Laura Young:

Welcome to the SAGES Climate Science podcast. I'm your host, Laura Young, environmental scientist and science communicator. And today, we are exploring the very beginning of climate science before the rest of this podcast, where we will explore different facets, whether that's the cryosphere, snow and ice, flooding, communities and many other things, and to do this I'm so excited to have two amazing guests join me. The first is Dr Rebecca Wade. You're a senior lecturer in Environmental Science at Abertay University, based in Dundee. Your day job, you say you're on a personal mission to help the next generation of civil engineers to work collaboratively and sustainably. Change you are an award-winning STEM ambassador and was named Woman of Influence 2022 by Action for Children Scotland. And this year, 2024 was named one of the top 50 women in engineering by the Women's Engineering Society. Your teaching and research focus on sustainable water management. That includes things like river restoration, which I know some of that is award-winning, sustainable drainage and nature based solutions. And you've recently returned from a life changing voyage to Antarctica, which I want to hear more about, and that was part of the prestigious Homeward Bound International women in STEM Leadership programme. Welcome to the podcast.

Rebecca Wade:

Thank you very much, Laura. It's a pleasure to be here.

Laura Young:

Here also is Dr Kate Donovan and you are the Co director of the Edinburgh Climate Change Institute and the policy director at ClimateXChange. You're a senior lecturer in climate risk and resilience at the University of Edinburgh and a member of the Scottish Science Advisory Council, which is Scotland's highest level science advisory body. You've worked as an applied researcher, project manager, and practitioner in Disaster Risk Reduction and climate change adaptation, both here within the UK, and internationally. Before working in Edinburgh you were working as a hazard and risk engineer at the national water and Atmospheric Research Institute in New Zealand, so the other side of the world, and there you Co managed a national risk tool project and led International Development on adaptation risk assessment tools for those Pacific Island communities. Welcome to the podcast.

Kate Donovan:

Thank you.

Laura Young:

What a couple of introductions. I'm so excited about our conversation. There's so much that I want to get into there, but I think probably a good starting point. Maybe Rebecca, you could help us with this is. We've heard a bit about the history of the climate, but what picture are we seeing now of climate change?

Rebecca Wade:

What we're seeing now is a really rapid change in our climate, and in fact, it's even more rapid than climate scientists predicted even just a few years ago. So in the past, even 24 - 48 months, couple of years, we've been seeing changes that have been surprising climate scientists and the change is not so much in the types of events that we're seeing, but it's in the intensity, rapidity of the change. And so some of those changes are things like the intensity of storms, the frequency of storms, the amount of ice mass loss. So that means the amount of ice that we're losing from the ice caps that are on land and of course as they melt, they come into the salt water of the sea and that's what's changing our sea level and as well as just the amount of water that we're seeing in storms and from ice caps. It's the temperatures that we're seeing so the temperature, particularly of the atmosphere and the ocean. And one of the big surprises in recent years has been the speed at which our oceans are warming and the realisation that our oceans have actually been keeping the heat off us quite well by absorbing heat and carbon dioxide. So carbon dioxide's really important gas in climate change and we might come back to that later. But yeah, so our natural environment has really been buffering us against some of the worst impacts and what we're realising just recently is how much those impacts are happening, how quickly they're happening and it's that speed of change. That's really the surprising thing.

Laura Young:

And Kate, when we think about all of those impacts, are there particular places around the world globally that that we associate with climate change and the impacts?

Kate Donovan:

Well, I think conventionally and in the past, we've always thought about these things happening to someone else. So on the TV, you might have seen awful droughts, maybe floods in places like Bangladesh and in Africa, and we've been pretty lucky actually in the UK, largely we have avoided some of the worst impacts so far. But actually now we're starting to see them. So we are starting to see flood events happening that are unusual, that are really big, maybe really rapid happening in the middle of summer, perhaps catching us off guard. Also, seeing kind of a general trend as well towards warmer, wetter winters here in Scotland and drier summers, so what maybe a lot of people thought, oh, it's never going to happen to me. We now definitely are experiencing the impacts of climate change right here in the UK, Ireland, and Scotland.

Laura Young:

And I'm already going to get Antarctica in there, Rebecca. But I mean, that's one of the places that people might think because, yeah, I would say growing up in school, when you learned about global warming, the changing climate, you saw a polar bear or a penguin on a little ice cube and it was melting rapidly and that was what I thought of climate change, as Kate said.

Rebecca Wade:

It's far off, yeah.

Laura Young:

Somewhere else, but you actually have been to that far off place and I just want to hear some reflections from your trip. And actually, what you saw there, because even though it's far away, it is actually impacting us through what you said around these oceans are all connected.

Rebecca Wade:

Yeah. So that was one of the really big lessons that I learned from going to Antarctica. And I think that it was something that I knew beforehand, but there's nothing quite like experiencing something for yourself, for it to really drive at home. So in November 2023,

I spent the best part of a month in Antarctica on a ship full of women with a background in stem from all over the world.

Laura Young:

Just in case anybody doesn't know what is STEM?

Rebecca Wade:

Conventionally, we say science, technology, engineering and maths, but with homeward bound we use a double M so science, technology, engineering, maths and medicine. So we had women from all over the world, working and studying everything from particle physics to space weather to high altitude medical issues to novel medical technologies and policymakers, local government, national government, all sorts of things in relation to climate and science, technology, engineering, maths or medicine. So fascinating group of women to spend any amount of time with. And while we were there, we got to witness first hand some of the changes that we've been reading about in Antarctica. We were visiting predominantly the Antarctic Peninsula, which is the bit that's closest to South America and sort of sticks out into the Southern Ocean. And that's one of the areas in Antarctica that's experiencing the most rapid ice loss. So big changes there in terms of the amount of ice that is there during the Antarctic winter and the Antarctic summer, and it relates to news stories that people might have seen about Penguin colony breeding failure. When the sea ice breaks up earlier than expected because the oceans warmer and the currents are different and the sea ice extent hasn't been as extensive as it maybe has in in other there's then sometimes those breeding colonies, so the baby Penguins don't manage to survive because their habitat breaks up before it maybe has done in the past. So these are some of the stories we hear and that is happening in Antarctica, but I think the critical thing is that what's happening in Antarctica effects what happens all around the world. Antarctica is surrounded by the Southern Ocean, which connects all the oceans of the world. It's like a beating heart for the planet. It drives all of those ocean patterns, ocean circulation, the connectivity of all of our terrestrial or land based environments. With the oceans that come between us, but it also effects atmospheric or processes in the sky, processes in the air. It affects the wind patterns and the global circulation patterns above our heads, as well as in the oceans. So seeing that first hand and hearing from the expedition leaders, the scientists that are working on Antarctic science was really eye opening and daunting, but it also really drove home for me the impact of the emissions from the populated parts of the

world that are driving the ice melts in Antarctica, and it also encouraged me to think about how the things are happening in Antarctica affect us in the rest of the world. So the story that I really came back with was about connectivity. It was about the way in which our global processes are connected, and we're affected by them every single day, so whether we're in Antarctica or whether we're in Scotland, we're actually all experiencing these global processes and we all have an influence on them and they have an influence on us.

Laura Young:

I think that's a really important point. I remember when you came back I got to see some of the footage that you captured and Abertay University put up a brilliant video from what you collected. And actually, as somebody who was in Scotland that whole time, you know, basing my own research there, I thought actually this does matter even if I've not been and gone and seen it, I actually got to see a glimpse of it through what you captured. But I guess, Kate, that brings us on to here in Scotland. What's happened in Antarctica doesn't stay in Antarctica, and I guess with climate change, what are we seeing? Are there areas in Scotland specifically that that kind of have red flags for climate change impacts, whether that's heat flooding, sea level rise, anything that we're we've got?

Kate Donovan:

I think one of the big problems we have where we've got people living in areas that are on the coast, but also near a river system, those are going to be their hotspots if you like. So these are areas that are going to be experiencing flooding from the rivers. But also potentially from the oceans as well and potentially coastal erosion too. So those are the kind of really sort of more risky areas if you like to live. And unfortunately, as humans, that's where we like to live. So we've traditionally lived in those areas. If you think of all our big cities, they're on big river systems. They're by the coast for obvious reasons. And so actually we're going to be experiencing higher risks in those areas. So it's not just about the hazard. So it's not just about the flood or the drought or the heat, but it's also about something that we refer to as vulnerability or exposure. And so vulnerability is all about how we can respond to those hazards. So what makes us more vulnerable to those hazards? It could be characteristics of individuals, or it could be the characteristics of even buildings, or bridges or any of the things that we have that keep us our society going. But also we have to look at exposure. So that's just how many

buildings, how many people, how many cities, if you like, are exposed to those hazards and if we look at all of those things together, that's what gives us an idea of risk. So when scientists talk about risk assessment or understanding our risk, that's what we're talking about. We're talking about what is the future hazards in terms of climate change, so it could be more severe flooding in certain areas. We've seen recently some really awful flooding events that have affected many communities across Scotland. People who are flooded or often out of their homes for many, many months, even years. So we've got to look at the full picture. We look at the floods, we look at the hazard, we look at who might be exposed to that and what damage might occur. And then we also look at the vulnerabilities in that region too. But we've had some pretty unusual floods as well. So we did some research recently where Edinburgh Castle was flooded, and if anyone's been to Edinburgh, you'll know that it's on top of a hill. Yeah, so not necessarily the place that everyone thinks is going to get flooded. But the rainfall event was so short, sudden and severe and unusual that the that it was like a river system coming down through the castle complex. And it happened just after COVID so 2021. So there weren't so many tourists, which was very lucky. Because actually it was quite dangerous and the water just streamed inside. And it took historic environment Scotland quite a long time to recover from that, about six months to get those rooms back open to the short tourists again, so that was a 15 minute rainfall event that caused some major damage in one of our most well known historic buildings. So these are the kinds of things that are unusual, but they're going to become much more frequent. So the research that we've done is suggesting that these things, severe climate change, a rapid climate change we're looking at probably 60% more likely to happen. So these kinds of summer rainfall events, we're going to see many more of them in the future and it's going to catch us out if we're not prepared.

Laura Young:

And am I right in thinking that with Scotland's climate or the UK's climate what we are trying to predict is what's coming up next and is that that we're going to get kind of wetter winters and drier summers, is that is that the kind of picture that?

Kate Donovan:

What we're sort of seeing from all the research is that, yeah, we're going to get wetter, warmer winters and we can all relate to that because of last summer being very warm and wet and not particularly lovely. But generally, summers in Scotland are likely to be

dryer, but with these extreme events, and that's the danger these extreme events can then trigger other things. So if you have an extreme rainfall event, it could trigger a landslide. For example, could trigger flooding. So we've really got to make sure that all of the people in Scotland are aware of what might be happening or what might happen in the future and that they have the ability to prepare for that. And it's much easier said than done, so we need to really put some effort into preparing and what we call building resilience for some of the most vulnerable people across Scotland. But also I would say everybody needs to get ready because if it's not flooding, we're going to suffer from maybe more heat waves. And drier weather might even be some water restrictions in certain areas. So we're looking at a suite of things, but we are a very resilient community and we do have the ability to adapt to those hazards and impacts that are coming our way. So in Scotland, we're going to be experiencing warmer, wetter winters, which isn't going to be great for houses, you know? Mould in the houses and things like that. So not really looking forward to that kind of weather and we're already seeing that playing out. We're also going to be having drier summers as well. But what's also really concerning is these extreme events that we're going to experience. So really heavy rainfall leading to flooding. We're seeing this regularly through the summer months. And when the soil is really compacted and hard and baked due to the nice weather, it means the that the water runs off really quickly and we get those really severe flooding so we are going to experience changes, gradual changes in our climate. So the warmer, wetter winters. But we need to watch out for these extreme events that are going to catch us out if we're not prepared enough.

Laura Young:

I think you've picked up on two really good points, which is episodes we're doing later in this series. We're focusing on flooding and we've actually got an episode where we're going to be thinking about drought as well and thinking about water. Rebecca, I'm still struck by what you're talking about with Antarctica, and actually the fact that we do need to try and limit the damage we're doing to the planet, we need to reduce our emissions and try and stop, you know, polluting the environment and all the ways that we do. But it is also important that we adapt to the changing climate, because also a lot of this is baked in. When you hear, you know, flooding and droughts and these things, particularly as you sit in that engineering space as well where the solutions often come from, how do we need to adapt to these impacts that we're seeing?

Rebecca Wade:

That's a huge question. So basically, yeah, I think you know our wetter days are going to get wetter, our drier days are going to get, you know, more frequent and perhaps longer periods of dry days or hotter days are going to get hotter. We're looking at a sort of a different climate regime in Scotland and one of the things we know about these differences and it's important from an engineering and infrastructure perspective, so infrastructures, all of the things that we build in our built environment to help us, you know, communicate, connect, transport, live, all that kind of stuff. If we're looking at a different climate regime, we need to think differently about the way that we build buildings, the materials that we use for a start, we need to think differently about those things because the amount of embodied carbon that they have in them, so even starting at the very beginning. From an infrastructure and sustainability perspective and resilience perspective we need to think, what are the materials that we're using? Where have they come from and how much carbon do they have in them? We also need to make sure that we're thinking about what are they going to have to stand up to in terms of, you know, can they be tolerant of damp in really wet conditions, can they reduce the impact on the people using those buildings by not being so prone to being damp places which can have an effect on respiratory illness or require more heating, which is not necessarily what we want to be promoting. Can they also be tolerant of those kind of conditions, but also physically tolerant of winds and wet weather and storms that are more likely to come our way, can they also be cool enough during hot periods so that we're not having to start embedding air conditioning across Scotland, in all of our buildings, which we're really we're not set up for infrastructures not set up for cooling, it's set up for opening the window when it's warm and putting the heating on when it's cold and our building stock and our infrastructure and everything needs to be thinking about how do we adapt so that we can be resilient so that we can have resilient communities. And also it's those interconnected capacities around those things. So if the power goes out because the electricity substations or the pylons are affected by storm weather. Then how does that knock on to thinking about? Well, then we don't have heating or then we don't have cooling or then, you know all these other things can happen so. Thinking about engineering, it's absolutely true. I think that engineers have got a role to play in terms of thinking about a future for Scotland and around the world and it could draw back about 70% of our emissions in some form or another to the way that we design, build, use, construct and deconstruct our infrastructure. And if 70% of the emissions that are causing the climate change impacts are linked to infrastructure then we've got a really good focal point for making change for making those changes. So I think that, yeah, there's a really interesting role there around thinking differently about how we've always done things and realising that we need to do things differently. But very importantly that we need to adapt the spaces that we've already built, the

infrastructure that we've already built. In terms of these new challenges that are going to be coming along.

Laura Young:

And Kate thinking about places in Scotland. Have you seen good adaptation projects already? Is there any examples that that you think we could be looking at?

Kate Donovan:

There are some really great adaptation examples around Scotland. Actually, and we adapt as humans and society all the time to change. And we have done in the past. So I think it's easy to get a bit depressed about climate change. It's easy to think, Oh my gosh, this is a much bigger challenge than I can even consider. But, but we make decisions about reducing our risk every day we put seatbelts on when we drive cars and we try and eat healthily and exercise. So all of these things are decisions about risk and climate change shouldn't really be any different. And we need to also think about the Co benefits, so things like taking the bus or cycling instead of maybe using car. You may be actually contributing to our climate action without realising it, because you might want to be healthy so it doesn't have to be a hardship to adapt to climate change. Obviously some things are a bit tricky and you need to get a bit of help, but not everything and we've got some good examples of adaptation across Scotland. We've got things like rewinding and putting the wiggles back in rivers so that it's actually you're making space for water. And you're not moving it quickly on to the next town where it's going to flood. So in The Borders, there's an amazing project that has been looking at what we call nature based solutions. But really that's just letting the river be wild again and letting farmland floods where it can and where it's appropriate. And so that's been a real success story over many years and it's been a real source of information for researchers as well. We've also had some really great examples, I was chatting to someone from Scottish Canals the other day and they were talking about all the amazing work they've done to try and make the canal system more resilient. And actually, it's the stuff that doesn't make the news, because it worked. So you might have had a really heavy flood, a heavy rainfall event that may have caused flooding elsewhere, but the canal didn't breach. And places like Linlithgow are safe because they've invested millions of pounds in making sure the canal is as resilient as it can be to major flood events. So sometimes adaptation success stories are the quiet ones. But one of my missions is to try and make sure that we share those stories because

knowing that it works is essential. One of the real challenges around adapting to climate change is knowing what works. Where and how much it costs and all the decisions around that. We don't have a great database on that. We don't have a great resource to say this is a wonderful thing to do. Try and do this. And of course that's very difficult then for decision making. So as researchers around Scotland, we're trying to gather information around what works on adaptation. And then share that as widely as we can with local authorities and other people who are responsible for maintaining our infrastructure. But also with everyday people who might want to protect their homes from flooding or heat waves. So there's lots to do, I think we get hung up on the negative side of climate change and it is important to discuss it, but it can also be a bit paralysing for action. So there are lots of good things that we can all do. Lots of good case studies across Scotland. Lots of people trying to be more sustainable, companies trying to be more sustainable and carbon neutral, local authorities thinking about flood risk and putting in all sorts of defensive measures, but also working with communities. And we've also got Community Action hubs across Scotland now supported by programmes such as the adaptation Scotland programme and you can go on their website, there's loads of resources. And that means that people in different regions across Scotland are getting involved learning about climate change and learning what they can do together as a community to take action to protect themselves.

Laura Young:

I think that's really important. And Rebecca, I know that you've been involved in work with nature based solutions as one of the words that that Kate was using there in Dundee in a sort of city context. I wonder if you could just share a bit of what has that looked like and what would people see differently around them that's helping with some of these climate impacts, but are nature based solutions?

Rebecca Wade:

Thanks, Laura. One of the one of the best things about nature based solutions is it's not rocket science. You know it's actually working with nature and natural processes to design in the way in which nature's already helping us to buffer some of these impacts of climate change. And the wonderful thing about working with nature and designing in nature into our urban realm and it can difficult to redesign it in because we've got a lot of urban spaces that are concrete lot of concrete lot of stone, a lot of roads, a lot of hard surfaces. But if we can design in nature, not only do we have the benefits of adaptation

helping us to cope with the changes that are to come, but also some mitigation, which is a term that means trying to reduce those hazards or those risks in the future by trying to absorb some of those emissions now and plants are absolutely brilliant, so nature based solutions often include vegetation. They're sometimes called blue-green solutions because they involve water and vegetation. And plants are brilliant because they take in carbon dioxide and they give out oxygen, which is pretty important to us as humans as well. So they can be a very, very useful tool for us to use in our toolkit of solutions. So what it looks like in Dundee and I'm going to pick up on one of the points made earlier. Some of the success stories are around communication. They're around collaboration and what we're seeing in Dundee is this programme around water resilient Dundee. So it's a whole city agenda, which is all about Scottish Water and the city authority, Dundee City Council and other partners working to working together to try and deliver solutions that actually give multiple benefits for all of the partners. So the great thing about this is you know, we'll all have had that complaint somewhere along the line where, oh, they've dug up the road this week, but they dug it up last week as well. You know why can't they just do it all at once? Well, this initiative is about communicating and collaborating so that the different stakeholders in the city know that something's going to be happening in a particular location and they can get multiple benefits by doing multiple actions in the same place at the same time. And hopefully that might involve something like a water management action. It could be bringing a rain garden to a street or bringing sustainable drainage systems to take the storm water away from the sewer systems. So a big agenda in Dundee is about trying to get that rain water which is coming faster than before and more quantity than before, so we're getting more intense storms and that rainwater has traditionally been conveniently channelled into many of our sewer systems. Anything that lands on your roof goes down a drain pipe and it goes straight into a mostly a combined sewer, at least over most of history. That's what's happened increasingly. It's required not to do that, but it can still be difficult because our sewer system, our drains were all built 100 years ago or more of them. So if we can try and take the pressure off some of our existing infrastructure. By taking that rainwater, that storm water from these intense storms that we're getting out of the drain systems and putting them into vegetated natural areas in our communities, then we're enhancing our community. We're taking the pressure off the infrastructure associated with the storm. We're also helping biodiversity, pollinators and nature connection for our community. So in addition to having concerns about, I don't know, there's all sorts of financial crisis as a climate crisis, as a nature crisis. But we've also got, like, a health and well-being crisis. So our mental health and our physical health could do with a bit of a helping hand as well. So the more we have pleasant, accessible and safe places on our doorsteps, the more people will choose perhaps to walk to the bus stop or to take the bicycle to school.

They might take advantage of one of the great resources that's happening in many cities like Dundee, where new people in need can get a free bicycle and they can get bicycle training so they know how to do those things and they've got access to the tools to enable them to do those things. So really, to sum up, it's about joined up thinking and my mantra at the moment is really communicate, collaborate, co fund, co benefits. Because when we communicate about what we need to do and what needs to be done and what are our different strategies are and then we come together to collaborate, to deliver them. We can save money individually by all sharing the cost, and we can Co benefit across all these multiple benefits that we get. When we do that communication and then when we install clean infrastructure into our neighbourhoods, so nature based solutions for me, are there a really good way to move forward and we can do it now. We don't need new technology, we don't need new knowledge, we can just get on with it.

Laura Young:

I think that's really nice because what it does is it, first and foremost, address is a really serious problem or risk which is flooding. As an example, using a rain garden, which is a beautiful installation that's designed to capture that water and kind of yeah, store it so it doesn't overwhelm the system. But actually, while you're doing that, you're also able to say what else does the community need? You know, do that bring in the community and say what else would be useful? And sometimes communities are able to say, see if there was just a little path there, actually connecting up those two. But that would be perfect because that's my walk to work, or actually a bit more cycling infrastructure. Actually just a bench to stop and it's nice to be able, you know, to do that, that community engagement part of it and get all of those benefits, which hasn't always happened when planning things have happened. So it's good. But Kate, I guess thinking forward, so we are obviously trying to adapt to the changes that we are seeing. But one of the other things we're trying to do is do that mitigation. We're trying to bring carbon emissions down. We're trying to have less of an impact on the planet and one of the terms that comes up a lot is net zero. So a lot of countries around the world have said we want to reach net zero and that's almost like a set of scales, isn't it? You're trying to, you know, balance it so you've got all your emissions on one side and then you've got all the good stuff you're doing on the other, which tries to balance it out at zero and I guess would you be able to give us a few reflections on ne zero as a concept, but also when we reach net zero is that the goal? The goal just to get there?

Kate Donovan:

So net zero people will hear this term all over the place. It is actually quite a technical term, so you'd be forgiven for not understanding what it means. So it's about reducing those greenhouse gases, those gases that are really good at absorbing heat, which are warming our planet. So reducing those greenhouse gases in kind of two ways. First of all, reducing our emissions so, you know, not burning fossil fuels, which leads to an emissions of greenhouse gas not cutting up our peatlands, which releases these gases as well. There's lots of ways we release these gases into the atmosphere, so we need to think about lots of different ways of reducing that. But it's also about removing emissions from the atmosphere that we've already put into the atmosphere as well. So that could be by planting many, many more trees. And recently we've had some reports helping the Scottish Government understand whether we can actually reach our net zero targets. We had some very ambitious targets. We're probably one of the most ambitious countries in the world, which is great. But recent reports have kind of indicated that we're really struggling to keep on track. So we're trying to aim for net zero by 2045, which is really just around the corner. So we need to think about all the different technologies and innovations that we can use to reduce our emissions, but also remove emissions. The atmosphere, so we get to net zero is a big challenge. One of the things about net zero, which is why it's so good is it gives you a target, right? That it's something to aim for and it's measurable. So we can do, we can take actions that we can go, ok, great, we've reduced this amount of emissions into the atmosphere. And so it keeps people kind of moving forwards. The challenge is adaptation doesn't really have that kind of target. It's not something that you maybe be able to measure as such in terms of carbon dioxide in the atmosphere reduction like you can with net zero. So it is a big challenge. That's something that's sort of not helped us in our journey towards adaptation. But when we get to net zero, which, gosh, I hope we really do and we really all need to work together on that. Whether it's 2045 or maybe a little bit later or even earlier, if we're really on it, we are still going to need to be resilient and adapt to the changes that we have created in the climate system. So unfortunately, we know as scientists as researchers that all the emissions we've put into the atmosphere over 100 years or so have created a change that we can't just undo. So we are in a different climate state than we were. So even if we reach net zero, which we absolutely have to do because we want to, or that we can be as safe as possible if we don't reach net zero, the climate will change even more radically, and we know that that will be really dangerous for humankind. So if we reach net zero, that's great. We're going to be kind of hoping to get the climate system into some kind of more stable place that we can actually adapt to. So beyond that zero is adaptation and resilience, but we have to keep that net zero going as well. We can't just stop and go, ok, brilliant, let's you know, turn our heaters up again and burn fossil fuels again. We've got to maintain that. Even

though having a global target and having a national target is really fantastic for emissions reduction. We always need to be mindful that that has to be maintained and that we have to adapt as we go forwards after that as well.

Laura Young:

And I guess Rebecca, reflecting on the fact that this is also a global picture, isn't it, if Scotland gets to net zero, that's not the only country that needs to do.

Rebecca Wade:

Absolutely. So I mean that's why these big conferences like the COP conferences.

Laura Young:

And we had Glasgow, didn't we?

Rebecca Wade:

Yeah. So in 2021, it should have been 2020, but the global pandemic did affect that, just like it affected everything else. So in 2021, Glasgow hosted COP26, which was the 26th Conference of the Parties. That's what COP stands for. Conference of the parties. And it's the UN coming together to talk about the global targets and there are COPs for other things too, like biodiversity and for refugees and for all sorts of different topics. But yeah, Glasgow hosted the UK and Italy session for COP in 2021 and I think it really started to raise awareness within Scotland and the UK, not just about where Scotland and the UK need to be and what we need to do in playing our part, but it also raised awareness, I think about what all the other nations have to do. And also some of those really kind of thorny elements about what do we do now that we know that we've had a huge influence on climate change and global warming? But actually our emissions are influencing bigger changes elsewhere and it's kind of coming back to that Antarctica and Scotland and how are we all linked with those global processes mean that the emissions from wealthier countries have really affected poorer countries or developing countries. And they're feeling the effects of our lifestyle. And so sometimes these big international agreements and big are helpful in thinking about joining those dots, joining us together as a global community and thinking not just about what we need to do here at home, but what our responsibilities are globally. And trying to hold different countries,

nations and parties to account and saying, you know, this isn't just for one country or for one income bracket or for, you know, one type of thing, it's about bringing all of those together. And the great thing about those same parties also going to these other COPs for biodiversity or for displaced people or whatever it might be, is that there's communication across those topic areas. So more than ever, we're understanding how climate and nature are intrinsically interlinked and that we can't address climate change without addressing, you know, nature restoration. Equally, we can't address climate change without thinking about the social impacts, and that might mean climate migration. It might mean famines, crop failures. It could mean permafrost melting. It could actually mean more climate emissions from areas that have had their carbon locked in over many centuries. So it comes back to that connected nature. Yeah, you're absolutely right. It's not just us here in Scotland or the UK that are working on these targets, they're global targets. And these global international agreements are essential in bringing those together.

Laura Young:

And I know that many people within the SAGES network have attended these conferences be that academic science voice and I've been there as well. And I think something I took away is what you were mentioning there, Rebecca, which is I think it's important to acknowledge that Scotland and the UK and other we would maybe say developed particularly Western global north countries, we had our industrial revolution over 100 years ago. We did all of that on the back of fossil fuels, particularly coal, and then later oil and gas. So back in the day, if you use that phrase, we were the big emittors globally in terms of contributing to that baking and of climate change. Now that we developed ourselves, actually we now are doing that transition to much more renewable energy and green and clean and actually we are a lot more sustainable. And we have to play our part in helping countries around the world who are now doing their big development pushes to not make the same mistakes that we did, which was do it all on the back of fossil fuels. I guess that's partly where you know we a play role in helping them, whether it's financially or with the technology. But I also think recognise that other countries emissions are also partly ours. One of the big questions that always comes up is, you know, what is the point in a country like Scotland doing anything for climate when you've got huge emitters like China, America and other big states? And I think one of reflections as well. Pick up almost anything, and it'll probably say made in China, made in Turkey, made in India, made probably just not in the UK. And so all of the energy and materials that it took to that plant pot or that coffee mug comes from another country, but it's us who is buying it and demanding it. And so I think it gives s perspective of all of

these other countries that also have big emissions. Actually, that's partly us that that that we need to do that and I think having that connectedness thinking about global agreements and even local people. Everybody trying to get their voice heard, a theme that often gets dropped. But it's climate justice. I'm wondering Kate, could you could just give us a few words on what that means or what we're striving towards when we say that.

Kate Donovan:

Absolutely. So climate justice is a really important area of discussion at the moment. It's important for many reasons, one of which is that countries like Scotland and the UK, we have a responsibility to support the most vulnerable people who are being affected by climate change all around the world because we started the industrial revolution, we put a lot of the emissions into the atmosphere that are now causing the problems. So climate justice talk about those the people who did the least are the worst affected, and so actually we have a responsibility to lead the way and innovative solutions supporting their development without creating more pollution, but it's also about ensuring that everyone's voice is heard within the conversation, so it's about ensuring that when a new flood defence system might be proposed to a community that the people who are going to be impacted are part of that decision making process. So that's also climate justice. It's very important for us to think about climate justice at an international level, but also at a local level, because at an international level, countries like Scotland are leading the way in putting money towards things like loss and damage, and what this means is basically saying ok, we will do everything we can to adapt climate change, but there's always going to be some kind of residual risk. There's always going to be something that we might not be able to tackle and so we have to support those communities who lose everything going forwards. And so there's a discussion around climate justice and loss and damage. So people might come across these terms and they're a bit, maybe a bit confusing, but it's really about helping the most vulnerable. And Scotland actually has done a lot to raise the profile of communities overseas and here who are suffering the worst from these kinds of natural hazards as well, floods and droughts, so climate justice is really important. It's driving a lot of decisions at the moment and that is essence. It's really about thinking about human rights. No one should die from a hazard event. We have enough knowledge to prepare and respond. Sadly, they still do, and we've got to ask the question why? And so events like the Conference of Parties bring international people together. COP30 is going to be in Brazil. It's going to be in the Amazon rainforest, in the gateway to the Amazon rainforest. Climate justice is going to be the hot topic at that event. And so for those who

are interested, I would encourage you to learn more about the topic. To understand how your voice can be heard in climate action, but also, you know, let's be a bit wiser and how we vote, how we use our power as individuals as well.

Laura Young:

And I guess that brings me to what I would love to have as a bit of an ending question for you both, which is I think there's a lot of stakeholders in this, but what role do we have in you know, this whole issue of climate change, whether it's net zero, adaptation. Or engaging with government, business, SAGES, as a research institution. What role do we have? I love a take away. I know that it's not all down to people, but maybe just some reflections of what we can be thinking about moving forward.

Kate Donovan:

Yeah. I mean, I think one thing that I get asked quite a bit is how do you do your job when it's so depressing? And actually I think it's so important to have researchers and academics and practitioners all working together. To try and, you know, come up with innovative ideas and solutions, but also the evidence base around some of these things. So thank goodness we are having frustrating conversations around climate change action because a number of years ago scientists were sat here going, it's happening, come on, people, get on board. And actually we're now there. So people are on board. They understand that climate change is happening. Decision makers have put in place policies and have the targets to try and reduce emissions. We have made huge progress. But there is still a lot that we need to do to support decision makers to support communities, to understand what is the best route forwards right now. It's complex, it's difficult, it's interconnected as we've discussed today. And so basically we need everybody round the table to come up with solutions when you've got a complex problem, you need lots of different minds and lots of different perspectives to try and solve that problem. And climate change is definitely a complex problem. So, academics, researchers, the SAGES community, we still need to keep plugging away. Understanding what the risks are, understanding what the impacts are, understanding the nuances of what might happen. Going forwards, trying to put that evidence base in front of decision makers in a sensible way where they can understand it. And then make decisions based on it. So we're working closer and closer, I think with decision making decision makers that we've ever done before, which is fantastic. We're all getting really frustrated, which is fantastic because that means we're actually tackling the hard stuff.

We've kind of tackled the low hanging fruit and now we're on to the big, difficult things around climate change. So it's a positive space to be in. It can be really challenging and difficult at times. But we need researchers. We need arts people, we need communicators. We need social scientists. We need physical modellers, we need them all, and we need everyone to come together and share that knowledge. With those solutions, they're really going to help our community move forwards.

Rebecca Wade:

Yeah. So I think that there's these huge kind of contradictions. We've got despair and we've got hope. We've got droughts and we've got floods. You know, we've got all these different contradictions that don't seem to sit well together, but they do sit well together. So part of what we can do, I think is that education and communication piece, and definitely that's where we do need to come together, not just with a single discipline in the SAGES community, but across all the different disciplines that I study and could be, business could be nursing, could be engineering, could be almost any discipline will have a role to play. In, not just dealing with climate change in terms of the adaptation, but communicating and educating within their communities within their discipline, within their professions about why we need to do it and how we need to do it. And we need those stories that do you know do maybe instill a bit of despair? A bit of kind of depression in us because we need to understand how important and how just vital work in this area is, but we also need the stories of adaptation. We need the stories of hope. We need the good news stories where the communication and the collaboration has led to beneficial outcomes and that can inspire people to deal with. The sort of anxiety or the despair around the reality of the situation that we're facing. So I think. Yeah, there's. The easy the take away is communicate. Have a conversation. So whether you are a professional or just in your personal life, have a conversation with people around you. Inform yourself as much as you can. Try and inform yourself with trusted sources where you can actually find out information that can help you to understand the situation, but also. The personal tools that you can harness to be able to adapt to it, it could be something like figuring out you know where your savings are you know, is the bank that you bank with actually investing in fossil fuels or is it an ethical bank? Is it investing in in green and renewable energies and adaptation and resilience. So think about what your superhero cape contains. You know what are your super powers? Is it having a conversation with a neighbour? Is it contributing to a community garden on your doorstep? Go beyond recycling. Go beyond the things that you're already doing because all of us need to go beyond. So yeah, have a conversation, find some hope

and move forward, because that's what we've all got to do, whether we're in the thick of it or on the edges.

Laura Young:

You mentioned their actions. People can take things like banking, sustainable banking, better consumption choices. I guess that comes back to your point about everything's connected, because actually the Antarctica - Scotland, but also a lot of our stuff, it's not made here so, so that helps us help other countries, is that right?

Rebecca Wade:

Yes, to a certain extent. I mean our global production systems are connected. Our economies are connected, we have big global companies and organisations that we all sort of rely on, whether it be for our, you know, internet, our telephone, our mobile phone, in our pocket, our banking, the products that we buy online or in stores. So there's lots of different impacts that we have every day based on every single choice that we take and. I think sometimes if we just stop and ask ourselves the question. Whenever we do something, so it might be we're leaving the house, do we need to take the car today? Or actually have a look at the weather forecast, because climate's not always predictable as it used to be. Do I need to make a different decision in terms of wearing a coat or taking a brolly when I'm buying something? How far is it travelled? How far have these green beans or this mango travelled and how did they travel to get here? Thinking about everyday choices can really help us to understand the impact that we individually are having.

Laura Young:

Thinking about trusted sources, where could people go for really good information about climate science?

Kate Donovan:

One of my favourites is a website called Carbon Brief. It's a fantastic source of information. They follow all the hot topics in terms of climate change. But it's accessible so you can pick up an article and read it as you would anything on any, like any newspaper or any online media. But what's nice is that a lot of the articles are written by

scientists, so it's kind of underpinned by research. So you know that it's coming from a trusted place. And a lot of those scientists are leading the way in their countries around policy understandings around some of the climate modelling. And if you also want to follow some of the COPs which we've been talking about, they have a policy thread and you can go and read about what is a COP, what are they talking about? COP29 and COP30 going. What are the big outcomes from these events and get clued up around, you know, what are the people who we vote for are meant to be talking about? How are they supposed to be engaging with climate change? So Carbon brief, I would highly recommend as a source of information for people.

Rebecca Wade:

I recommend just looking up the UN online, so the United Nations has got a lot of resources in lots of different languages. So whether you live in Scotland but maybe English isn't your first language, you'll still have an opportunity to find some information suitable, not just. For an adult consumption, but also for children, so they have YouTube videos that just explain the basics. They're suitable for primary school through secondary school and all the way up to, you know, dive into some of those more technical documents. And if you do dive into those more technical documents from the different UN frameworks. One of them would be the Intergovernmental Panel on Climate Change. You might have to try a bit harder to get into those documents, but they usually have a summary for policy makers and that would be the one to go to. So if you select the report which is the summary for policy makers, they make bullet point comments on the main factors and their level of confidence in those factors and so. Yeah, go to the United Nations or the IPCC. That would be some trusted. Sources and yeah, I'm sure there's lots of really good information out there.

Laura Young:

Thank you so much for having this conversation, actually and kicking off this series of the SAGES Climate Science Podcast and we are going to explore so many of the themes that we've just lightly touched on today in the rest of this episode. But thank you so much, Dr Kate Donovan and Dr Rebecca Wade.