

Paul: As sea levels rise, coastal habitats will find it necessary to migrate landwards. But when human made constructions such as sea walls impede their progress, the habitats are squeezed, resulting in the loss of life sustaining environments. To lessen those impacts scientists are developing [00:00:30] solutions such as compensatory habitats to preserve affected sea life.

Hello, I'm your host Paul Thies. And in this episode of If/When, we explore the challenge of coastal squeeze and how it's being mitigated with Dr. Chrissy Mitchell, national principal research scientist, flood, coast, reservoirs of the UK Environment Agency, and Dr. Nigel Pontee, global practice leader, coastal planning and engineering at Jacobs.

So, Nigel and Chrissy, thank you both so very much for joining me [00:01:00] today. We're going to be talking about coastal squeeze, and it's a concept and a topic that I recently became familiar with. I don't know a lot about it, but I'm looking forward to learning more. And I know we've got two experts here who can really shed some light on what it is, why it matters, and what we're doing to mitigate coastal squeeze.

And so, Nigel, just to start things off, and for our listeners out there who might be similar to me, [00:01:30] who, you know, coastal squeeze kind of a new concept, can you tell us what coastal squeeze is?

Nigel: So our coastlines contain a range of habitats, such as beaches, sand dunes, and salt marshes. And those habitats are formed of some sediments, mud, sand, gravel, and also some vegetation in some instances that grows in that sediment. Where those habitats occur, the zonation depends on waves and tides and also the sea level. And on natural coastlines as [00:02:00] sea level rises, habitats can migrate further landwards to maintain their same positions relative to the sea.

But on coastlands that have been modified, then that landward migration can be slowed or prevented by manmade interventions like seawalls or cay walls for ports, for example. And in those settings, when ongoing sea level can result in losses of habitat and those losses due to a combination [00:02:30] of manmade actions and climate change and sea level rise, those losses are called coastal squeeze.

Paul: So, and then Chrissy, how widespread is the problem of coastal squeeze? I mean, is it just maybe be some of the world's major port areas or is it more widespread than that? What are we looking at?

Chrissy: It will be worldwide and it will depend on the sort of geography and morphology and geology of the area and how much sea level rise is [00:03:00] changing in those particular locations. I can only talk really on behalf of England, which is, you know, we've got particularly prevalent locations such as in the east or in the southeast.

But that's not to say that other areas, this might become more of a problem as climate change and sea level rise continues. So, you know, it is fairly widespread.

The estimates of coastal squeeze losses have been used to set targets here. And [00:03:30] really that's to create new replacement or compensatory habitats around the country. So, by that I mean that once we've assessed them, once we understand where they are, we take that land area and then we compensate those habitats elsewhere.

And we've been really closely working with other organizations here in England, such as Natural England through estuary and coastal monitoring and assessment service. And really to get a really good understanding of [00:04:00] sea level scenarios and the sensitivity to intertidal habitat loss.

And by doing that, we're constantly refining those estimates of losses and gains. It's not all one way. And we get to understand more about coastal squeeze. And I guess in particular, what we've learned from recent research is there's no simple one cause of this habitat loss. And this will be the same all the way around the world, that these losses that have been observed [00:04:30] are due to multiple causes. And that makes it quite a challenge to assess just how big a problem it is.

So when you ask how widespread the problem is, in England alone there's, there's about 250 locations of between 0.1 and one kilometer in length where we think closer attention will really benefit the way we manage the coast there.

Paul: Hmm. Interesting. So, one thing I want to pick up on that you said, [00:05:00] if I understood you correctly now, are there efforts to move habitats, move wildlife, and kind of relocate some of those, the biologies to other coastlines maybe in England for instance? Is that correct?

Chrissy: That's exactly. That's pretty much it.

Paul: Wow.

Chrissy: So, if one area is squeezed where, for argument sake, the entire habitat is lost, then we will look as part of a scheme or something that happens in that area, [00:05:30] we will look to provide or compensate that habitat by building more of it elsewhere. Yes.

Paul: Interesting. Okay, cool. Well, I think I want to pick back up on that here in just a moment, because I think that's very fascinating. I can imagine those life forms and that the habitats are very sensitive. So I'm sure it's very delicate work.

Now Chrissy, you recently have published some research that considers coastal squeeze. Can you tell us a little more about that?

Chrissy: Yeah, sure. So this research report was commissioned [00:06:00] under the joint Defra, which is our ministry, our government here in England, environment agency, and the Welsh government natural resource as well. It is an R&D program. So, that's where I work. And it brought together key organizations that alongside those mentioned, like Natural England and Scotland and marine maritime organizations, and it also brought together experts from across schemes where this is already happening, and [00:06:30]

our rail network, rail, and councils, and universities. Brought them all together to try and look at really understanding coastal squeeze and providing a sort of standard approach.

So, you can find this research on www.gov.uk, and simply by typing "coastal squeeze" there. And I guess what's worth mentioning is that this project was really successful in a number of areas. [00:07:00] It was led by Jacobs who Nigel is, and, and supported by Kenneth Pye Associates. And it provided really clear guidance on which environments coastal squeeze applies to. So, we had a really good idea, but this provides really a good understanding and some clear guidance on how to actually apply methodologies in those areas.

And the second part would be standardizing that methodology. So what we were finding across the country was that [00:07:30] people were assessing this in different ways. And we didn't want to constrain people, but we wanted to be able to provide a good practice so that we could have an understanding nationally of how big a deal this is. So, it sounds simple, but it's certainly not. And this report provides that standard methodology.

And then finally, and possibly most importantly, all those parties came together and agreed [00:08:00] a carefully defined definition. And that's really important because that underpins everything and it supports sort of consistency in the way we assess and understand what is coastal squeeze and how we can act on that.

So, this research report is available. It's out there, it was published earlier this year. And it's been used already to improve some of our underlying data. And it's provided further consideration and support to the assessors and the methods they use. And it's being [00:08:30] used to underpin statutory habitat compensation programs associated with flood and coastal management activity.

But outside of the environment agency, with some of those other organizations that I've mentioned, I know that it's led to updating their guidance and they're also using this to support them in their assessments.

Paul: Excellent. Excellent. And I'm sure it's information and research that is relevant and will be useful for other geographies. And we'll [00:09:00] touch on that here in a moment. But, accounting for differences obviously in climate and the the south of England is obviously going to be very different than say, the Eastern coast of India or whatnot. But there probably are some relevancies as well.

Now Nigel, regarding coastal squeeze, what new developments are you seeing in your work? What is your work showing you that you'd like to comment on?

Nigel: I guess to put it in context, the term coastal squeeze, especially [00:09:30] in the UK context has been in use since the late 1980s, early 1990s. And it's become quite pervasive as a concept, quite widespread. And it's been a real, as Chrissy said, it's become a real driver for creating compensatory habitat. And what we've done in this particular project, we've taken a closer look at previous definitions and methods, and

built on about 10 years of work that we've been doing for [00:10:00] the Environment Agency around Britain and a series of journal papers and conferences.

And what we've come up with is a new definition. And that's one of the most important things. And there's a number of differences between that definition and earlier definitions. And I'll just pull out three important differences just to briefly talk about here. Firstly, our new definition includes a range of coastal structures and management activities [00:10:30] and explains how they can cause coastal squeeze. And that's different because in the past, the focus was on flood defenses alone. And we've shown that other structures such as railway embankments or cay walls could have similar effects. Or even management activities in some instances.

A second important difference is we've shown that this idea of coastal squeeze, that habitats are lost by a combination sea level interacting with a man-made structure, [00:11:00] then that process can affect a range of habitats. And in the past, we tended to think of just salt marsh and mud flat habitats being affected. But what we've shown in this work is that this can affect a range of other habitats. We list of further eight types of habitat, including beaches, sand dunes, and lagoons on the coast. And that's a real step forward to clarify that, make it clear.

And then the third thing I wanted to draw out was this [00:11:30] definition for the first time consistently includes some terms relating to habitat quality. In the past, we were just concerned about losses of areas of habitat. Here for the first time we bring in the quality of those habitats as well.

So there's just three main differences that are sort of subtle technical details. But that's really important because these definitions go on to drive our requirement to generate compensation [00:12:00] for the losses.

Paul: So, if I understand correctly, so the reason the definitions are important is because then it helps you determine where coastal squeeze is occurring, such that it actually requires action. And then maybe, I'm assuming, being able to designate an area as undergoing coastal squeeze. Then you can drive funding, and research, and attention for that. So it's just making sure everybody gets on the same page. So it's like, [00:12:30] we've got to take care of the beach here at X, Y, and Z, because it clearly falls within the range that we've defined. Is that kind of why these definitions are so important?

Nigel: Yeah, yeah, absolutely. Just as you say, it's really important for agreeing the causes of loss and then what should be done to compensate for those losses. So, these sorts of investigations are very technical. But ultimately, they lead to projects [00:13:00] creating new areas of habitat. And those projects are expensive. They typically can cost millions of pounds. One I'll describe later cost 20 million pounds. And so you want to be sure that you are providing the correct compensation for the correct type of losses. So this detailed technical work underpins that.

Paul: Excellent. Now, you mentioned salt marshes and some other habitats that it sounds like those were kind [00:13:30] of the preliminary ones that were getting attention. But then

the definition is expanding to look at others. Are some habitats or geographies at greater risk than others?

Nigel: I can answer part of that question at least, that definitely some geographies are higher risk areas. I mean, there's some underlying requirements for coastal squeeze to occur. You need have sea level rise. You need to have some sort of man-made structure [00:14:00] or activity that's preventing your habitats moving. If you've got those things in play, coastal squeeze is a risk. And furthermore, in areas with more rapid rates of sea level rise or areas with lower sediment supply, so less availability of sands and muds and gravels that help nourish those habitats along our coast, we have those two things, high sea level rise, low amount of sediment, then your habitats [00:14:30] are more vulnerable to change and more vulnerable to coastal squeeze.

And at least in the UK, as Chrissy alluded to earlier, those types of conditions tend to be more prevalent on the south coast of Britain and the southeast coast. And around the world, there'll be areas which have higher rates of sea level rise and lower sediment supply and. And it's those areas that are most vulnerable to coastal squeeze.

And [00:15:00] the other part of your question was are certain habitats more vulnerable. I guess the honest answer right now is, we don't know. There are about 10 or so types of habitat in England and Wales that are potentially vulnerable to change. And I don't have an idea of the different vulnerability of the different habitats at this stage.

Paul: So, maybe as our technology continues to advance and we're able to detect with a greater refinement of sensitivities [00:15:30] on the data and what the various dynamics at play, maybe those will become even more self evident, like the degree to which the risk is present.

Nigel: Yeah. I mean, that's a good point. And it reminds me to say that we do these scientific studies, but the real proof comes from collecting data and monitoring the data. So, this report clarifies some of the underpinning science, some of the causes, some of the things to look for. [00:16:00] And going forward, that's what we in this country and others elsewhere in the world will be doing, monitoring and seeing if these changes are being realized.

Paul: That's interesting. And I imagine in the scientific community, there is some like data exchanging and conferencing and sharing knowledge across the different geographies. You know, this is what we're hearing, or this is what we're seeing in Asia versus this is what we're seeing in Northern Europe or the Caribbean or whatnot. But [00:16:30] that's fascinating. So, what are some of the things that Jacobs and the UK Environment Agency are specifically doing to counteract coastal squeeze?

Chrissy: Well, I mean, I'll let Nigel explain some of the specifics in a minute. But, in broad terms, we are basically looking to use the best of the expertise that we have across many organizations and work truly in partnership here. This is a challenge and there are answers, but as you can tell from what we've been discussing, [00:17:00] it's not easy.

And it's really important to have this good evidence base to carry out these assessments and back up the decisions that are being made.

So, we've got to look at how we are considering a cost effective planning along the coast. And we've really got to have an eye on recognizing opportunities for adaptation and think about long term resilience. You know, how we're going [00:17:30] to manage these coasts in light of this sort of changing climate.

We've got some good structure here. We've got the environment bill and the 25 year environment plan that supports us here in England. And those, alongside habitat regulations, really set the principles and the direction for what we're doing. And I guess from an environment agency perspective, we've got shoreline management plans, which break the country down and look at how we're managing [00:18:00] those shorelines. And we've also got habitat plans. And we look to commission work that such as realignments schemes, where we sort of shift the coastline.

Those have been ongoing for quite a number of years now. So we're we're already taking action to address this situation and look at it. It's just that we're learning more and more, and we're getting some clear, good evidence to support the ways we do this. And I guess really ultimately, we're trying to [00:18:30] provide this sort of national overview. And there's a group that we have called the habitat conversation and restoration program that takes in all this information from these various locations, and really looks to consider those projected losses and consider compensatory habitat across the national picture. So, that's just some of the things we're doing to look at coastal squeeze on a broad context. But I'll pass you over to Nigel now to sort of detail some of the specifics.

Paul: [00:19:00] Excellent. And so Nigel, just again, the question is what are some of the things that Jacobs and the UK Environment Agency are specifically doing to counteract coastal squeeze?

Nigel: I mean, as Chrissy says, the environment agency has taken a lead role in the UK in identifying and offsetting the impacts of coastal squeeze through some of the long term planning studies that they do coordinate called these shoreline management plans, but also through the projects on the ground to create replacement habitats. And Jacobs is one [00:19:30] of the in suppliers of coastal services to the environment agency covering all of these aspects of work. And so, for my part, a significant part of my career over the last 20 or so years has been the creation of new habitats through the process of managed realignment, whereby we move a flood defense further landwards, and create more space for habitat.

And so, one recent example that we did for the environment agency is the Steart Marshes [00:20:00] scheme in Somerset. That project created over 400 hectares of habitat, including some 250 hectares of intertidal habitat. We realigned some defenses. We moved them landwards, we created some openings so that the sea and reenter that land that was hundreds of years ago was formerly intertidal area.

And that scheme today, which is managed by the wetlands and wildfowl trust, attracts thousands of visitors each year, not only [00:20:30] humans, but birds and other animals as well. And recent research has shown that that scheme in the first four years has locked away nearly 40,000 tons of carbon in its first four years. So, these schemes as well as creating biodiversity benefits, are creating other benefits to help offset some of our climate change impacts.

Paul: Excellent. Excellent. All right. So for my next question, Nigel and Chrissy, I've [00:21:00] got this one for both of you. And Nigel, I'm going to start with you this time, just going to ask you, how do you see coastal squeeze remediation field evolving in the next three to five years?

Nigel: I think let's just put a bit of context to that then. In Britain, perhaps in lots of other places in the world, we've had a long recognition of the value of nature for nature's sake, if you like. Habitats providing habitat for different species of animals [00:21:30] and plants. And we've been doing that for at least 50 years, if not longer. But today we're increasingly recognizing that those habitats may have additional benefits for humans. And those additional benefits are often called ecosystem services.

So for example, the benefits of spending more time in the natural environment have been recognized and demonstrated over the last couple of years for improving our general wellbeing. You know, that's an important thing we get out of the natural environment. In the correct settings, creating additional coastal [00:22:00] habitat can help reduce flooding and erosion on our coast, the habitats themselves form natural flood defenses.

And then a particularly topical one at the present time is that coastal habitats such as salt marshes are important stores of carbon. They remove huge quantities of carbon dioxide from the atmosphere each year and bury it within sediments. So, these habitats can perform multiple functions. And in the future with increasing [00:22:30] rates of sea level rise, these coastal habitats may be at risk of loss due to coastal squeeze and other forcing factors.

So, what we've learned from this project is that causes of coastal habitat loss are many and varied. In the past maybe coastal squeeze has been used a little bit as umbrella term and used to cover multiple causes. But regardless of that, the methods we've developed in this project allow these various causes to be teased [00:23:00] out and understanding those causes is the first step in choosing the best way to manage our coastal habitats. And so, I think in the next three to five years, I think we'll become even more interested in conserving and enhancing and re-creating coastal habitats for a variety of reasons, for nature itself, for climate mitigation, and for climate adaptation as well.

Paul: Excellent. And then Chrissy, how do you see the coastal school's remediation field evolving and in the [00:23:30] three to five years?

Chrissy: Yeah, I mean, I guess from government perspective, the overriding ambition of the environment agency is to leave the environment in a better place. And that translates to this as well. So, in relation to coastal squeeze, I'm hoping our listeners agree that this, we are looking to drive the restoration of the natural environment rather than continually compensate for it. So, it's important that we still have these habitats [00:24:00] and that. But really we've got to look at how we can best improve the natural environment.

And Nigel's done a really good job there of mentioning a very clear ambition of ours, which is for net zero carbon by 2030 here in the UK. And recent research from this same joint R&D program has looked at carbon offsetting and the importance of habitats as carbon stores. So, as the pressure increases to find these sort of financially viable carbon balance [00:24:30] alongside the needs of the environment, and alongside increasing climatic related factors like sea level rise, the attention is going to be more and more focused on this sort of habitats.

And alongside this with the changing climate, there's a recognition of a sort shifting baseline here. And we need to provide a really strong evidence base to support long term resilient decisions while taking this non-stationarity into account. We're not there yet. This is something [00:25:00] we're sort of hoping to be working on in forthcoming years.

It's worth mentioning as well, that when it comes to flood management and coastal defenses, we can only invest in flood and coastal infrastructure here at any of the protected sites, of which there's many around the coast, if there's an overriding benefit to public interest. And if we can show that the lost habitat will be otherwise compensated. So, it requires really strong local evidence to underpin these decisions. And [00:25:30] I see this research really helping us underpin these as we move forward.

So, as a result of this, watch out for further commission modeling and understanding of projected losses and really being able to apply this in those assessments.

Of course, running steadily in the background is the need for cost effective mitigation and conservation program that's part of our regulations. And that's led through those things that I mentioned earlier, the shoreline management plans, habitat planning, et cetera. [00:26:00] So, that of course is still ongoing.

I guess, if I reflect on all that we've talked about here, one of the things that really jumps out and that we've learned over our time together, is that good communication and the sharing of the good practice is fundamental. I mean, it goes across all subject matters. But engaging early and with a really good understanding of multiple benefits, you can help local communities to really buy into that long term adaptation. There's some difficult choices here, and it's really important the community [00:26:30] comes along with us.

And we've got a scheme here, a Medmerry scheme that showcases how the scheme can not only benefit the local community through improving the flood risk, but also gave the

land back to nature. And that's really carefully chosen words there. When we talk about giving the land back to the sea, people worry. They see it as loss. But actually, the benefits that these habitats provide and the changes to the land, it can provide really [00:27:00] strong wellbeing, both to people and to those that populate the habitats.

So, in summary, to your question, let's come back to that, coastal squeeze is just one part of the question. It's what we're really trying to do is, how do you best manage our coast? And over the next sort of three to five years, we expect that nature-based solutions, including restoration, will be a part of that long term resilient strategy. Working in partnership [00:27:30] and finding cost effective solutions is going to be absolutely key. And it'll be important to be consistent in our approaches. Which is what this research really helps us with, as well as remaining compliant with our regulations here. And the ultimate aim is what I mentioned right at the beginning of this, which is we need to leave our coastal environment in a better place.

Paul: Yeah. And it's interesting because as you were talking, it made me think, it's analogous I think in some ways to soil erosion, right? Soil erosion [00:28:00] is a very onerous problem worldwide. And our farming practices have really depleted so many of the nutrients and the microbiomes in the soil to where now we're really having to change in very, in maybe not radical ways. But we're having to change our farming practices to ensure that the soil stays nutrient rich. So it's an investment and in the future.

And I see with coastal squeeze and what you're saying about habitat preservation, [00:28:30] this idea of giving back to the sea, it's not just nature for nature's sake, but it's helping, I think, I'm assuming, helping populations who live in those areas understand, look, you need to invest in your future. This ensures that this remains viable for the long term. You can't just use a resource, and use it, and use it, and not carefully management or else at some point it runs out. Right? And so it's very, very fascinating.

Well, [00:29:00] Chrissy and Nigel, I really appreciate y'all sitting down with me and talking about coastal squeeze, and what it is, and what we're doing to mitigate that. And I think it's really fascinating the idea of being able to move the habitats to new areas and create additional habitats to offset coastal squeeze. So, I want to thank you both for sharing your expertise and your time today.

Chrissy: Thank you.

Nigel: Thanks, Paul.