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Good afternoon, welcome to today's webinar. Techniques and concepts for improving coastal ecosystem resiliency to benefit both people and wildlife. My name is Jen Ryan, natural resources specialist for the natural resources conservation services with national technology support Center, and I will be your host.

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And, with that call we will now begin. Joining us today, is our moderator, Don Riley. Don is a biologist in the ecologist at ENTSC where he has served as a member of the team for over seven years. Prior to joining, he held positions within our district conservation in a number of locations, and of a state biologist. His professional career, before an NRCS includes times in the private sector and in state government. You may now begin.

Well, good morning, or good afternoon, depending on where you happen to be hitting on this fine day, thank you, first off I taking some time today to join us. Got a presentation here today that I think is going to be timely, but also very interesting. I've got my notepad out. Planning to take notes myself as I will be a student is much as the moderator here so right off the back, thank you all for taking time today to join in. We do have two excellent presenters today. First, we have Christopher Miller. Chris has been the manager of the USDA plant material center since 2009. Prior to this, he served for 18 years in the an RCS field of plant material specialist for the Northeastern and mid-Atlantic states. He has provided guidance to the state technical specialist, and field office conservation districts onto and plant selection for many conservation practices. Including critical area stabilization, conservation cover, filter strips, criterion buffers, and restoration. In addition, he has worked with many partnering medical federal state and local agencies such as dunes, tile shoreline, streambanks, and my my. Between 19 he mitigated and adapted to saltwater mitigation. He had a degree from Penn State, and a plant science from the South State University. And Chris will be our second presenter today, starting us off today for our first presentation will be Gary Casabona . Gary holds a BS in environmental sciences from Rutgers University, and an MS in biology from Virginia Tech. He has worked for the USDA natural resource conservation service for 25 years with the last 11 years of state allergist for NRCS Rhode Island. Rhode Island's current initiative will have management for New England, Monarch butterfly and native pollinators along with moisture restoration. On top of all that, including the close print. So with that, go to turn it over to you, looking forward to the presentation today.

Well, thank you very much, good afternoon, everyone, or good morning. As Don said, depending on where you are, I'm going to share a little bit of technical background on two species that are really near and dear to my heart. So, this is part technical presentation, and hope we, part a call to arms, especially for our NRCS status, hoping that I can lasso some of you into the efforts, here to help with conservation of these two species. So, in addition to being the NRCS biologist for Rhode Island, for many years now, I've represented NRCS on the Atlantic coast management board. And, species that work are Blackwell and American black. And, while we can bring any of our NRCS programs to bear on conservation of these issues, we very much focus on what reserves. That would be within, and containing marsh habitat for salt marsh barrel. And, containing either salt marsh, or freshwater evidence for black rail. So, in New England, here, we now have a number of projects, and we have been in great, great situations, working with our local partner. They bring decades of experience in salt marsh restoration. That really makes my task easy knowing that we have solid advice, in terms of implantation on the ground. Now, here in New England, most of our salt marshes do have a history of agriculture, through salt marsh take. And of course, and eligibility is very important for getting a landowner into our wetland reserve. So, as I, with the help of save the Bay, we got four current projects moving through the process, and it looks like we have two more coming up, as long as the landowners does to go forward. So, it's been pretty exciting. We could be of two 5, 6, possibly 7 salt marsh related wetland reserves. So, I want to make the point that as I talk about these two species, or of the eastern coastal states, they can potentially contribute to this effort. During the conservation practices on the ground, through acquiring easements. Within either the rating or the non-reading range of one or even both of these issues depending on which state you're in. And how short the shared range maps are on that. This slide is from our Rhode Island state wildlife action, and shows you what the sparrow looks like. This sparrow, again only is utilizing salt marsh habitat. We all know that through climate change, sea level was, and other many other

fact there's, that are salt marshes are at risk. And I think that that's generally well-known. When we go together. Several years ago to put together, the update to our statewide action plan I was on the habitat committee, and I think it took us less than two minutes of folks sitting around the table to decide that salt marshes were our number one rarity among all habitats. So, here, you can see the range map for salt marsh sparrow. It is hard to see but the orange breeding extends all the way up into southern Maine. The first year-round from pretty much southern New England all the way down to Virginia, and then, you can deduct the wintering range of them all the way down to Florida. So, it is a fascinating. With, has evolved to handle lesson Dacian that may destroy eggs or checks. With the sparrow is able to do is renounce when it is hit with title inundation. However, as you may have guessed, now that he is seeing the effect of climate change mediated sea level rise, that balance has been ineffective and many are lost to these high tides. So, you can download the conservation for the issues at the Atlantic coast website. Which you see is a CJB.org. I believe Jen also put that in the materials on the webinar page, so you should be able to grab a file that has links to both of these sparrow conservation lands, as well is lack conservation plan. And, you can see from the side, there is substantial data to show that the species is declining at a rate of 9 sent here. So, from 50,000 individuals just a decade ago to let them 30,000 currently. So, this really is very much in perils the she's. So, what do we do? To mitigate this issue. So, obviously as I said a moment ago, one of the main is mitigating blood inundation with less, and the way we do that is through restoration, at least partly back to what our native hydrologic conditions. But, depending on what your income salt marshes can vary quite a bit. Appear, when we are doing it, excuse me, we're doing restoration, we are to excavating old channels. That is the we would help us appear to restore flow onto the marsh and off of the marsh. Working with when Ferguson and his staff at St. the bank. They have done an awful lot with creation. Those can be thought of as sort of the capillaries where the channels are the arteries and, they can be created, even on sensitive areas of the marsh. These are done with quickly with hand shovels. And folks walking the marsh, digging the little capillaries and, the entire effort eventually result in a prudent that will help to reduce blood inundation of nests. I also do a lot of work in the society appear, we are part of a pollinator partnership with 6 of the New England offices in one of the wildlife services and university partners. So, these landscapes to provide in Rhode Island, in most cases, significant outflows that we are including in the easement. And, we will manage these to benefit pollinators, Monarch or fives, as well as, you know, throughout my life, my favorite group species, which is the migratory songbirds. And, we do that through seating, and need of shrub planting. Species like for example can be very important to Monarch under five. Many of these sites will have Willow, that will provide some very important early-season pollen for bumblebee queens, when they are coming out of hibernation, which, within sections, referred to as diet pods. The native shrub plantings we have Dr. Scott McWilliams here who has done quite a bit of research on the best shrubs for migratory songbirds in terms of nutritional value of those fruits. And, some of the preferred species are with Burnham. Perry, Elderberry, several dogwood species. Particularly, okay dogwood, gray dogwood. So, that is what we are doing in the up lens to complement the title channel restoration being done on the marsh itself. Switching over now, to black rail. And, you can see the species in that lower insect photo. Black rail, again, not limited to utilizing salt marsh habitats, but will use other types of wetlands. So, potentially, the playing field for NRCS staff, to help us to acquire easements for this species is a much, much bigger playing field. So, again, the full conservation plan can be downloaded at a CJB.org, and this plan strongly emphasizes the short-term need to create more non-entitled habitats that is safe and at sea level rise and entitled flooding, as well as the longer-term need to continue to require and manage software systems to facilitate marsh migration and provide future real habitat in those title systems. So, especially for you non-avian folks, the black rail is really quite an interesting and unique species. It's the most secretive of all the so-called secretive marsh birds, and it actually is one of the least understood species in North America. The Ranch has contract did in recent decades. And, you can see that now, there is very little evidence grading north of pretty much southern New Jersey. Again, you can see that the year round range extends all the way down to Florida, so, between these two range maps, you can see there's opportunity to jump in and help with conservation of matter which of these states here in. And obviously, the mid-Atlantic states are very, very important. Having the capacity to support nesting, for both of the species. So, for black rail, sloped wetlands were shallow moving water. It's what we are looking for. So, we are working with a number of partners, I think I want to put out a call to any hydrologist online. That we would love to have your input on this. We've heard some anecdotal stories, one, for example of a leaking, irrigation line on a farm that was accidentally providing just the habitat that rails need. So, unlike the sparrow, where we have a very good handle on what we want to achieve and how. With black rail, there are a lot of great folks really looking into this right now. To try to tie enough on how they can manage his best for black rail. They maintain that water depth and appropriate education. And impounded wetlands, prescribed fire in some cases to set back education. As I said a moment ago, Krishna freshwater sloped wetlands or wet meadows. The use of beneficial use of drugs spoiled. Or other materials

that can be shot to the marsh that can provide higher nesting areas and title marches and Chris has worked with the U.S. service town on Delaware. Doing exactly that. Supporting their work with the similar deposition by guiding them on coastal plant restoration. And, control of invasive plants in the high marshes. Also important. So, I'm going to wrap up by saying I hope that some of the partners, and especially NRCS staff on this call will keep this in mind. I know you all are out there, very, very busy with a lot of contracts and a lot of landowners. Like especially when you're in coastal and near coastal areas. I hope that you will keep this in mind, and just remember to ask your landowners. With a potentially interested in learning about these easements. Taking a few steps to see number 1 with other eligible or number 2, what sort of compensation they may be able to ask act, how many acres they can enroll so forth. Just to make the point for folks. Even though it is called the wetland reserve easements. We can actually take more effort than wetlands when we acquire the easement. And, it's obvious how that will benefit us in terms of marsh migration in inland terrestrial sites. Of course that is very important for her. Turtles, frogs, toads, to have these upper areas, not just the wetland habitats. So, with that, I will just say anyone that like to learn more about this, please do feel free to contact me at any time. And, now, I want to give it over to Christopher Miller. Chris and I go back to my very first day with NRCS 25 years ago and I could tell you that his knowledge of plant is obviously absolutely faster than I'm really looking forward to this presentation. Oh, why don't you take over, Chris?

Okay, Gary. Thanks a lot. I think you dated me a little but that's okay, I appreciate the compliment. So, Gary, was actually the information for this webinar. Because he's been trying to get some coastal training and coastal plant training and application. Information to the center of New England folks. The field office and district folks for the last two years now. We have not been able to do it for obvious reasons. You know, mainly because of covert, but so, he said maybe, maybe we need to think monitor way. And this is where we are going to do it. So, you're doing it now. So, I'm happy to be involved in this, happy to present some information. So, I want to talk about some professional experience, and the plant material center has gone both independently and with partners, as it relates to application of plant materials in the coastal environment, sort of with a broad overview of climate change and some of the issues that we're dealing with, you know, relating to sea level rise and more things like that. So, I will advance the five, here. Okay, so here's where we are at now. I give you a second to read the slide, but you know, things are happening. Sea levels are rising, storms are more intense, they are more frequent, and, even if we dramatically change the amount of carbon dioxide and greenhouse gases in the environment, there's going to be a long lag time before we actually the result as far as sea level stopping such an intense. Probably a lag in seeing any reductions intensities or frequencies for that matter. So, that's just the situation. So they need to learn how to deal with it. It's issues to face, here. There's a paper I came across recently and this is the title for there's no such thing as a natural disaster. Of course it piqued my attention. Of which of course I suspect that thoroughly piquing your attention too, but it was written from the perspective of of a sociologist from an environmental geography. And, really considering that disasters are socioeconomic impacts to humans. And to society. There are the natural events that have occurred through, since the life of the planet, since the life of the earth, there are natural events that have occurred, really with the humans that the natural disaster occurred. These natural events are always the occurred, they occur frequently, and nature is resilient enough to take care of itself in most circumstances. But, the disastrous art of it. It comes in from an ecological or economic and social perspective. So that is put things into a different first active. Of course, super storm Sandy was almost healed, a catastrophic storm here in New Jersey. And, you know, since this event occurred, and you know, New Jersey was ground zero for this, you know there's been a lot of funding, a lot of projects implemented, a lot of things happening. So I'm going to make reference to Sandy throughout this presentation. Just because a lot has happened and. And we've been doing a lot since then. You know, but the thought occurred to me this was a late October storm. You know in May of the following year. So, after the winter season I drove up through the area that was highly impacted race for storm Sandy. And, lo and behold, there were magnolias that were starting to bloom here. Even in this slide on the left where the storm surge actually came through, you see the opening in this house, here. It was obvious infrastructure damage, massive damage to the homes along this coastal strip. But, in the midst of all the devastation, we had you know, we have the magnolias blooming, and on the right-hand side, here, it's a native plant garden, that we help install and see that park at the municipal complex therapy which is only literally blocks from where you saw the iconic roller coaster in the earth, and this area was also impacted by the storm surge, but yet, the following summer, these plants come alive. So, I really got thinking about how nature is. Not all the plants survive. There are conifers that were impacted by the salt flooding., Much of the plants have come alive. And, that's something I want to mention before I forget, is that the time of the year, the stones actually has a lot of impact on the, how the plants are affect did. For instance, if the plants are dormant, if it see when a northeastern struggle to get here in the mid-Atlantic and the Northeast, you have much less plant damage

from self ray, and saltwater flooding than you do for a summer hurricane where you have everything they doubt, all the plants are actively growing, though, really, the time of year really has a lot to dictate on how much plant damage occurs. Okay. So, what makes a resilient coastal? You know, the ability for a plant to rebound from damage. You know, many of our shrubs, our coastal shrubs talk to a little bit. You know, sprouts from the stones, the trees. The zones and grasses. You know, if the plant was damaged you know, they can rebound from that. The ability to tolerate the saltwater flooding and dry conditions obvious the heat and drought tolerant. Again, the spreading abilities, reproduction biology, the plan has a lot to dictate on how resilient it is. And again, just generally annotations are very in environmental conditions whether it BPH, you know, very coarse textures. You know, versus refined texture soils and things like that. So just a little bit about the plant material center, what we do here and how we actually keep this plan could so we were established in 1965 after the, it was a three day northeastern that hit the mid-Atlantic coast, and 62. So, it was identified that there was a need to have a facility test and select coastal plants to make them, ultimately make them available to commercial nurseries for use, and products up and down the coast. We also worked in the on coastal environment looking up plants that are adapted to the hot and dry conditions in the nutrient of the coastal plain in general. But, we are ideally situated both where we are at geographically. You can see in the upper portion of this photo. This is found up here. This is the tidal marsh behind the barrier island. Where Avalon is referred to a seven mile Island. You have the pain the march behind it. The great sound. And then there's our facility, just to the west of the garden date Parkway, which is right here. This pond, right here is actually freshwater pond, and it was, it was in the creation of the elevation of the garden state Parkway. It was actually installed in late 50s or early 60s for it so, we have the benefit of using that freshwater there. And then, geographically, are located between seven communities in that transition with the communities in northern communities. So, we are ideally situated to do adaptation work for my climate change perspective. So, little bit about how we do the work. So, our first director from the soil conservation nursery back in 30 became the plant materials with the materials program. Basically the nature has evolved for every purpose. That, you know, that the plants are genetically you know, adapted to certain conditions and it's a matter of us going out and making widescale, widespread collections of other particular targets issues, bringing that material back to our plant material centers and observing. So, it's observation selection process are not doing any intentional breeding in these plants is basically the are already out there, genetic material projects already out there. We're just trying to identify, you know, what may help us to solve a particular resource problem. So, we identify a plant we want to work with for the target plan. Where to buy the evaluation criteria then we go out and make collections about material, and then we evaluate them on center as off-center. We call it advance evaluations when it's off-center actual site that we want these plants to be used, and then we do what we refer to when I say we release the plant material. We make that available to the nurse three and feed industry. And, that, those industries produce the plant material to make them available for projects. For municipality projects, liver wants to use them in the landscape. So we do the R&D on the front end, and then the materials became commercially available. So, just a little bit of a background on that process. Through the years, working a plant material specialist and doing some continuing edge. Some training for record University. I got to know Dr. Stephen as a restoration ecologist at record University who is also the editor of ecological restoration journal. And, he wrote an editorial after super storm Sandy. I don't think it's the 2013 edition called sheltered from the storm and he makes the comment in there that the concern about restoring local genotypes of plant may be a loose or deception that successful restoration may require new genotypes of plant issues from different locales that can tolerate the much changed conditions in the coming decades. Basically, that provides background and justification to the work that we do here. We go out and make these widescale collections of these plant materials and evaluate those. And, the industry, those perform the best. So, in other words, he got that and told me personally that to take a proactive approach, that that's the really the way to go to introduce these adopt a resilient plant to help some natural resource albums. So, I'm happy to hear that from him back a few years ago whenever we talked about that. But, just a little bit about that. I know most of us folks that work necessarily in the dunes, but that's a lot of work that we do here, or that's how we got our start. Our first 40 or 50 years or so was the title IX and doing work. This happens to be a shot of the Avalon dunes, and many cases, they are very well developed systems which have actually female words for hurricane resilience. But, if you notice that a little bit about the donation of the materials here, you have upfront, here with right, adjacent to the beach surface. You notice that the coloration of the beach grass primarily American beach grass growing in very vigorous, the Sanders Varian, the plants are growing vigorously. And then you get into the area, here. Which basically the coastal grassland system, or you have a lot of diversity back here. You have some beach grass. But, more coastal blue stems, seaside goldenrod. Among some other species, beach peak, and then, then you get into, if your beach is wide enough, actually, you get into your shrub zone. And it's interesting to note, hear from this area about the shrub zone that occurs roughly at the same distance from this earth. From the shoreline, from the

back him up in the frontal area. So, that's dictated by storms, primarily, I believe. But, this is a habitat ear. This thicket. Even maritime behind it. It's really a threatened plant community along the coast. There are only a few of these that actually exist in New Jersey for us, sanded national seashore. Island Beach State Park, and a few of these municipalities including Avalon, where these zones exist. So, they are highly sought after, highly desired so, unfortunately there's a lot of folks that sort of resist the formation of these, and obviously when the Army Corps comes in and does their projects, they design a trapezoidal Zune. It will not, 15 foot elevation. Any at the height of the plant materials on top of that. Yes, it can be restrictive as are as the water. But obviously, you're giving a protection for the view, because otherwise, you're going to end up with a situation like this. So, again, on the primary doing your have your American beach grass. Has to prefer sand secretion produces bigger when it's not growing in a setting and it I will show a picture of that from Cape May, city. There's another, that's the most, this is the most common variety that is available which originated from Cape Cod. And selected here at Cape May. There's a North Carolina that has also been used in this area that performs fairly well. However, after super storm Sandy, there was a lot of material brought in because of the demand, and we even got some of the projects here in New Jersey in Long Island. And up and down the mid-Atlantic and southern Italy would cost, we are getting material from the Great Lakes of a witches freshwater environment. So, that material with not be performing nearly as well as the variety in the saltier environment. So, just a few things we worked through in the future. From a new perspective, and developing some additional seating techniques, including hydroseeding. On the dunes system which is diversity of grasses and wildflowers and shrubs need. Even nurse drops, we consider the American beach cup to be a nurse cup because it's shorter length, especially as our climate is changing, getting hotter here even in New Jersey. We are noticing it just on the precipitous line but there are some other things we can do to see out there, you know, to stabilize and, there are some things we done some trials with the wild right, with trailing the annual native legume which does really well with early success. You know, the plant on the Dune. And, lamenting the beach grass with other species like bitter pendent grass which is a more southern coastal grass as well as CEOs. Which I'm going to talk about in a minute from some of the testing, here in New Jersey of the sea oats. Little bit about micro fund inoculation. We tried trials without using the commercial and we found a little bit of benefit from using that. But, there is been a process developed to actually grow your own, which is something that we sort of fiddled with a little bit. But we need some more development. And then, improving the seed availability of diversity of species, like the trailing well-being, seaside goldenrod, it's fairly easy to change the seed. This has been successful for feeding on the dunes. And then another plant that folks have been asking about that is very hard to propagate. We had our sights to work on. So, the dilemma with the beach grass is, in that frontal Dune area, if it's not receiving active sand, loses vigor, and if you had nothing else planted there, with encouraging the state of New Jersey, and the Army Corps of Engineers. Diversify their specs for their doing prepping. And they are starting to catch on. But it's a long process. Essentially, what will happen is the beach will die in this picture on the right, here. It's an Cape May city, and again, it was not received, it was just back at the beach grass, American beach grass and it was actually state owned Greenacres, open-space property. It was not receiving frequent over wash and it was not getting sand blowing in here to make the plants vigorous. So, I could not find a picture of it, but one of the things that was done here was prescribed fire. So, the New Jersey Forest fire service actually came in here and burned this night. This is back in like the mid-2003 2003, 2005, something like that. And then, I was down at roughly the same spot recently and you can see the arcade building in the background, here from a slightly different angle and different distance. But it's roughly the same area at a now notice, notice the look of the, or the plant community in the doing it now after prescribed fire, relieved a lot of seed material. You know, reduced that latch and succession was allowed to take place, and now we have shrubs and beach plum. We have coastal pendent grass which is a native one to the grass and we have coastal bluestem. And, with American beach grass mixed in there. The other species I mentioned is bitter grass. It's predominate in the south, but we have looked at some varieties, here. To see if we can complement the American beach grass but this material. It's agitatedly propagated. It's a little harder, slower to get established, but once it is established, it's long-lived. But, the focus I really want to mention, here sort of the climate change standpoint was our sea oats relief effort. Back in the mid-80s, collected by the staff, here at the Cape May materials center from Virginia. North Carolina, South Carolina, I think even as far south as Georgia. That material, you know, it's really in the, the indigenous range of the CO. And, you know, we brought that material back to the materials center seated out of accessions. The field preppings, and, we continue to evaluate in a test, though. We never really came up with the release. We thought we lost most of the things through the stars. Back in 2016, I think it was, we went out to a former site in Avalon, which is where we do a lot of our plant testing, and then there were about 18 individual plants that were survived from the 1992 planting that survived the perfect storm, the howling storm, many northeastern's. And so we brought this material back to the PNC, and we propagated new plants and went out with new trials. Here, the

new trial that we did in Avalon in the back area, which subsequently was damaged by super storm Sandy. And, at any rate, we are now at the point where we think we've got naturally selected called part. The northern part. They survive here in New Jersey. The releasing that material. So I'm going to talk about that a little bit. So we receive some University Delaware. You know, they are you know, they turn basically most of the material over to us to do further testing and get it into the commercial marketplace. I already mentioned some of these species here that occur in the back area, but the point I want to make is that high diversity leads to high resilience, so the more variety of plant materials you have, not just grasses, but wildflowers, legumes, these will all contribute to, you know, the resilience of the back Dune area. There was a situation in Ocean City, Maryland that it was a compliment to the beach grass. Back in the early 90s, the Army Corps did their beach punishment project. They had an issue with the height of a lot of people, the condominium owners probably had an issue with the height of the dunes as well as the height of the coastal panic, which is a 3 to 4 foot tall native grass. So, they commissioned us to take a look at what else we grow in the back Dune and still provide stabilization we needed. But yet, would not be so tall. So we did this trial with the beach grass bitter panic, but I mentioned all these in the coast and the one that really turned out the best, as far as the survival and the spread was some core grass. And you have the associate core grass growing in the Dune system. But, it does treat a grocer naturally and as it turns out, on already, it grows there the Avalon variety in the high Dune system very well. Here is a natural stand-in of grass growing in Seaside Park, and again, in that name vicinity where the super storm Sandy hit. We've also exceeded coastal panic. As I mentioned, the Army Corps actually took some of our technology from the early 90s and contractors went through and conceded this in the back Dune. This is about a one-year-old coastal pendent grass in the back Dune. We did some early trials using a single row garden feeder, garden planter. You need to get the seat in deep. Howdy for the seat is, the more protective of his from heat, the more moisture is a pain. But after super storm Sandy again I refer to Sandy, up on Long Island, there was an effort to you know, a promotion of using the seed bombs, and I don't know if you've ever heard of these bombs before, but I think the Army Corps of Engineers, they actually, the cold region lab up in New Hampshire used, started using these, or trying these entrails on their training lands of that were disturbed by the tanks and other equipment explosives and all of that sort of stuff. And, you know, with some success, but, I would say it's a feel-good sort of a process for folks who are getting volunteers out there to throw these. They are basically kids Clay Falls that are impregnated with different kinds of seed depending on the environment that you are ceding in. But, I think the original idea came from a Japanese farmer and philosopher. A, the author of a book called sowing seeds in the desert. He actually has a concoction the back, a recipe in the back of his book on how to create these clay pellets, or clay seed balls. And then, the Army took that technology and the folks in Long Island after super storm Sandy started using them. And, I think it's been successful to have not personally been involved in any of these, but I would suspect that a lot of these things are, if they're not used at the right time, like before mirroring, the moisture does not stay in the ball, and the ball dries out. I think the seat is going to draft a of the most effective way of seeding, but it's certainly not as effective as the direct seating. The back like I showed you on one of the previous pictures. As far as doing plantings in the back Dune, certainly the back row, as Gary mentioned, they very to the Eastern and Red Sea. All desirable's issues to have in that shrub ticket and three ticket and maritime forest. And, this is actually a table with basically showing what Gary was mentioning about the nutritional value of many of the fruits, fruits that are preferred, migratory songs that I think mentioned a few of these. But right Burnham. Graydon would. Basically all the dogwood species, they spent very rapidly on the Dune. And then there's others that are highly recommended on the service barrier, elderberry, flowering dogwood. So, you know, looking at the nutrient content. And the antioxidant properties of these barriers, the researchers at the University of Rhode Island came up with this you know, preferred list. And, you know, basically you know, Gary's used this as basically, I learned about this from Gary, and he's very high on the promoting these particular species for these coastal areas for migratory songbirds. And then, there are a few songbirds that use more than beriberi, Winterberry, black choked very, made a leaf lack or no, they're not quite as preferred by you know, a large variety of migratory birds, but they are certainly preferred. For instance, they actually were down in Cape May last week for a conference, and the tree swallows were just died coming the scrubs there along the Dune to get the seed. And just one example. So once again after super storm Sandy, the Rockefeller foundation funded a project called structure of coastal resilience route and there were teens that set up. There were many academic teams, there was the bay team, which was comprised of the Harvard school of design, there is a tenet of France and that was looking at Jamaica Bay. I think there was a team of the University of Florida that was looking at some of the southeast issues, and they were given the charge to sort of get out of the box for natural based design. And, the team from the bay came up with the solution to what they referred to as conceptual designs. These were mainly landscape architects in combination with some ecologists that were looking at these projects. The insinuation is basically what we would refer to as the maritime horse. The shrubs that create you know,

these pickets and rising the substrate. You know, that basically responds to storm damage by re-sprouting. So, disturbance creates the injury which encourages new sprouting, or root suckering. So, there list of shrubs, if you take a look at this, it's really, and highly complementary to the same list of shrubs that I just showed that were highly desirable role species for migratory birds. You know, so there was a lot of overlap with the resilience and the trees that were recommended in the structures for coastal resilience project with was the researches Rhode Island found to be the most highly desirable nutritional species for migratory birds. And, here is a schematic of it. I know the writing on here is blurry. I could not blow it up any larger, but it's basically, you have your water, your watercourse out here, your ocean or your bay, and then, you grade into you know, into may be a marsh of some kind. You know, if any dredge materials needed to increase the width of that beach, that was recommended. And then, you have your insinuation for us back here protecting may be structures, or protecting the land behind it. Again, this is conceptual. They came up with these drawings of the root architecture of different plant materials, like American beach grass. Which again, is highly rising. So, you can see the rise of zone, the rising structure going across here as well as the smooth core graph. And then, even looking at a few shrubs, like bayberry, again, re-sprouts from the base. In the same way. As soon as you try to define, you know, the routing structure or routing architecture of these plans, so, switching gears a little bit, talking about applications, we also looked at screening species for saltwater adaptation. Selecting and testing what we consider to be underutilized plans for shoreline application. That was being very choreographed, Eastern graft, and just now starting to work with running area with the northern end of its range. It's natural range for that. But, and also developing strategies to plant diversity of mighty stance, which I'm going to talk about in a little bit. One of the first things we've done more recently was developing some seeding techniques with collaboration with the Army Corps of Engineers up in Jamaica Bay, New York. And, why develop this seed? Well, it's cheaper to say. Less labor-intensive than planting plugs. Less labor-intensive. And, you know, it really could be a compliment, not necessarily replacement for plugs, but a complement of planting plugs, and reliance on maybe less plugs, less labor of installing these projects. So, some simple trials were done, just using a set will single row Cedar. And, because the seat is stored wet, we had to mix it with cat litter. And, the preferred cat litter to use is actually the cheapest cat litter but not the clumping cat litter or the non-clumping cat litter. It worked for trying out the seat and allowing it to flow through the Cedar. So, it's a picture of the initial trial that we have done in September, actually, July we see this is the look in September of 07. Using the single row Cedar, you can see the ceilings coming up and then the following season, almost complete fill-in of that seated area. So that was very effective. It was pretty impressed with what we did on the small scale. So based on that, the contractor who was got the bid to do the seating of about 32 acres and another island it was being dredge and expanded, purchased a native grass feeds rail and brought to the material sent to. We calibrated it. You know, basically got it set up to work the way we thought it should work. Again, mixing the seed with cat litter to allow for flow ability, and the contractor uses this piece of equipment on the yellow bar island up there, and here's a picture. Again, the seating was done. You know, in the Midsummer. You can see the seating coming up. You know, the next year, September 2013, it's a pretty big stand for alternative flora. So, the conclusion from some of the work that we did there. Seeding is a viable option where you have lower energy. And, the higher energies that you need to actually physically plant a vegetative buffer, and, feet in the upper third of the title range. So, not going any lower than the upper third of the title range. Using high-quality seat is obviously very important. So, we actually resigned the weaning process first part-time alternate flora. And, you know, we were able to provide seats that had greater than 85% termination. Typically, what is being done by the nursery folks who grow in plugs is overcrowded to the Mars, collect deed, and then, they will use that will exceed, the Rossi, they won't go through any sort of a cleaning process, or very minimal cleaning process. Just the seed there, flat. And then, whatever germinates they will transfer into the plugs. But, you know, they're probably only getting somewhere around 20, 25, 30% the viability of that secret buddies the, if you're putting seeds, you really want to have much higher percentage of high quality seed. And, I also, the disclaimer, here is that. It's going to take about 2 to 3. After the second growing season it's a little slower to establish. Again, that's why you need to do this in a little bit higher elevation or lower energy environment. Also, you know, drills sitting in the higher soil would not work because you know, because it's not supporting equipment. They stand material. It was firm enough in order to get equipment. And, this is just a shot of a site after, from the air after super storm Sandy actually for this was February of 2013. Only about five acres of this island was damaged by the storm. Of course, you remember may remember that. The barrier island here, Rockaway. It was pretty much devastated, there were fires and all kinds of problems there. But, because this island was behind and sheltered from Rockaway, and actually the part that was needed was actually oriented to the Northeast, it was much less damaged to the planting, to the seating. Another more recent project. Again, using Sandy funds was in prime national wildlife refuge in Delaware. And there was a breach that occurred. You know, from Sandy, the breach

occurs from the din system. It was actually at the time. The freshwater pallet. In the back area. Well obviously, you know, the saltwater came through. Mixed with the freshwater. So we decided that from a resilient standpoint was going to be a hard sell. It was easier to maintain so there was you know, a very extensive project that occurred. You know, that basically we use the materials to close that reach off. It's a lower profile, and a flattered dune than what the Army Corps typically recommends in highly developed coastlines. Where it's about 15 foot elevation trapezoidal. The bottom line for elevation. Much more parabolic around it to allow for over wash from storms from the Delaware Bay. Into the back bay area, and in the back bay area was dredged using a side casting dredge where you know, they put channels to the back to allow for a title flow throughout the whole area. So, this is actually beneficial to, you know, making you know, the drag actually, you know, with the population of the drag reduced because we are restoring title flow. But, we had all of these open mud flat areas that needed to be seeded, or they had some of the units that thought needed to be seeded. So the actually Ariel's needed about 1000 acres of this back marsh area. And they, the seed that was used in that process actually came from the Bureau of land management success program which we were involved in actually cleaning, uncollected seed that was collected from North Carolina. You know, to northern New England. All that she came here to our facility. We went through a cleaning assess and some of Ceci was made available directly to projects, including this one. But, because the quantity of seed was not really enough for thousand acres, they actually had to make that seedless commercially purchased Japanese food which was not the most desirable species to use, but it was somewhat adopted. It was the annual plan. He was commercially available. It was used as sort of a booking agent for the native seed, and then there was also a lot of natural recruitment that occurred on the site. And, you know, a few years later now, the service folks are extremely happy with the results of that planting and that seeding. And just another comment about the dune species that was planted on the frontal area, there. And the area that was dredged. And reformed into a long profile, that was the salt grass and the coastal panic grass. They were all releases from the plant material center which were commercially purchased for the project. This shows the process of mixing the seed. They used to be success seeds along with the commercial supply of the Japanese Miller seed. Now, just a little bit about you know, using materials, or marginal lands, or conservation things that we deal with, here. And, is going to make a few comments about each of these items. The salt grass. Planting buffers of biomass. It's the multifunctional buffer. Harvesting native shrubs, for soil bioengineering. These are all things that can be done on marginal lands. And, in some cases, you know, for value-added income, so, this was actually harvested from naturally harvested from the marsh. It was a big industry, as Gary mentioned in southern New England. It was a big industry here in southern New Jersey. And, now down to Delmar appeared we are finding out now, however that this area that you know, are actually more, less resilient, I should say to sea level rise because essentially, they were dryer to allow for the equipping to get in. You know, there's not an organic layer, so they have lower elevations, so that much more vulnerable to sea level rise, but you know, interestingly enough, there is still demand for that product. For the product. So, with that in mind, you know, we are looking at, you know, evaluating the various successions of the core graphs. They may have application for actually establishing a crop, per se. In that transitional area, may be the craft area that is being impacted frequently by flooding. You know, just an area that could be dedicated to growing salt meadow. It's higher and drier than the natural March. And we are finding that you know, harvesting materials can get anywhere between 3 1/2 and upwards of 10 times per acre of biomass. From a planting crop. And there is some data here from a study that we have from PNC. Us is a local farm along the Delaware Bay that is along, being impacted by the coastal flooding. This would be a prime location for this particular grower to may be back off on the amount of acreage he's growing and put in a salt meadow hay crop. We worked with, we actually had initial conversations with the landowners of this property, and they seemed really interested in putting in planting for them, they changed hands and they were bought out by another larger company and sort of lost the actions to that particular area to do this work. But again, that is the setting that would actually be desirable. The native grass, native season grass species like switchgrass, coastal panic grass, Eastern gamma grass, Perry core grass. All can be used in multifunctional buffers, or even in some situations, be harvested for biomass crop. Here is a field in the lower eastern part of Maryland, and you cannot see it, but on the right here, to the left of, or actually to the right of the road, just the large brackish ditch. A ditch that has brackish water in it, and it will occasionally flood under storm situation and flood over this buffer area, but because there is a buffer area here, protecting the crop field. It was interesting to note for me, that this was not intentionally planted. It was the natural buffer, but most of the large component of this particular buffer was actually Eastern gamma. And, that's one of the grasses we have in our target was to look at the salinity of tolerance, upper-level tolerance for salinity. Not far from where that location was, here was another brackish ditch that is connected to the manikin River which is the Chesapeake bay. But, you don't often find patent and flora growing right next to, literally, right next to a soybean field. But, you do, you do find this in the lower eastern shore from Maryland, down

through North or Alina. Has the fields growing right next to the ditches that have vegetation in them. So, Alisa, these are areas those opportunities for the RCS field stuff to work on creating buffers to actually protect the crop land, allow for the flooding of the ditches to spread out over the land, and you know, to get some capture of that, and some tolerance of that situation from the native grasses. We did a study with ARS back in 2005, 2006, and I think it was the result were actually published in the Journal of soil water conservation in 2009. Now, keep in mind that this was done in a freshwater environment, so it was not in that environment but done in fresh. Just focus on the right-hand column, here. The lower the number, the better the ranking of the individual species. So, we had a graph. Our high tide switchgrass. Are Eastern gamma graph. And then some other species of switchgrass and Big Blue and Indian grass which did not perform quite as well. But, the item to note, here is that the top three performing grasses in this particular study are also no somewhat salt tolerant. So, the same species could be used in a salty environment. In the same varieties could be used in a salty environment. And, it's all about the roots, the roots are highly dynamic. The roots adapt to their soil environment, whether it's a saturated soil environment, it'll develop more, these are roots which you see on the left-hand side. These are straw like roots that allow for oxygen exchange. Eastern gamma grass. These are large component of the regular roots. There is a regular route in the middle. And on the right-hand side, of the switchgrass through the switchgrass will develop some regular roots, when it's in saturated soil, but when it's in dry soil, it will develop this as much is the percentage of the amount. It'll be more of the fibrous roots, which are you know, really the final roof that take up the nutrients. It's the larger roots that allow for oxygen exchange. And then, this whole concept of you know, establishing these buffers. If the buffers could be potentially harvested, like for example, if you were to plan a buffer with the grasses and harvest that for biomass, for either burning, or for palletizing, you know, for poultry bedding, or other animal bedding material, then you actually taking nutrients off the site which can be highly beneficial. So you have hello fights which are your salt living plants. They these plans actually incorporate daily water into their tissue. And then exude that salt water through the glands and the leaves, or stems, and basically, the salt marsh species are hello fights. But, then you have the plants like the native grasses that tolerate infrequent flooding from saltwater or over wash, and because salinity mimics drought, these plants are highly drought tolerant, so they can actually tolerate sort of the drying effect of having the salt in the soil. Excuse me, having the salt in the soil. And that is how they are able to adapt to a saltier environment. Then, you have another group of plants that really don't like to be in standing in saturated waters, particularly, salty water but have salt displayed tolerance in those examples would be like American Holly, the bayberry and beach plum. Have waxy leaves, they can tolerate that salt spray. And then, you have other plants that can tolerate some salt and soil but not flooding at all. And whether it's freshwater or saltwater, you have vegetable crops, like asparagus, beets, and potatoes. For instance, has some inherently salt tolerance. Sums grains, particularly barley and rye, and then for instance, these are all crops that can tolerate some salt in the soil, but not being flooded. So, you need to keep these aspects in mind when you're also designing what you're going to rent in a certain environment. So, just using an example, they've got to start it on the salinity effort. We collected a switchgrass that was growing in the shoreline site up in the upper Chesapeake bay of Maryland. Just where the Susquehanna Bay at the end of the upper Chesapeake. So it's completely freshwater. We refer to it as high tide was released the commercial industry. I believe we are going to have this available on this coming year for they got a large supply from it a few years ago. But we, we sort of, by accident, we found this high tide germ and we were acclimating to salt. We put some of these containers of the high tide germ switch in the saltwater environment and controlled something here at the PNC. And, we found it, you know. It did not seem to be stress at all. So, we ultimately took that out to a planting site behind Stone Harbor and a very brackish marsh setting, actually address containment facility that was eroding at the base, so we thought that I was a good spot to do some erosion control, and this photo shows the plants growing, you know, they are dormant right now for that's why they are brown, not strapped. This site has existed for many years, and this has been collecting in the freshwater environment. It seems to be very tolerant of the saltwater environment is growing in. So, that got us think about what others she's, you know, what might have other types of salt tolerant. That we don't know what, you know, when the literature, there's not a lot of data on some of these sort of you know, like they are not, if they are black, like what is the, the up level of tolerance is assault in some of these species. You know, it is unknown in some cases. So, we embarked on a screening study, looking at a number of different grasses, and this just shows the chart of prairie core grass, which is the only issues that we've completed to date. But, you notice that from 0 to 5, to 15 to 25 thousand. So, we go from control, no holds to five, to 15. 15 brackish. 5 in the low end of the brackish. 15 and the high-end. We don't really feel a significant difference in the decline of the biomass. Which is the blue bar, and the orange biomass, until we get up like 15 parts per thousand. That's when we really see a dramatic drop off in the above and below ground dry weight of prairie core grass. And, of so, we did not have any mortality. Obviously we had bigger differences between the different levels. And again, it

was a big difference between 15 and 25 a little bit of difference between the five and 15. But, no mortality. So, we are going to do this. I don't know why my truck does not show up, here. But, I had a picture of the other flow tables which did not show up. And we are going to do this for some additional issues, Eastern gamma graphs, switch graphs. Eventually, may be the giant sugarcane graph. And, giant cane around an area. Another plant we are working with is also having some value added capabilities, possibilities, I should say. And, we started corroborating with Dr. Jack Gallagher to the University of Delaware on this species a few years ago, and as I mentioned earlier, we got most of their germplasm that collected from the Gulf Coast all the way to Delaware. And, have done some initial evaluations, like we would do, here at PNC. We've already done that and got that out of the way, so we are based running with a few lines of germ that we think of application from a commercial standpoint. But, it could be used again in that transition area, the same kind of setting that the salt could be used. And here is the field that was actually a trial field that we were not involved with in Delaware, but it was planted by a farmer. In the Dover area. In the solid standard of that again. This is an obligate tolerant wetland native wetland plant that also has some pollinator value. And, the feed and the stems could be used for different purposes that are being tested by some researchers. For example, this is the lab from Peoria, Illinois. They look at some agricultural utilization of some plant materials, and again, it has potential to see it self. It's a very oily feed. If potential to be used as a biodiesel or conversion to ethanol. And, also, the stones have been evaluated as far as being absorbent. Much like the native warm season grasses with the cellulose, hemicellulose fibers, highly absorbent materials that can be pelletized, used for bedding, using it as an observant material. The biomass can also be made into erosion control products, like erosion control socks, and things are that are used in the industry for, at least I've seen them used and recommended in the industry where you know, they are fracking and pulling natural gas out of the ground, and you know, they are creating erosion and using the natural socks to control erosion around those areas. And also, expanding the use of coastal shrubs, we've done a lot with willows and dogwoods that are growing in a freshwater environment. But, looking at things like the high tide Bush, the round cell Bush. These species also have the ability to read from an unlimited cutting that can be used in those bioengineering applications, potentially for short line stabilization. Here is just an example of, you basically cut these things at the base, they copied or sprouted stems, and then you use those unrooted stems on eroded bank, in the form of sort of the plant structure, which again, is referred to as soil bioengineering. A little bit about some work that we have done on dredge material. So there are a couple here in southern New Jersey that I was leaving dredge from the intracoastal waterway behind Ocean City New Jersey. It is cleaned. You know, it's coming out of the water, does not have heavy metals. Just the nature of the material is that when it's first arrived, first of all, it's very wet. So it has to be the water on site, which is been done in containment facilities. And, it's very salty. So, it is moderately leading to strongly salt laden, as well as this material dries out, it becomes aerated, and becomes a sulfate material. So, the pH drops. It's a very difficult substrate to get plants to grow on. But, we were collaborating with the conservation District, and they did some trial planting. Not an affordable study. Looking at a few of our plant materials that we've worked with, here, American beach grass. Salt metal core grass. This is prairie core grass roots meadow core grass good American beach grass in the background salt no core grass. This is with the material at like. When the land applied initially, this is the Deepwater material but still he highly arose. So it was important for them to get cover on this material. Again, it is salty initially. The salt level goes down over time, but the acidity goes up, because the sulfates in the material are digitized. But, we found that after one year, of establishment, of these plans, we actually put them in while they were dormant in December, we actually had about 99% survival on the beach grass, and the salt meadow core grass, and about 70% survival on the prairie core grass. No, and of two years later or three years later now, be plants are still growing, they are absolutely growing, doing well, we have not had any mentality. So, obviously, we have some material that we will tolerate that fills up straight. That the dredge material. I know I'm getting kind of close on time. So, I'm not sure I want to proceed any further, because there may be some questions about what I've already mentioned. I was very very briefly going to mention a little bit about fracks. And then of the biologists in the group might want to knock me over the head, but rather you're a friend or foe of frag really depends on your perspective, and there seems to be more more information coming out that you know, it's not all bad in all circumstances. Certainly if you are Gary and you want to establish a salt marsh sparrow habitat or a black real habitat it's not good to have the fragments there, but from a coastal resilience standpoint, from a sea level rise perspective, you know, they can keep the base a little bit better than the marshes can with sea level rise, because of the amount of residue they produce. And, they just, they created an environment where they actually raise the marsh plat elevation. And so, can keep up with sea level rise. There's also some research showing that it more nutrients and pollutants in the marshes. So, I guess the bottom line is you know, obvious the, we, it's a site-specific situation where there's area that it needs to be controlled in order to get a more desirable tech community in there. Certainly, it may be worth the effort on a smaller scale to do that. Again, adaptive

management. You know, small-scale modification. And ecosystems. But, trying to broadscale, trying to completely eradicate it. You know, the service has pretty much given up on that aspect of doing it. Allowing title thought to occur in areas that used to be freshwater, it's also the keeping it at bay. In a lot of circumstances. So, there are some things that are being done. I guess the bottom line is can we learn to have some native plants that we think will coexist with fragment. Completely eliminating it. But would allow it to coexist. Is kind of like where we are, where our approaches at this point. Looking at the negative grasses. The negative flowering plants, like the seashore and the Rose Malott. And others that we have seen coexisting with fragments in the marsh. And there are's techniques and applications where we can establish those desirable's she's in amongst the frag mighty street and maybe even have the best of both worlds. So, I'm going to stop there as far as my narrative goes. I think I have a slide at the very end that has our contact information, and some references, here. Which, I will just move to, right here. And, of the, as far as a handout goes, I have a record sheet that I together that list a lot of the different agencies, but federal state and NGOs that work in the coastal environment. And resources that will be able to tap with them. So, with that, I think I will stop and Don, I guess you can take over, and answer any questions that folks may have.

, Well, thank you, folks. Thanks Chris, and thanks Gary for putting this together. Thank you for the obvious amount of time that you both put into pulling the resources together and creating a really informative presentation here. So, thank you both. As of right now, looking at the list, there's a couple of comments. You know, thank you great presentation. Just kind of putting out some information similar kinds of work dealing with resiliency. But there are right now a couple of questions. One is a little bit outside of the geographic range of what we have been discussing. But, since he did mention it, I will go on with the question if you're able to answer it. Great, if not, we might have to pass this release provides some information. And it's a got the Great Lakes region three what types of plant species do you recommend on the Great Lakes, such as Lake Michigan? If you mention the plants were brought up this way from there. I thought maybe you might be able to feel that question.

Well, there are some similar issues that growth here. Like there are some shrub dogwoods and there are, there is actually a beach grass. There is each grass that grows along the Great Lakes. It's obviously a different genotype then the beach grass we have here along the Atlantic coast. Because obviously, it didn't, it was brought here and put in projects, you know, I started hearing about the Great Lakes material not doing as well, he actually did a small trial ourselves. At the PNC, and off-center nearby, where we compared the Great Lakes material with the Plaza from North Carolina with our cake material. And, Logan Case did much better than the Great Lakes material did. But, so there are similar's issues that grow along the Great Lakes, I think there is a repro, like any debris grass that grows out there, the one I believe it is. A native on the warm season grass that grows in that environment. But I'm not quite as familiar with the plant ecosystem, there. As I am, here.

Okay, great for the other question we have right now, there are other questions, feel free to type those in now as we are answering these. We will catch them before we run out of time, but the next question. Any thoughts about dealing with ghost forest along the eastern coastal areas of the United States?

Well, that's a bit of a concern. There's a lot of folks looking at that from a research perspective, and I would refer some folks to Rutgers University. Looking at that as well as the University of Maryland and George Washington University. I think there was a report that actually was put out based on the proceedings of a workshop that was held in January of 2020, I think in the national library. Anyway, it was a Rutgers sponsored, or coordinator workshop along with the Northeast climate lab. So, there's a proceeding from that conference, but there are no easy answers, obviously. You know, the sea levels rising, and it's not just saltwater that is impacting these forests, effectually with the sea level and saltwater rising, it's also raising the level of the freshwater groundwater, which is you know, a lot of the plant forest species, tree species just don't want to be you know, in saturated soil whether it fresh or salt for that matter. It's really a localized rate could be an episodic event from saltwater, like we had over Sandy, along some of our, like the Mullica River, in southern New Jersey, it was impacted. The Atlantic white cedar stands are impacted by saltwater. But, a lot of it is you know, the chronic just, the slow rise of the freshwater lands above the saltwater that is impacting these forests. So, in some of these areas, we are being invaded with frag mighty's, which again is discouraging. You know, succession, discouraging diversity. So, there are no easy answers to this, but there is some academic research done, some information in the literature out there.

Okay, great performer question popped into it so maybe we will see this one before we close it started with a concrete interesting comments about the sought vegetative strip. And so, that was followed by a question. It may be is kind of a joint answer that even I, as the moderator could be on the conservation practice standard in the near future. And, what I would say to that, from someone at the Tech Center, that this is definitely a possibility that this could lead to either you know, adapt thing a currently existing practice standards to do this kind of work, possibly like it practice standard to look at the possibility of what we might be able to do

in the future. And possibly even have a standalone standard. I don't know if either of you guys want to add to that, or you think that answer sufficient?

Gary, do you want to take a stab at that? Maybe I will add in sure. Sure. And I think I uncovered it pretty well. I will just remind all the staff under WRE. As long as we can tie the on the ground practices back to practice standards, even if there is you know, some creativity there. It's a little bit different than a quick, because we are paying for the restorations. And so, you know, I guess my point is very simply that there is a little more wiggle room. When we are doing restoration under WRE. A little bit more opportunity even now. As long as we don't go too far outside the lines. To incorporate some recent ideas and research. So, is good for folks to keep that flexibility in mind.

From the perspective of the conservation land treatment and conservation practices for the buffers, and filter strips like that, I think that we necessarily need another standard to deal with that, like it's just a matter of having the approach yet plant materials recommended in the standard itself that are self tolerant. So, in other words if you're in environment, and you need to know, what the salt level is, you know, I mean, it changes. Changes through the season. If we are in a really severe drought it could a lot higher than you know, if you're in a situation where there's plenty of freshwater rainfall coming to the system. But, knowing what may be the worst case scenario would be, having the plants that are, that we recommended for that particular level in the standard itself, it was no matter what, you know, what treatment it is with conservation practice.

So I think the summary there is let's use the tools we currently have, and if we find polls in our toolbox, let's start working to figure out how we can get those tools in there. But, with that, thanks again to both of the presenters. They did a great job. Thanks to everybody to be dialed in. Thanks everybody for taking the opportunity to come and listen. So with that. I will turn it back over to you to close us out today, Jim.

Thank you, on behalf of the USDA and national resources conservation, I wanted to say thank you to Gary, Chris, and Don for providing an excellent presentation today in the Berlin coastal ecosystem resiliency to benefit both people and wildlife. And they you get everyone for attending today's webinar. Participants don't forget to provide your feedback about the webinar and if you selected to earn use, please return to your open browser window to continue to process offered to the combination webinar.net. This concludes our webinar presentation.

[Event concluded]