COASTAL FIELD TRIP
Professor: Al Hine

[MUSIC PLAYING] Welcome to our field trip to the Pinellas County coastline. This is a field trip that I use in our advanced course in geological oceanography, our core course. Bring students out here. This is a perfect place to introduce people to basic coastal processes.

But before we actually start any kind of field trip, as Dr. [INAUDIBLE] knows, and I know, safety is a huge issue. Florida is the lightning capital of the world, for good reason. And being out here in the afternoon when a thunderstorm is brewing is not a good idea. Because the top of your head is the highest potential. So the lightning bolt will aim at the top your head.

And maybe the tree-- but if you're out there at the beach, you are the target, as far as lightning is concerned. So, again, if we're out here on a field trip, where we're working, and we have worked in the marsh a long ways from-- and a thunderstorm, long ways from any place-- and those thunderstorms start to build up in the afternoon, we get out.

We get out. Because you can literally have a bolt out of the blue. And there's lots of lightning that can come out, not right in the storm, but can lead the storm. And so you have to be extremely careful, as far as that's concerned.

The other thing is sun, somebody mentioned that. And you can see how I'm hopefully appropriately dressed. I am not wearing my dark glasses, so maybe you can see my beautiful blue eyes. I don't know. But I'm fair haired, and I sunburn easily.

And I did sunburn extensively as a kid. Any dermatologist will tell you, if you have experienced significant sunburns as a child, you are setting yourself up for skin cancer as an adult.

And so it's always a good idea to protect yourself. And you see what I've got on here. It's a hot day, and you got on a long sleeve shirt. So am I crazy? Actually not, I'm protecting my arms. And this is-- fabrics nowadays are breathable, so you can wear a long-sleeve shirt on a hot day.

And I wear a hat. I had to borrow it from Steve. I forgot my own here. But where a floppy hat, a broad brim floppy hat. This is just basic stuff to keep you from-- particularly if you work outside a lot. If you come to the beach once in a rare event, you have to be careful, but you don't have to be persistently careful.

Always be mindful of protecting your toes and your feet, when you're out, particularly out doing field work. That's really important, to protect your feet. I've got sneakers on here, but sometimes I wear flip-flops. A lot of you guys have flip-flops, and you exposure your toes. That's nice and it's comfortable, but it's also a safety hazard if you're doing work on a ship or going out into the field.

So I've got a few things here that I want to show you. So always bring your sunscreen with you, and wear dark glasses. I don't-- wearing dark glasses now, but I will in a second. And then somebody else has brought some water here. Bring lots of water. You have to hydrate yourself. So always pack some water with you.

And you can get dehydrated before you know you're dehydrated. You start shaking. That's happened to me. I've had heat stroke, and didn't realize I had heat stroke, and basically almost fell over. And so you have to keep yourself hydrated, even though you don't feel thirsty.

And so those are important things.

All right, so that's enough of that, unless there are questions. All right. Did I just scare you enough, so we have to run back home? All right, good. Well, we'll continue on.

The coastline of Florida is one of most valuable assets of Florida. We have 19 million people that live in the state, but we have tens of millions of people-- I've heard as many as 90 million people, which is hard to imagine-- 90 million additional people visit the state. And one of the reasons they come here is because of the beautiful beaches.

Pinellas County is the densest county in Florida. We have the highest concentration of people per square kilometer. And so there are a lot of people here, and a lot of hotels here, so a lot of people come and visit the coastline.

And as a result, the coastline is an asset. It's a tax base. Money-- it's worth a lot of money. And so if anything's worth a lot of money, it attracts a lot of attention.

And so it's in our best interest to maintain the coastline as healthy as possible. And that means not have it erode away. And have it as attractive as possible, so there aren't dead fish or seaweed washing up. And so there's a lot of grooming and cleaning of the beaches, and making sure people don't throw bottles, and that sort of thing. So coastline is a real asset to Florida.

And so we're looking at two points of the field trip. One is the natural processes. And the second is how we manage the coastline.

Now Florida is a state, like I say, it has become a recreational state, probably since World War II. So Florida is a relatively young state, as far as human development is concerned. And the great attraction wasn't Polk county, or someplace in the middle, it was the coastline.

Then eventually Disney World came here. And of course, there are the Florida Keys and the Everglades. So we're blessed with some very important national parks and other natural areas, but probably the coastal system is the primary driver in my opinion.

So in order to protect all this infrastructure, the Army Corps of Engineers has the authority-- have been given authority by the federal government to be the curator of beaches, so to speak. The protector of beaches, the protector of our inland waterways, and that sort of thing. That's part of their mission, and making sure the beaches don't erode. If they do erode, what do we do about it?

And that has been an ongoing process, and will be an ongoing process, forever. The beaches are incredibly dynamic. They move all the time. They're never going to stop moving.

We've had beaches ever since we've had oceans. We've probably had oceans on Earth about four billion years ago when the first oceans and the atmosphere first developed. So there's nothing new about beaches being dynamic.

And yet we're replacing very immovable objects in a very dynamic environment, which sets up a problem right away of what do we do if the beach moves, and the houses don't move, then the houses fall in and that creates a problem. And so the coastal engineers-- a huge community of coastal engineers-- has risen, to become an academic field all in itself.

There are some schools that have departments of coastal engineering, where they have engineers that try to come up with structures, such as a seawall here, or whatever. We'll see another one-- rock jetties and t groins, and a whole quiver full of arrows of ways to protect the beaches. And some of those have been OK. And some have been disasters.

And so I'm going to show you one that I think is OK, and another, later on, that I think is a disaster.

OK, so that's the reason why we're here. Before we actually start any kind of field trip, the important thing in any kind of field trip is where the heck are we? Find out where we are.

Well, we're on the west coast of Florida, obviously. The West Coast of Florida is dominated by two large estuarine systems. And then it has a series of sand shoals-- exposed sand shoals that lie offshore. And these are called barrier islands.

What's a barrier island? And how'd it get formed? Anybody have an idea?

We are out on an island, right now. Believe it or not. We crossed a bridge to get out here. And between where we are here in the mainland-- this is the mainland here-- is about, maybe, half a kilometer, a kilometer of open water, called a lagoon.

So why did these islands form offshore? Why didn't we have a mainland-- why do we have what's called a mainland beach, where there's no water body behind us. And you see that in places like Myrtle Beach, or north of Cape Canaveral. But we have these offshore sand shoals that are exposed-- severely exposed means exposed to air.

And they built up and they allow us to put all this infrastructure out here, and we're separated from the mainland by a body of water. And it's called a barrier, for obvious purposes, because it provides a barrier to prevent storm waves from hitting the mainland. But on the other hand, we've exposed ourselves by building out here so much.

But we're standing on a body of sand. And you can see it's a necklace, or it's a series of islands that exist offshore. Right here, Venice, it doesn't. That's called a mainland beach. The barrier islands disappear.

And if you go down there, the sand is a different color. It's a dark color, because the local sand is being-- a local sand is from the Hawthorn Formation, which is a much older geologic unit, and contains shark's teeth and phosphate. And so the sand is dark in there, because there's a local source.

And so that's a mainland beach, but these are all barrier islands in through here. Here's the mainland back here, as you can see. And there are lagoons that are sometimes just a few hundred meters across, to maybe a couple of four or five kilometers across altogether. Couple miles, something like that.

Well, they're entirely made of sand, OK? Number one. And number two is that as sea level rose from the last glacial event, last ice age, it started to decelerate in the last 4,000 or 5,000 years. And as it decelerated, the wave energy could concentrate sand and sweep it up, and build these barrier islands. And so they became stabilized.

Now sea level continued to rise at a rate similar to what it was rising let's say 14,000, years ago. These islands never would have formed, and the mainland beach-- the coastline would be back here along the mainland beach.

But because sea level decelerated, it allowed waves to focus, and sand that was just kind of laying out here during the interglacial period was swept up by winds and waves, and created these offshore barrier islands.

So ironically, sea level rise gives birth to barrier islands. Now we've all been hearing about how sea level rise is going be the death of barrier islands. And that may be true. So it's kind of a Goldilocks thing. You need just a little bit of sea level rise, but not too much, to create a barrier island system.

Let's see. What we're going to do is going to walk down there, and then take a right. And we're going to go down to the beach. And we'll talk about the natural processes going on here.

I'd like to have you notice this. This isn't just for decoration, it serves a purpose. And if you step closer, you can see that there's another wall there.

About 25 years ago, 30 years ago, maybe Steve remembers better than I do, when I first came here, high tide waves were breaking up against that wall. You guys are going to have to step over and see it. This is more of a storm surge wall to prevent the surge from going into the street for low storms. A big storm, like I say, six meters, 18 feet, 20 feet of water-- none of this-- it's all going to be underwater-- the houses, the roads, the sea walls, and everything.

So this is to protect from minor storms. But, like I said, 25 years ago, that was the seawall. And high tide waves crashed against that sea wall right there. You can see there's a difference between 25 years ago, the ocean's way out there now. So that's kind of the lesson of what happened.

[MUSIC PLAYING]

Well, we just crossed on the other side of the sea wall. If you look back there, you can see it's a double seawall. And the lower one, like I say, was an active seawall that reflected wave energy about 30 years ago. So the ocean was right here. And during high tide, waves would hit that sea wall and reflect back into the water. There was no beach, virtually. There was no beach at all.

And so the county engineers said, well, we need a beach. And so they put their heads together, and came up with a plan to construct a beach here, and that's what we're seeing.

Now associated with the beach are sand dunes, as you can see, and they're very heavily vegetated. And if you look carefully, they're in bloom right now, or they've passed the blooming stage, and they're producing these seeds. And if you can see these stalks.

These are protected plants. You can't pick them. You'll go to jail if you pick them. In the old days, you could pick them. They were popular for dried flower arrangements in fancy homes, and things like that. These are called sea oats. The fancier name is uniola paniculata. And they grow in an environment such as this one, where they aperiodically flooded with salt water.

But there is a Freshwater table here, so they are primarily Freshwater plants. But they won't grow in an entirely Freshwater dominated environment, because the other Freshwater plants, that can't stand the salt will outcompete them. So this is their niche, so to speak. A little bit of salt, but they need the fresh, as well.

If it's entirely salt, they die. But they can handle the salt. Where you take something out of your garden and put it out here, it would die, because it couldn't handle the salt. So this is kind of an ecological niche that it occupies.

There are other plants, as you can see, the sea grapes. And then these are palmatas, and so there's other vegetation. And through time, trees will eventually grow here, and produce a maritime forest. So what we're seeing here is a biological succession.

The first was just bare sand. And then the sea oats came in. And now these other plants are starting to come in. And with time, there'll be trees like that casuarina back there, which is an import from Australia, or native pines, or live Oaks, that sort of thing. And you see that on natural barrier islands, where there's what's called a Maritime forest. It's a forest that can live next to the coastline. It can handle it periodic inundation. It can handle salt spray being blown into it. They are unique, botanical environments. And of course, they support home for birds and other types of varmints and critters, I suppose.

Anyway, now you can also see some crossovers. Now they didn't exist about 20 years ago. In the old days, you could park your car and just walk to the beach over the dunes. And of course, even before that, you just park your car and jump in the ocean, because there was no beach.

But the dunes are protected. You can't pick them, because they're vital in producing the sand dunes. When we have a strong onshore breeze, wind from the beach-- which is, believe me, it's out there-- will dry out. And it'll picked up by the wind and blow inland.

And so something has to trap that wind blown sand, and the grasses will do that. The sea oats will do that. So they trap the sand grains that are in suspension, and they'll drop out. And so, as a result out of the many wind events, the dunes build themselves up as a result of the vegetation. So the vegetation is critical in creating the sand dunes.

So these sand dunes were artificially generated. Like I say, there was no beach here at all. And so you had to produce a beach.

And then they put sand fencing out here. The sand fencing are like wooden slats connected with wires, so the wind could blow through it, but it would also trap the sand. So you build up a pile of sand, and then people come out and artificially plant the sea oats. So these sea oats got started here by good citizens interested in developing a dunefield. And you can see it's just taken off.

And so they put the walk overs, obviously, so you don't trample the dune grasses. So those vehicles, or mechanisms, to protect the sand dunes. So we have to first figure out how the beach got here in the first place, and I've told you how the sand dunes got here in the first place.

You have to have significant onshore wind, persistent onshore wind of a significant velocity. You can have a light breeze. Is the sand being blown now? But you can feel a breeze. Well it has to come above about 17 miles an hour is a threshold velocity to actually pick up dry sand and move it. The wind's not blowing 17 miles an hour. It's probably blowing two or three miles an hour, something like that.

And it has to be dry sand. Wet sand doesn't blow very well. And it has to be sand size, it can't be a large shell fragment, or cobble fragment. You don't see flying shells. You don't see flying rocks, unless it's a tornado or something like that. But you have to have an environment where there's persistent onshore breezes that can produce big sand dunes. We do not have persistent onshore breezes here. They occur occasionally, but they don't occur as frequently as the east coast of Florida.

Here we have very small sand dunes, and as a result, the natural barrier islands aren't very high.

[MUSIC PLAYING]

Well, we've walked about, gosh, what 100 meters or less, something like that, from where we just were. But we're on the front side of the dunes. There they are, back there. And we're out standing on the active beach. And you can obviously see the waves breaking from the open Gulf of Mexico.

The Gulf of Mexico is a real ocean basin, but it doesn't have oceanic type waves. It's a small ocean basin. And so it's a low energy system. So it's low energy, so we have the dunes are small because we don't have persistent strong onshore breezes, and the waves aren't very big either.

But this is the active beach. And, again, I go back to basics, which are surprisingly-- people just take the basics for granted-- what are we standing on? What are we standing on? What's the beach made out of? That's the question. What's the beach-- OK, it's made out of sand.

OK, and what is sand? It's a common term. We use it all the time. But the engineers actually have a definition for it. And the definition is grain size-- it's a grain size function. And the grain size is between 0.6 millimeters long dimension, or diameter, to two millimeters. OK? That's defined. You can go to a book and say, that's defined.

Sediment that's coarser than two millimeters is called gravel. Sediment that's finer than 0.62 millimeters is called silt. Sediment is finer than four microns is called clay.

So when engineers talk about, well, we're going to bring in sand or silt or clay, they're talking about something specific that has a measurement involved. And geologists have adopted the same thing. We're kind of like hey, this is sand.

But it really does lie in the sand size fraction. It's between-- this is actually fine sand. It's not course sand, but it's actually fine sand. But I'm trying to get at what it's made out of.

We agreed there are shell fragments, which is calcium carbonate secreted by organisms. Where did this stuff come from?

It came from the southern Appalachian Mountains. These grains are made of what?

Quartz.

OK, these are quartz sand grains. And there is no local source of quartz. Quartz is silicon dioxide. It's the most common mineral in the crust of the earth, the continental crust of the earth. And it comes from the degradation of granitic type rocks.

And so we have to ask the question, where did it come from? There's no source of quartz locally, so it had to be derived from somewhere, and the somewhere is the southern Appalachians. And what we do is we weather granite. Granite has quartz in it, and we pluck out those crystals that are released naturally.

They're brought into streams. They are brought into rivers. The rivers discharge along coastlines, and then a magic process called the longshore transport system-- waves breaking on beaches transport the sediment down the Florida peninsula. So that's where the quartz came from.

This quartz came from 1,000 kilometers away. And it took a long time to get here-- 30 million years to get here. Now the barrier island is only about 3,000 years old. We know that because we can drill down and date the shells, and that's about what they've formed.

But the sand is ancient. Probably that granite is a billion years old. And then it was introduced-- it was weathered and then introduced and carried down here in the last 30 million years. And then washed up into this deposit here in the last 3,000 years.

So the point is, a barrier island is a pretty ephemeral feature geologically. This thing will be gone in no time.

Now you can see the waves are coming in from the Southwest. And these waves are being refracted around, I guess, but you can see the waves breaking on the beach. We won't worry about the direction now, but when the waves break on the beach, energy is expended. There's a lot of turbulence, or bubbles. And the sand that forms the seafloor is picked up by that turbulence.

Now if the waves come in at an angle, they break and that energy is directed in a certain direction. So if the waves are coming in from the north, energy will be pushed in that direction, water will be pushed in that direction. If the waves come in from the south, the waves will, when they break, there's a mass of water that's pushed in that direction.

As a result, there's a current that flows in that direction. So between where the waves break and where they swash up on the beach, is kind of a river of current. It pulses, because the waves pulse. But every time a wave breaks, it brings a little bit of sand up in suspension, then that current takes it. And then it drops out. Another wave comes, picks it up, moves it. OK?

This is called the longshore transport system. And we have millions of waves, and we can always count on waves working. And the sand can go in either direction, or nowhere. It can go-- it can just stay still, if the waves are coming in perfectly straight. But, generally, it goes one direction or the other.

Now we have to consider the time scale. Is there a net flow? Does it go more to the south or more to the north? And that's called net longshore transport of sand. And here, this particular beach is to the south.

We can come out here and find sand being transported to the North, no problem. But over a one year, or five years, or ten year time frame, if you average it all up, more sand's going that way, than is going this way. That's called net longshore transport.

That means that if we put a barrier up, we can trap sand that's going to the south. And that's exactly what's happened here. This is what Dave has in his hands. Here is a jetty, and there you can see it right there. That's obviously a man made structure. And it has trapped the Longshore transport which wants to come down here. Here's a bar. All right? And here's where the waves did break up. They put this jetty out here, and the sand has been trapped behind the jetty, and has built the beach seaward. Simple as that.

So now we have the beach, then we can put dunes on it. So I won't go through that story again. So this is an artificially created beach-- built by natural processes-- but because of this barrier here, the sand grains have not gone into the inlet, which is here, and built up this nice wide beach. Which is-- we can all enjoy. It provides protection for the human infrastructure back through there.

And, like you see, people lying on the beach, and it's a habitat for organisms. So it's a good thing. It's a good thing. And it does another good thing. Another important component of barrier islands is what?

It lets the sailboats go through.

Tidal inlets, channels. So these barrier islands are broken up by tidal channels. And inlets are really problematic, as far as barrier islands are concerned, because they're highly unstable areas. That's where we're going to go next. We're going to see a highly unstable tidal inlet.

But this, all this sand, would have gone into that channel. And if we wanted that channel, so we make a choice. We want that channel, or we could just say let it fill in. But we made the choice. Politicians made the choice, the voters made the choice, the taxpayers made the choice. We want that channel open, because there's a lot of infrastructure, lot of homes back here, fancy yachts, and they say, it's important that we have access to the ocean. So that channel needs to be open.

And one of the ways you keep it open is prevent sand from filling it in. So this prevents sand from filling it in. So it provides two purposes. Build a nice beach, and we prevent sand from filling in.

So bottom line is this is human engineering, probably is pretty good. It's worked. It's done two good things. It hasn't done any damage, at least not here.

The question you could say is well, OK, what about the beaches on the other side of the inlet. And that poses a problem. The beaches on the other side of the inlet are part of the protected area. Nobody cares if the beaches erode or not. It's a bird sanctuary, so it's not a big deal. So we don't worry too much about that.

But if it's trapping sand here, because of the net longshore transport, it's stealing stand from the downdrift side. They're called updrift and downdrift. This is updrift. That's downdrift.

So we're sequestering sand here, which means we're stealing sand from the downdrift side. But the downdrift side here doesn't really count. We don't care. It's a natural system, and beach erosion has been occurring, like I say, ever since we've had oceans. No problem. Beach erosion is a problem when we put a condominium right next to it. When we put in an expensive structure right next to it. Beach erosion is an entirely natural process.

[MUSIC PLAYING]

Well, we're at a different place. We've moved up the beach about three or four miles. I'm guessing something like that. We were down here past the grill, but we've come up here on the road, and we're at Blind Pass. Which is right there.

This is a heavily nourished beach, which is a good thing. Heavily nourished means it's been constantly fed sand by offshore dredging companies that have taken sand, probably from well offshore, and then pumped it onshore, or dredged it out of the inlet and placed it here. So what we're standing on is entirely an artificial beach.

We passed the seawall over there. That was the active seawall. When I first came here 30 years ago, the waves, again were breaking way over there. You can see the waves are breaking way out here.

Also, when I first came here, this seawall, which is mostly buried, I could hardly touch the top of it. So we're up about six or seven feet anyway. Six or seven feet of sand vertically has been accumulated here. So a lot of sand has been pumped into this place. And the question is, why?

Well, it's undergoing severe erosion. Why is it undergoing severe erosion? It's undergoing severe erosion, because there's an inlet which we can't see right at the moment, not too far from where we are, a few hundred meters. And that inlet is trapping all the downdrift sand.

It's basically a giant sand trap. And so there's an abundance of sand on the other side of the inlet, and there's a dearth of sand on this side of the inlet. And so as a result of that, this beach has eroded very fast. And is in a constant state of erosion. It's in constant state of erosion.

And so in order to maintain it, the Corps of Engineers, or the taxpayers-- there's a complicated formula who actually pays for it. It's a private company that's hired, but it's under the egis of the Corps of Engineers.

They go out and find the sand. And they've got all kinds of permits. And pump the sand here, and they do it very frequently. No question about it. They do it very frequently.

And you can see that an awful lot of sand has come here. And this beach will eventually go away, and they'll have to keep doing it again. Now they put some structures out there, we'll see a little bit, to try to retard the rate of erosion. And you can decide whether or not that's a good thing, or a bad thing. It does retard the rate of erosion, but it-- does it harm the beach such that it makes it less attractive to come here? So it's kind of a value question.

Now, behind us, are three condominiums. That's an older one there, as you can see. And these are younger ones that have sprouted up. And like I say, this sea wall here, waves were breaking against this sea wall, and broke against that sea wall over there. These condominiums were at risk, and still are at risk by storms.

And now it has a nice wide beach in front of it, but not just a year ago, the waves were breaking against the seawall there. And we had large storm and rocks that are now buried, but partly there to uphold the seawall, were actually carried out by storm waves, and chucked into the second story windows. That's how-- so these buildings are really at risk. There's no question about it.

And not only are they at risk from the ocean, they're at risk from the inlet, which wants to migrate into them. So to make a long story short, this is a terrible place to build a bunch of condos. But in 100 years, those buildings will be 100 years old or more, and so it'll be time to take them down. And you take them down, and you just leave it. You don't replace it with another one. You turn it into a park. You turn it into a-- plant trees or do something like that.

So these are kind of issues that we have to address as long term planners. That's a key issue for young people that I urge students to get into. Learn the science, and then learn the management and the policy behind it.

And so you can go talk to politicians. You go talk to city planners or county planners, and say, OK, this is what's happening, and this is what we should do. Because there's a huge gap between the people in political power who can make things happen, and the people that know what is going on. And we have to kind of bridge that gap.

[MUSIC PLAYING]

Well, we haven't moved very far from our last stop. And we're closer to the beach. You are standing on a hump. This is unusual for a beach to have a big bump out here. It's entirely artificial. And you can see that nature doesn't produce bumps like this, so this bump is on top of one of these T groins, which I'll talk about in a second.

But the thing that strikes you right now, is gosh, this is a really wide beach. This is cool. There's no beach erosion problem here. But there is.

This beach is highly vulnerable to erosion. And so it's been recently renourished. That is sand grains have been brought in from another source, most likely offshore. There's sand lying on rock offshore that's of beach quality. It's pumped in. It's very expensive.

Beach renourishment is at least $10 a cubic yard. And we're talking, maybe, a couple hundred thousand cubic yards. So we get right into the million dollar mark, right away. So who pays for that million dollars? And that's another question altogether.

And so the point is that you build a lot of sand out. So you buy yourself time, because it's going to erode back. And so maybe you, hopefully without any big hurricanes, 10 years will go by, and then you have to do the whole thing all over again. Spend another couple million bucks. And then it's just an ongoing process.

So there you're looking at recent beach renourishment project. Somebody'd come out here, and say oh the beaches aren't eroding. And then and by that single observation, that snapshot in time, they'd be right. But if we monitor this, and it has been monitored by coastal engineers, this beach's fluctuation goes right back to that seawall.

And, like I say, the rocks that are protecting that seawall have been carried by waves and have broken windows in the second story of that condo. There's a third condo there. So we have three major league human infrastructural features that are really built in a bad place, 'cause this beach is so highly vulnerable.

And the inlet is prone to migrate in the downdrift section to the south. And so, if there aren't significant stone structures over there, the inlet would take out the condos. So the condos are being threatened both from the north and from the west. From the north, by migrating inlet, and by the west, by the large storm waves.

Now here, this picture is-- we're right about-- here's this point here. And these are T groins, gigantic bags of sand made out of a very tough fabric. And the idea is, that way you could take them out, or we can cut them up. Rocks are permanent things. Once you put rocks on the beach, they're there forever. But if you put big bags, and they turn out to be the inappropriate thing to do, you can get rid of them by just slicing them open, let the sand go, and just take the fabric, and move it away.

But we're standing on one of these. This guy probably right here-- that's why this big bump is here. And so the whole idea is if they've stockpiled a lot of sand, and hoped to buy enough time, or sufficient amount of time, so they don't have to do it again anytime soon. But all bets are off if we had a hurricane-- a vigorous hurricane season.

And four or five tropical storms entered the Gulf of Mexico, that surf there would go to be much larger. And the longshore transport system would get cranked up. There's not much sand being moved now, but during large storm waves, it goes up by an order of magnitude, based on wave height and period. And so this beach could erode back 50 meters in one storm. So they have a second storm, it's 100 meters. Third storm would be 150 meters.

So three storms could take this whole beach away in a month. Whereas, they probably have a plan for it, to last-- I know they have a plan, but I don't know what the details are. This beach should last six years, or eight years. And the Corps of Engineers have got this down to, sort of, a science. But it's not a science, because we can't predict the weather very well.

And this beach could be gone in three or four years, and then we'd have to spend $2 million to bring it back. The question is, we've locked into a process-- a keep spending more and more money to protect these buildings. And my question is, let the buildings fall down. Or take them down. Spend the $2 million to take them-- buy them out, and have them go away. That's pretty drastic, but that's one way to start to think in terms of long term coastal management.

But we bought into a process now. We're spending a lot of money to protect some buildings. We have a nice beach, but the beach is ephemeral. People can go to other beaches if this erodes back. And let the inlet do its own thing. So that's another story later on. So I think with that, we'll stop, get in the cars, and go to the other side of the inlet.

[MUSIC PLAYING]

All right, this is the last stop. We're on the north side of Blind Pass. You can see it behind me. We had to come, kind of, a circuitous way via the roads to get here, but nevertheless, we just were over there, 15 or 20 minutes ago looking across here, and now we're here, looking back over there.

And you get a good view of the inlet from here. It's called Blind Pass because the access way is basically blind to boaters. It takes a left hand turn right here. If you look down there, you can see. The inlet just doesn't go straight in. It takes a left hand turn.

And that's very common in the smaller tidal inlets along the West Florida coast. The big inlets like Tampa Bay, they're straight. They go straight out, and there's a really deep channel that, kind of, anchors them in place. But these small inlets-- which, there's not a lot of water that moves in and out. The tidal prism is the volume of water that moves in and out on a daily tide, is relatively small.

And so these inlets have a tendency to migrate. And they migrate as a result of the longshore transport filling in the updrift side of the inlet, pushing the channel towards the downdrift side, hence they can migrate significant distances, like a couple of kilometers, a mile or two, laterally. And then they poke out into the ocean like this.

So this inlet has a tendency, because longshore transport goes to the south, and to get a sense, you can look out here, and I know, it's hard to see right now, but the sand is moving in this direction over the long term. And has pushed the push inlet laterally, and engineers and people decided well, this is a problem. We don't want the inlet to migrate anymore. And we don't want the inlet to fill in with sediment. So we'll stabilize it. So this is a fully stabilized inlet. It has jetties on both sides.

And that says OK, this is fine. It allows outboards to go in and out. And so there's an economic value there, and an economic value for the people that own houses and docks and boats that goes with houses, have easy access to the Gulf. But we make a significant cost in doing that. And we have to maintain this inlet. Again, we're in a very dynamic type of environment.

The inlet, if left untouched, would close up. And so by stabilizing it, we're preventing it from closing up. But we're doing a couple of things.

One is that we're preventing these sand grains that we're standing on here from reaching that beach over there. So that's why that beach is in such severe-- has such severe consequences. Right now, it looks wonderful, because it's been recently nourished. But it's under constant threat of erosion.

Here, this beach is wide. And you can see those condos have been built well back from the ocean. And you can look at this map here. You can see how wide this beach was build out. This is abnormally wide, because it's been trapped by this jetty here. And that rock wall, in front of those condos, prevents the inlet from migrating into the condo.

So there's a lot of engineering activity that has gone on here, at great expense, to maintain this inlet for two purposes. One is to prevent the condos, and two is to allow boats to pass in and out of here.

So I ask the question, is this worth it? We spend millions of dollars maintaining this inlet. And the boats that go in and out of here aren't aircraft carriers. They aren't big bulk bore carriers. They don't carry oil. They don't carry a lot of expensive commerce, so basically 16 or 18 foot sport fishing boats.

And so you could ask the question, well, is it worth spending all that money just so a handful of boats can go in and out-- have easy access to the Gulf of Mexico. The owners would obviously say yes. The taxpayers would say no. This is not a good way to spend taxpayer dollars. We'd rather spend it on something else.

So that's a constant ongoing thing in Florida. Put in these expensive engineering structures, and we have to maintain them. And who maintains them, and for what purpose?

Now if this were a major military installation, or a major commercialization like a tank farm, where oil tankers would come in-- yeah. You have to spend the money to maintain it, because it has great economic consequences for the country, and even security consequences to the economy. But I would say, argue, that Blind Pass does not.

Second of all, the argument for keeping it open like this-- because it'll seal up in a heartbeat if we take these jetties away. All the sand here will go right in there, and that's the end of the inlet. There's so many homes in there, and there's such a huge build-up, and people put fertilizers on their grass. And when it rains, it washes-- in the old days, leaded gasoline, exhaust, into the drain pipes and it would come into the bays. And so the bays are polluted by the 3 and 1/2 million people that live in the Tampa Bay Area.

So one way to fight the pollution is to export it out through the inlets into the open ocean. It's the old adage, the solution to pollution is pollution. So we just take the pollution that we've created in the bay, and we flush it out into the ocean. Well, I think that's a specious argument. If we have a pollution problem in the bay, let's solve the pollution problem in the bay, rather than just flushing it out into the ocean.

But those two arguments-- that we have to maintain it for economic purposes, and also to reduce the pollution in the bay-- is I think points that aren't worth the millions of dollars that are spent keeping this inlet open. But that's just one take

Nevertheless, you can see that this beach is almost reached to the end of the jetty, so sand grains actually make it around the jetty. So the jetty has basically done its job. So sand grains are now moving around the jetty, and into the inlet. So the inlet is actually shoaling. So dredges still have to come here and dredge out the inlet.

So the solution is we keep extending the jetty seaward, and keep making the beach get wider, or do we start dredging the inlet. Well, the answer is-- or the solution so far-- is dredging the inlet. Very interesting thing happ-- and in the inlet, that makes sense, because you can dredge the inlet, and put the sand back on the beach. You just move it over there.

And that's a common solution to stabilizing inlets like this. The sand that the inlet is tracked, you dredge it out, and you put it on the downdrift side, so that feeds the beach. You don't have to go ten miles offshore, and spend a lot of money retrieving the sand grains. They're right in the inlet.

A number of years ago-- I can't remember exactly when. In the early mid '90s, there was a collision of two oil barges in Tampa Bay, and a lot of oil was spilled. And that oil made it up here and soiled these beaches. And it made it into the inlet, and then became buried by sand. So it was out of sight, out of mind.

And then they came back years later, like a decade later, and said, oh well. Blind Pass is too shallow. We can't even get the 16 foot outboard sport fishing boats out. We have to dredge the pass. And so there was a bond sold, and money was raised. And Congress appropriated some money. And the state appropriated some money. And the county appropriated some money. And so they brought a dredge in and started dredging the inlet.

Guess what? They released all that oil back into environment. So they respilled the spill. So they had to put booms everywhere, and they had to scrape the oil off the beach everywhere. So it was a big surprise. Nobody expected that at all, so that was, something nobody predicted. I guess it's one of these things, once you start into a project like this, you never know really what you're going to get into. That was totally unexpected. But it was a legitimate oil spill. And you couldn't walk around here, because it all had it all fenced off. And it was a oil spill type of project.

So there you go. Here is a an example of, what I think is, poor coastal engineering. It's poor coastal planning. If we could turn the hands of time back, you'd say, just let the inlet fill in. Don't build those big condos over there. We don't have to protect them. Make this a park, picnic tables, bathrooms. And if they get washed away in a hurricane, it's no big deal. But now we bought into maintaining a large infrastructure, and we bought into for the future.

So more of this is not a good idea as far as the environment is concerned.

Thanks for coming. It's been enjoyable. It's fun to do this sort of thing. It's easier to stay in a classroom, and just show slides of these things, but you really don't get the feeling unless you actually come out here and see it for yourself.

As geologists, we try to come out when things are happening. When the waves are up, people just stay inside, but if it's not dangerous, come out and see geology in action. Large waves breaking on the beach-- that's when it all happens. That's when the sand grains move. They're just starting to move now. The waves are just getting to be big enough, but the wind isn't strong enough to move any sand grains.

So you have to be out here when the action is to really appreciate the geological processes. But like I said, I think it's important to make the classroom work where you can talk and show maps, old maps of how things worked in the past, and mate that with [INAUDIBLE]. Come out and see the real environment. So I hope this made an impression.

[WAVES CRASHING]