that carbon and basically put it away in storage is a very, very good thing and so anything we can do by losing grass beds, we're just making a problem even worse, recycling even more carbon back into the atmosphere.

[Lucas]: Not only is this decline bad for the environment, but it can also be detrimental to the economies of coastal cities and towns along the Gulf.

[Dunton]: And not to mention the fact that who's going to come down to Texas and spend money if there's no fish to catch? So, the economy is really, really built around a healthy marine environment. How are you going to maintain this vibrant economy if people are not going to come down here because the systems polluted, you can't catch fish, and there's no beach left? What are you going to do? Beach nourishment and maintaining our beaches and our estuaries so that all of these activities can continue, and they allow people to come to the coast and enjoy themselves, so we really need to think carefully about how we're developing our coastlines or not developing our coastlines.

Restoring Seagrasses

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[Lucas]: In past decades, more emphasis has been put on protecting and restoring these seagrass ecosystems. With the help of organizations such as Texas Parks and Wildlife, the Texas Commission of Environmental Equality, and the General Land Office, a conservation plan known as the Seagrass Conservation Plan for Texas or SCPT has been developed. One aspect of this conservation plan is educating boaters on actions that can be harmful to seagrass beds.[5]

[Dunton]: People would take their boats when they went fishing and those outboard engines would create deep scars in grass beds and destroy them. Those deep trenches that were made by props would become a conduit, become an erosional surface, become an area that would get deeper and deeper because of currents and seagrasses would not grow in there and worse than that, there's all these suspended sediments and exchange of nutrients and carbon, and it was slowly destroying a lot of the grass beds. Well, that changed both with education by Texas Parks and Wildlife, on the dangers to grass beds by prop scarring but also through technology so now they're building boats with engines that either use jet engines or they have shallow draft boats in which the engines are able to work in much shallower water and not dredge the bottom, and

[5] Texas Parks and Wildlife, *Seagrass Conservation Plan for Texas,* Texas, 1999, https://tpwd.texas.gov/publications/pwdpubs/media/pwd_bk_r0400_0041.pdf.

so it's been a lot of positive developments over the last few years so now prop scarring is not as big of a problem as it once was.

[Lucas]: Another change which can help prevent loss of seagrasses is changing the times in which dredging occurs. Dr. Dunton found that in the wintertime the temperature of the water was about ten to twelve degrees centigrade or degrees in Celsius, this translates to about 50 to 53.6 degrees in Fahrenheit. It turns out that this colder water had quite an impact on the plants.

[Dunton]: No matter how much light you gave seagrasses, if the water was cold, they wouldn't do anything. They'd just shut down at cold temperatures, so that led us to a recommendation to the state that dredging actives should really take place in the wintertime because they would have much less of an impact on the grasses then during the summer.

[Lucas]: While these changes are good, it won't be enough to save the seagrasses if more isn't done. New solutions are needed, and change takes time. That is why Dr. Dunton is putting his trust in future generations of scientists.

[Dunton]: And that's my job now, is to empower grad students to dig into these issues and think about new ways to solve these problems. You need fresh minds, creative minds that can think outside the box, right? That's why I love having grad students because they are thinking more creatively than I can think now because I've been doing this for a long time, and so I have certain ways I solve problems, but there's a lot of different ways to solve problems and having that fresh perspective that a grad student brings in where basically the whole world is their playground and they have a lot of energy, and I love that energy and to put that energy to work in terms of solving some of these big issues that we really have to address.

[Lucas]: It may be true that the topic of seagrass ecosystems is a bit mundane when compared to things like sharks or giant squids, but that doesn't make them any less important. We would not have the Gulf Coast that we know without seagrasses and it's about time that they get the credit that they deserve. So, next time you are in the water, take note of the vegetation and see if you notice any grasses but this time imagine them the way you do prairie fields or grassy valleys. Could you imagine those ecosystems being without grasses? Our shores aren't too much different in their need for them. Anyways, I hope you're grass-ping what I'm trying to say. Sorry, sorry, that's the last of my puns I promise. This has been Alyssa Lucas for The Gulf Podcast. Thanks for listening.

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