

Tracey Matisak: Welcome to radio times. I'm Tracey Matisak. In for Marty Moss-Coane.

Tracey Matisak: A new report from the United Nation says that as a planet, we're approaching critical mass when it comes to climate change. The Intergovernmental Panel on Climate Change, made up of scientists from around the world says that the Earth is warming much faster than they expected. So fast that we're on track to pass the high temperature mark set by the Paris Climate Accord in 2015.

Tracey Matisak: When that happens, nothing good follows. Scientists tell us that we're in for bigger and more dangerous heat waves, severe droughts, catastrophic flooding, everything we're seeing now only more of it. Some of the projected damage is unpreventable, but not all of it. Scientists say There's still a window of time to stave off the worst, joining us with more on the report. And what could happen from here is Bob Kopp, a lead author of the UN report. He is a professor and director of the Rutgers University Institute of Earth, Ocean, and Atmospheric Sciences. Bob Kopp. Welcome to radio times.

Bob Kopp: Tracey, It's good to be here.

Tracy Matisak: Let me just begin by inviting our listeners to join in on the conversation. I'm sure they will have questions for you. You can email us at Radio Times at why.org tweet us at why Radio Times or call us 8884779499. Bob, that said, let's start with the report itself. I mean, this is essentially the latest climate science research from around the world and its updated every few years.

Bob Kopp: Yes, that's right. And honestly, for people who have been paying attention, there shouldn't be that much new here because this is based on an assessment of about 14 thousand publications that have come out since the last big assessment report in 2013. Nonetheless, it's a clear statement of where our understanding of the physical science of climate change is now, we now know, as, we've known for decades that the world is warming and we're seeing changes in the climate that are widespread, that are rapid, that are intensifying, that are unprecedented and thousands and then some case for over a 100 thousand years and that are caused by human activities. Primarily the emissions of carbon dioxide from burning fossil fuels. So of course, we're seeing more intense heat waves. We're seeing more intense rainfall and parts of the world we're seeing, more frequent and severe droughts. We're seeing higher sea levels leading to more frequent coastal flooding. And some of these changes are locked in, but others could be slowed, and others could be even stopped or reversed by limiting warming, Every additional bit of greenhouse gas we put into the atmosphere will warm the planet up a little bit and make all of the things that we're already seeing more severe. I don't know.

Tracey Matisak: I'm sorry - go ahead.

Bob Kopp: You mentioned so the 1.5 degree temperature threshold that's talked about in the Paris Agreement. And one of the other findings is that in order to stay below that or in the vicinity of that, we need immediate rapid and large-scale reductions in greenhouse gas emissions, leading to net-zero carbon dioxide emissions. By the middle of the century. But even if we go over that, It's important to realize that all of these changes are made more severe every additional bit of warming we have. So the sooner we get to net 0, the less warming we get and the less severe the changes are.

Tracey Matisak: Well, you've given us a lot there to unpack and I'd like to drill down on several of those items. But one of the first things that you said was that if you've been paying attention to this over the years, there's not a lot new. And yet Bob, there does seem to be a much greater sense of alarm this time around. What do you think that is?

Bob Kopp: Well, yeah. I mean, I think it's it's simply a matter of the fact that we're seeing more and more conflict, right? We've moved from 20 years ago. It being quite likely that this is going to happen to now it's an established fact that we are living in a world where extreme weather events are made more intense by climate change, it's no longer a statement of things that will happen in the future. It's really, you don't need to be a climate scientist at this point to know this, right? It's, it's happening, it's happening today. And we now, since the last report in 2013 one of the areas of science has developed a lot is the science of attribution that is, looking at specific extreme weather events and seeing how the additional heat we're trapping on the planet through our greenhouse gas emissions is making the extreme event more intense.

Tracey Matisak: It sounds like the climate science is becoming more precise even in the years since the last report came out.

Bob Kopp: And becoming more precise and I thought, I had, it's also sort of moved from describing sort of general physical principles and things that will happen in the future to really now we're studying the world had not just in the future, but has it is now we're living, you know, we started this experiment many decades ago and now we're in the midst of it.

Tracey Matisak: All you have to do is look out the window or turn on the TV to see the effects. One of the biggest takeaways from the report seems to be the certainty that human beings are responsible for the alarming level of the warming of the planet. How do scientists determine that?

Bob Kopp: Yeah. Well, so there are a lot of different lines of evidence that go into this. The basic physics underlying it honestly has been known since the late 19th century. So we can look at how carbon dioxide concentrations have changed in the atmosphere and other greenhouse gas concentrations of change has a result of human activity. And we can go through the basic physics. We can also use the climate models that describe those physics and a great deal of detail and say, well, there's no way eventually you can see the warming trend that we've seen over the last several decades. If you remove the human contribution to the greenhouse gases in the atmosphere, it just wouldn't have

happened.

Tracey Matisak: And the human contribution, as you mentioned, sounds like it's primarily the burning of coal, oil and gas.

Bob Kopp: Yeah. So yeah. So carbon dioxide is the largest contributor to warming and the roughly 90 percent of our carbon dioxide emissions are coming from the burning of coal, oil, and gas with the most of the breath coming from deforestation. There are also in this report draws attention to this important contributions from other greenhouse gases like methane. And methane in particular is important because it's what's called a short lived climate forcer, which means that we can have large effects on the methane concentration in the atmosphere through reducing our emissions now, whereas with carbon dioxide, carbon dioxide, basically we're putting carbon dioxide into the atmosphere and it's causing warming within the course of a decade or two. And that warming last for centuries. Whereas with methane, there's basically one of the main levers we have to slow the rate of warming in the near term would be to reduce methane emissions. So that's also an important part of the story.

Tracey Matisak: So you get a greater impact or a faster impact, it sounds like with reducing methane as opposed to carbon dioxide,

Bob Kopp: Faster impact, but the long-term warming is basically determined primarily by carbon dioxide, right? So it's not, they don't really substitute one another, right? We could reduce the rate of warming by reducing our methane emissions. But the long-term level of warming is going to be largely set by the amount of carbon dioxide we put into the atmosphere. Every bit of carbon dioxide range this the thermostat a little bit more.

Tracey Matisak: So the report tells us that the Earth has warmed by about two degrees Fahrenheit, 1.1 Celsius since the late 19th century, which the average person doesn't sound like very much, but it's clearly highly significant. Can you put those two degrees Fahrenheit into perspective for us?

Bob Kopp: Yes. So I mean, one way to think about this is in terms of the temperature difference between now and the last ice age. So the last ice age was about four to six degrees Celsius that's probably around ten degrees Fahrenheit, colder than today. And, you know, just north of where I'm setting in central New Jersey was covered by ice sheet that was kilometers thick. All right, so that's, that's what ten degrees Fahrenheit, we'll get you and we're sort of 1 tenth of an ice age difference in the other direction. And looking forward, where we're talking about sort of another half a degree Celsius or nearly one degree Fahrenheit. More. For the most stringent target, all the way up to a three to four degrees Celsius of cumulative warming started two to three degrees more but 4-6 degrees Fahrenheit more if we sort of continue on current emission trends.

Tracey Matisak: So to sort of circle back to some of the points that you mentioned early on, that two-degree difference. How is it manifesting itself even now?

Bob Kopp: All right. Well, I mean, you okay. As you said, you started just need to look at out of the window what we now have a pretty robust field of science to look at. This a new since the last large assessment report is the ability to say, okay, well, you know, this heat wave. Well, what, how likely would it have been - this extreme heat wave - how likely would it have been without those two additional degrees of warming? And by the way, that two additional degrees of warming is for the planet as a whole over land, the land warms faster. So let's really closer to about three degrees Fahrenheit over land. And so those heat waves are made more intense and then we're also getting more water vapor and the warmer atmosphere. So that leads to more intense rainfall. Um out and sort of the central and particularly the western US because it's hotter, you get more evaporation. And so that means you get more droughts and more droughts and more heat also leads to greater wildfire risk. And so those are some of some of the examples. And then you have for us here, in the mid-Atlantic region, right, trapping more heat in the planet means we have sea levels rising faster, both because the oceans are warming and because ice mountain tops and then Greenland and Antarctica is melting. And that additional sea level rise is making coastal flooding more frequent. So for instance, on the, on the Jersey Shore tidal flooding that used to happen once every year or two in the 1950s is now happening or closer to 10, ten days a year in some places.

Tracey Matisak: And then the report also says that really, no matter what we do at this point, we have already set some climate catastrophes in motion. There's simply unavoidable. So I mean, clearly, the things that you just described, what else should we be looking out for over the next, say, ten years?

Bob Kopp: Well, I'm going to say the term catastrophe. It's not a word used in the report. But, you know, what we can say is like, you know, so we can ask, well, what would happen if we were to go all the way to net-zero emissions today, globally, which is ultimately what you need to do in order to stop warming the planet. Well, you know, if you were to get to net 0 today, the planet would stop warming within a decade or two, right? So pretty much if we were to, and of course we can't do this. But if we were to get to net 0 tomorrow, the climate, we have, the increase in extreme events that were already seen. It is more or less what we would stabilize that. So if we look at plausible emissions trajectories, even limiting warming to 1.5 degrees C. We still have, you know, we're still going to see some intensification of that. But temperature is actually something that responds relatively quickly to changes and admissions. And so we can really slow things from getting worse. With sea level rise because the oceans are big and take a long time to respond to trapped heat. And because the ice sheets are big and took a long time to respond, it just starts a reference. You're raising global average sea level by, by, by, by about a tenth of an inch, is melt, involves melting about a trillion tons of ice. So we're talking about really large systems. They respond on a longer timescale. So if we were to limit warming to two degrees Celsius, our best estimate is that maybe we have global sea level rise on the order of about a foot and a half. And this and I'm going to keep right on.

Tracey Matisak: Bob, I'm going to stop you right you right there. I have to take a quick break. More on the other side when radio times comes right back.

Tracey Matisak: Welcome back to radio times. I'm Tracey Matisak filling in for Marty Moss-Coane. And we are talking about climate change specifically. We're talking about the new UN report that was released this week in which the UN Secretary General said that this is a code red for humanity and warned about warming on our planet that is taking place faster than scientists even expected and some of the anticipated results of that and what we can do to stave off the very worst of that. We have been talking with Bob Kopp. He is a lead author of that UN report. He's also a professor and director of the Rutgers University Institute of Earth, Ocean, and Atmospheric Sciences.

Tracey Matisak: We invite you to add your voice to the conversation. You can email us at Radio Times at why.org tweet us at why Radio Times or give us a call 8884779499, Bob Kopp. I'm sorry. I had to interrupt you just before we went to the break, but we were talking about sort of what happens if we start making changes now. You know, what's the lag time and what are we looking at down the line? And I wanted to give you an opportunity to finish that thought.

Bob Kopp: Sure. Sure. So everything that some parts of the climate system say temperature responds relatively quickly and the timescale, but a decade or two to changes in emissions. Sea level rise, which is particularly important for our region, is a much more slower, slowly responding process. So we've sort of locked in at this 0.6 to 12 inches of global average sea level rise over the first half of the century. By the time look, we're looking through to 2100 are most likely estimate is that if we were on sort of a three to four degrees Celsius trajectory, we would be looking at a bit over two feet of global sea level rise. And by the way, we would have more than that in our region because of a variety of processes that we can get into. Whereas in a two degree world, we're looking at something more like a foot and a half by the end of the century. But in both cases, sea level would continue rising for centuries to millennia. That's beyond, beyond that. At the same time, the more we limit our emissions, the lower the chance that we trigger instabilities and the polar ice sheet that could substantially increase sea level rise. So for example, under the most extreme emission scenario we looked at, we could not rule out rapid ice sheet loss leading to sea level rise approaching seven feet globally by the end of the century and 16 feet by 2150. Whereas if we limit warming to well below two degrees C, we're still going to hit that 7 feet mark. But it will take many centuries to do so. And so even in the most slowly responding part of the climate system, which is really the ocean than the ice sheets. There is still on those long timescales. And even looking towards the end of the century, a really important role for emissions reductions to reduce the ultimate level of warming and ultimate level of change, the rate of change. And some of this really important but hard to characterize risk that we are taking on as we push the climate further and further away from its historical state.

Tracey Matisak: So help me chase that down a little bit. When you talk about sea level rise in terms of feet, potentially. What does that look like then? How does that play out and what are the effects of that ultimately?

Bob Kopp: Yes. Well, so even just look at the sea level rise that we've already had. Sea level has been rising for the last, more than last century, globally, globally. In fact, over the last century has risen more than any century in at least 3000 years. As a result, primarily of melting of ice and glaciers, mountain glaciers on the poles and the expansion of water in the ocean as it takes up heat. And looking just since the 1960s, we've seen a near doubling and the frequency of coastal flooding in many coastal sites around the world. The sea level rise that's sort of already set the course for the next 30 years or so. That will change what used to be considered a once in a century. High water level in much of the world. To something more like a once in a 10 year high water level. And that's certainly true as I mentioned here, mid-Atlantic region where, for instance, in New Jersey we've seen roughly about a tenfold increase in the frequency of tidal flooding since the 1950s.

Tracey Matisak: So it's all so alarming and yet there is a ray of hope that is offered in the report when it says in spite of what is clearly coming and unpreventable, that there is a window of time to take some action to try to stave off the worst effects. How much time do we have realistically and, and what needs to be done in that time to try to mitigate some of this.

Bob Kopp: Yeah. So I mean, the basic principle to hold onto is that every bit of greenhouse gas we put in the atmosphere and gives us a little bit more warming. And every bit of little bit more warming gives us a little bit more intense heat waves, a little bit more intense rainfall, little bit faster sea level rise. And so in order to stabilize the climate at any level of warming, we need to get to global net-zero carbon dioxide emissions in order to hit the or be near the 1.5 degrees Celsius or about 2.7 degrees Fahrenheit target, which is the most ambitious temperature identified in the 2015 international Paris Agreement. We would need immediate, rapid and large-scale reductions that get us to global net 0 around the middle of the century to get another couple decades. If we're talking about two degree or 3.6 degree Fahrenheit target also identified on there. But any level of stabilization requires us to be thinking in terms of getting to net-zero emissions. Meaning we are putting no more carbon dioxide in the atmosphere, then we are taking out through technological or natural means.

Tracey Matisak: Do you see, and I know you're a scientist, but do you see the political will in the US and elsewhere to take those kinds of steps?

Bob Kopp: So I'm done. Thank you. Thank you for that caveat. I'll take off my author hat off right now because that the question you're asking, well, political well may even go beyond anything the IPCC is going to say, but even the domain of, well, what are our policy options and what are our technology what our technology options, that's going to

be the focus of another report out in March from another set of 200 authors. So I don't want to preempt that report. But now speaking has somebody who is a citizen of the United States and somebody who works in this area, I say is like I am made hopeful by some of the changes we've seen in political and policy arena over the last few years. I do see that I think because people are talking about climate change a lot more with one another and with their elected representatives. And because we're seeing these effect, It's really has moved up on the policy agenda. And ultimately, like this is a common problem. We need societal action in order to achieve net 0, since we're not gonna do it through individual actions. And so it's really important that we know that it be high up on the policy agenda if we're going to achieve limiting warming to 1.5 degrees Celsius, or to 2 degrees Celsius.

Tracey Matisak: We want to remind our listeners, you're listening to radio times on why, we're talking about climate change and specifically about the new report from the UN that lets us know that the planet is warming faster than scientists even expected. There is some damage that is just not preventable, but there is a window of time to try to mitigate the very worst of that and our guest is Bob Kopp, he is one of the lead authors of that UN report and he's a professor and director of the Rutgers Institute of Earth, Ocean, and Atmospheric Sciences. Bob, we have a number of comments from our listeners and some questions as well. I'll start with this email from Paul who says China and India committed to building more and more coal-fired electric generating stations. And Brazil having already destroyed the Amazon rain forest as a carbon sink. In all caps, he asks, Are we just doomed?

Bob Kopp: No, I don't think we're doomed. I think we have a window of opportunity for action. And at the same time that indeed China and India are our building new coal power plants. It's also important that China is actually taking quite aggressive action internally on greenhouse gas emissions. It set a net-zero target of 2060, which obviously is not consistent with global net-zero target of 2050, but is in the right framing of recognition that in order to stabilize the climate, we need to get globally to net 0, which means we need to get nationally to net 0 in every country. So I think, and think this is an area where the Working Group three report in March. We'll look at more detail, but I think we'd actually see evidence of progress around the world. And the other important thing to remember the way the IPCC process works, there's a 4 thousand page report. The first 40 pages, the summary for policymakers are agreed to by the scientists and representatives of a 195 different governments. So every government in the world unanimously has accepted the science represented in this report. They've agreed line-by-line to the summary for policymakers. And I think that is an important basis for discussions of what we, what we do need, which is global policy that ramps up. And I think it's great that this report is going to be available to inform the international negotiations that will be taking place either virtually or in Glasgow in November.

Tracey Matisak: We have another e-mail here from Mark who asks if you can please address number one, the warming of permafrost, especially in Russia, and two potential interruption of the conveyor belt of warm water going from the Caribbean to Northern

Europe.

Bob Kopp: Sure. So permafrost thaw is part of the changes that we're seeing. I think many times that people bring that up, they're concerned about permafrost carbon, meaning the carbon that's trapped in the organic matter in the permafrost, which turns into carbon dioxide and methane when melt. And our report finds that the fertile, There's some discussion about, about runaway warming. We don't find evidence for that. The scale of what we're talking about here is important. But it's less than the warming already caused by the carbon dioxide in the atmosphere. So it does matter when we think about how much more carbon dioxide we can emit. And that's actually in this report. We find that in order to limit warming to below 1.5 degrees C, We have roughly 400 to 500 billion ton carbon dioxide emission budget. Right now for reference, the world admits about 40 billion tons of carbon dioxide a year. But that number of factors into account, the carbon related to permafrost. With respect to what you're referring to, the Atlantic meridional overturning circulation. So this is the circulation of which the Gulf Stream is part, that carries warm water north, northeast ward across the Atlantic. What we find is that there is pretty clear evidence that this circulation is slowing down and will weaken over this century. Paleoclimate evidence, evidence from the geological record tells us that the circulation has changed rapidly in the past. And if it were to change, it would cause substantial changes and regional weather patterns. So that includes things like slowing the rate of warming and Europe, it includes things like additional sea level rise in the Northeast US and include things like changes in storm tracks and in monsoon systems. But most evidence indicates that such a collapsible not happen in this century.

Tracey Matisak: And we also have an email from Joan who asks, Can you speak about the reduction of biodiversity because of the warming planet?

Bob Kopp: So I say that that's really more in the realm of a report that's going to come out in February on on the impacts of climate change. And i'm, I'm not an ecologist, so I think this is a significant concern. Most of the reductions and biodiversity we've seen so far have more to do with changes in land use, that in climate, but certainly climate is an increasingly important factor in the working group two report coming out in February, will have more to say about that.

Tracey Matisak: Bob, I want to circle back and talk about the Paris Climate Agreement, which set for some ambitious goals for reducing greenhouse gas emissions and containing global warming. Can you, I mean, that's where six years from that now. Can you remind us what some of those benchmarks were and whether they're still realistic at this point.

Bob Kopp: Well, so it's important the Paris Agreement is a framework, right? So that the goals are not actually set out in the Paris Agreement. That I mean, that the emission goals are not set on the Paris Agreement. What the Paris Agreement said in terms of goals or temperature goals, and a goal of net-zero carbon dioxide emissions in the second half of the century. So the temperature goals are limiting warming to well below two degrees Celsius or 3.6 degrees Fahrenheit, and as close as possible to 1.5 degrees

Celsius or 2.7 degrees Fahrenheit. And under the Paris Agreement, countries periodically make what are called nationally determined contribution. So that's where they connect and say, for example, we're going to reduce our emissions 50% below 2005 levels by 2030, which is the most recent US nationally determined contribution. And so under the Paris Agreement, countries make these nationally determined contributions. And then periodically they're supposed to be a global stock taken which say, okay, well, where are we with respect to these long-term goals and end this meeting in Glasgow is going to be part of this global stock take.

Tracey Matisak: Do we have a sense that this point of how member nations are holding up their respective ends of the bargain?

Bob Kopp: Well, I mean, anything to say like looking at various assessments from third parties where we are we're not we're not at two degrees yet, but we are substantially below where people might have thought we were few years ago. I mean, I think the business as usual, current policies, best estimate is that would get us to something like three degrees Celsius of warming above pre-industrial. By the end of the century with uncertainty of about two to four degrees Celsius, although that will be looked at more in this March report, the pledges and targets, Would get us more towards something like 2.5 degrees Celsius. So we're getting there if countries follow through on their pledges and targets. And indeed, if you look at net 0, partner countries have, in addition to the pledges and targets that are sort of say where we're going to get to 20, 30 countries also have started making net-zero pledges. So the Biden administration has pledged that the US will get to global and net zero. Or if you get to national net-zero emissions by 2050. And of course that has yet to be followed through with policy. But if you look at the net-zero targets and if every country where to meet those, that would get us potentially to around two degrees Celsius. So, you know, it's there is a gap between current policies and sort of pledges and targets and net-zero targets. But I do think things are moving sort of in the right direction. In terms of these commandments.

Tracey Matisak: We are talking with Bob. Kopp is one of the lead authors of the new UN report that was released this week that lets us know that the planet is warming faster than scientists even anticipated. And talks about what some of the effects of that will be and what some of the things are that we can do to mitigate the very worst effects from happening. You're listening to radio times on whyy, we invite you to add your voice to the conversation. Email us at Radio Times at why.org tweet us at why Radio Times or call us 8884779499. More of our conversation on climate change, when radio times comes right back.

Tracey Matisak: You're listening to radio times on whyy, why I'm Tracey Matisak, filling in for Marty Moss-Coane. We're talking about climate change and specifically about the new UN report that calls it a code red for humanity, a warning that the planet is warming up quite fast. There is some damage that is not preventable, but there's also a window of time to try to mitigate the very worst. Our guest is Bob Kopp. He's a lead author of that UN report. He's also a professor at Rutgers, a climate scientist at Rutgers University. And we have been talking about all things climate change in this

conversation. Bob, there's been a lot of headlines lately about the Biden administration pledging. And we've talked about this a little bit, that the US will cut its greenhouse gas emissions roughly in half by 2030. Part of that is it involves electric cars and hybrids. Having sales account for 50 percent of all car sales by 2030. If President Biden were able to achieve a goal like that, how far would that go to helping us reduce our carbon emissions?

Bob Kopp: So I'm going to take off, my hat has a IPCC author here because they're really getting into a realm that is the topic of the report that 200 plus other authors will be putting out for the IPCC in March. But speaking as somebody who works in this area. You don't want to say it's like we need to get to net 0 emissions in order to stabilize the climate. And that includes addressing every sector of the economy. And electrification is a key tool in doing so because we know how to make an electric grid that is not dependent on fossil fuels. And what has we move other end uses to electricity that allows us to use those, those techniques to bring those sectors down with the electric grid. So that's why electrification is so important, both in terms of vehicles, but also in terms of things like heating buildings as well.

Tracey Matisak: It's interesting that you mentioned the grid because the new \$1 trillion infrastructure bill that was just passed by the Senate includes tens of billions of dollars for upgrading the power grids so that it can carry more renewable energy. It sounds like there's a few more billion for electric vehicle charging stations. There's money for clean buses and ferries. I guess it's a two-part question. Are you heartened to see this sort of bi-partisan willingness to put a lot of federal money toward mitigating climate change. And, and then secondly, will it make a dent?

Bob Kopp: So, and again, I want to emphasize that here I'm speaking for myself and not for the IPCC. I think the bipartisan bill is a mixed bag. I think there's a lot more that is included in the budget resolution that that's being debated right now. That budget resolution, for example, last time I checked anyways, included a clean electricity standard, which would set a target of an 80% reduction in emissions by 2030. And put us on track for the Biden administration goal of a zero-carbon electric grid by 2035. So that, you know, those sorts of measures are, are crucially important. As part of getting to national net-zero.

Tracey Matisak: Question from Sue, who says, should we not fly anymore? Recreational air travel seems very shortsighted. We're, when we're in this kind of crisis. There's no do over on this.

Bob Kopp: I'm going to take that and talk more about sort of this broader sort of personal action issue. I think personal actions to reduce a greenhouse gas emissions certainly can be useful. They increase awareness of where emissions are coming from, the system of the whole. But ultimately this is a collective action problem, right? We're not going to get to net 0 emissions through individual choices about flying. We're not going to get to net-zero emissions even by individual choices to say, electrify your

house separate from broader policy that does that. So I think individual action in general is, I think it can be quite useful both for facilitating discussions about how we get to this and for, for increasing awareness. But really any individual action has to be viewed in the context of how does it accelerate the national discussion about policy change.

Tracey Matisak: And I think that's what people find frustrating who cared deeply about this issue and feel like they want to do something. But knowing that this is one of those things that really requires collective action to, to make a big dent. But along those lines, a comment from Ralph who says, any advice on how to get family and friends more engaged in this issue? He says a lot of people I know just aren't paying attention to it or are good resources, I can point them to?

Bob Kopp: Well, I'm going to say I think the sum of the material associated with this report hopefully is a good resource that the US Global Change Research Program, the National Climate Assessment has good resources. I think there's a lot of material out there that, you know, the newspapers at this point. And this is really a change that I think has to do with why this is moving up in our political agenda is that we are seen in the media a lot more coverage of climate change than 10 years ago. But I think the listeners sort of asked the right question. For people who this is really isn't on their radar. That's probably because they're not hearing it talked about very much. Most people, you know, the Yale Climate Communication project surveys periodically. And that's still the case that most people have not had a conversation about climate change in the last month. Well, then maybe that's changed this year because of all the extreme events. But it's generally the case that there's a large pool of people who are sort of vague. This is vaguely in their awareness, but it's not top of mind. It's not, you know, not what they're going to talk about if they happen to meet an elected official, it's not that they're necessarily going to be thinking about has high up on the priority list when they, vote. And so simply by having conversations with people is a really important part of climate action.

Tracey Matisak: And Bob, for you, I'm curious as you watch all of these events play out with the rest of us. I mean, we see the wildfires in California that create haze in New York City, we see terrible flooding in Europe and more recently in North Korea, there are wildfires in Greece, we're seeing flights canceled because of extreme weather. People like you have been sounding the alarm about this for years and it seems that in the immediate aftermath of those alarms, there is, people start sort of paying attention and talking about it. And then there is this tendency to shrug our collective shoulders to Ralph's point. I'm just curious about your take as a climate scientist as you watch this play out in your, your thoughts about sort of the way that we have responded to these warnings over the years.

Bob Kopp: Well, I mean, I certainly wish we had taken stronger and more sustained action earlier because it would it would not have had to been quite as transformational had we started doing this. When the first congressional hearing on the topic was held in 1988. You know, frankly, most of, you know, where say most of the grid of the carbon dioxide that's ever been emitted from fossil fuels has been emitted since the late 1980s.

Alright, since the first congressional hearings on the topic and of course, President Johnson was warned about this in the 1960s. So the slower we move, the more dramatic the consequences are becoming and the more dramatic the action we need to take in order to stabilize the climate. That said, I mean, I, I think this really has become a top policy priority. In a way it's never been before. And they think that is in large part because it's become a top concern of many citizens. I'm particularly inspired by some of the young people who have taken action through things like the Sunrise Movement and Fridays for the Future. And so I think it's not too late to limit the effects of climate change and every bit of carbon dioxide we don't put into the atmosphere is a little bit less severe warming and a little bit less severe consequences.

Tracey Matisak: Along those lines, I just want to read you a couple of comments from our listeners. Patricia says, I worry about humanity's continued disregard for the only planet we have. I passed people parked in cars with the engine running on my daily walk. When I return in our later, they're still there engine running. We continue to drive gas guzzlers on and on. She says If our behavior doesn't change, nothing will change. And if nothing changes were worsening the effects of climate change, I worry about how bad this has to get before were jolted into action. And then another comment from Adrian who says we need to address the root cause of the climate issue. It's our consumption habits. We consume too much and it's not sustainable. So I just wanted to share those with you and have you react to those.

Bob Kopp: Yeah. I mean, I think a clear message from this report and from others, including the report on limiting warming to 1.5 degrees that the IPCC did three years ago, is that we do need transformational change in order to change from a world that is seeing greenhouse gas emissions increase to one that gets to net-zero. Behavioral change is part of that. It would be better for people not to sit idling in their gas cars, it would be even better if we had a transportation system where people weren't driving gas cars in the first place. And that's why this is really, has to, has to be viewed as a collective action problem where we need policies to support this transformational change.

Tracey Matisak: Question here from Meredith who says, what about carbon pricing? Would that force industries and individuals to change?

Bob Kopp: Yeah, So again, I mean, I want to emphasize on this last bit of the talk. We've really moved away from the Working Group one report and then talking about topics that will be addressed in more detail in March report. But this is an area I've worked on. I would say, I think carbon pricing is an important part of the toolkit. But also that it's not sufficient on its own, right. Really we also need infrastructure investment in order to do that. So we've, when economists first started talking about carbon pricing as a core solution. Again, this was the late 1980s. It was a time where nudges to not, nudges to the economy would have been sufficient to steer emissions on a downward course. At this point, we really need to be putting in place in this decade the infrastructure of a carbon-free economy. And so carbon pricing, I think it's part of the solution. And we already have it in parts of the country, in California, in the electric

sector, in the Northeast. But, but it's only part of the solution.

Tracey Matisak: One of the terms that we have not talked about in this conversation, but it's, we've sort of danced around. It is Climate Resilience. Can you talk about what you see being done by governments, by business to try to build it.

Bob Kopp: Yeah, So this is actually an area where we do a lot of work at Rutgers. I direct a graduate program in coastal climate risk and resilience. And we have a climate services organization called the New Jersey climate change resource center, which is based out of Rutgers, that helps support communities and businesses and the state government to make informed decisions about climate change. And basic thing is right, we, we can avoid a lot of the worst consequences of climate change, but we're already experiencing some dangerous impacts. So we need to make sure that we are living in a way that that can minimize the harm associated with these extreme events. So thinking about, for instance, the impacts of sea level rise and the associated increase in coastal flooding. Our communities should be thinking on a variety of timescales about how they're going to respond and minimize the harms associated with more frequent flooding. In some cases, that involves building hard protective structure. So there's a lot of work going on in this area right now, for instance, in Manhattan. In some cases, that involves protecting natural areas that can absorb wave energy and maybe things like building out oyster reefs. In some cases. That involves making sure we are better prepared for the floodwaters to come through our community. So things like building elevation so that you don't have as much harm is an important part of the solution, but it is not something that can be only done on an individual basis because if you elevate buildings, but you don't deal with sort of the common infrastructure and say sewage and water and electricity. And your people, your house might be okay, but the communities still going to take a long time to recover. And in some cases, we do need to be starting to think about when some areas we might need to relocate from. And I think the most important thing that, that these are when we're talking about multi-decadal community plans, these really need to be height happened in a deliberative process that is informed by the best available science. But also like centers, the values of the communities there, the costs that are imposed by extreme events, both to the community and to the state and the country as a whole. And we really need to start having these discussions at a community level now.

Tracey Matisak: And finally Bob, in our last 60 seconds before we have to say goodbye, You mentioned that the UN Climate Change Conference is scheduled for November in Scotland. What are you anticipating will happen there and how much urgency does this new report lend to that meeting?

Bob Kopp: Well, I mean, I certainly hope that the governments will take this report and recognize the importance of figuring out where we really are and tightening up targets if they, if they want to stick by the temperature target, temperature goals that they've already set out. So one of the things that will happen at this report is a global stock take. So looking at where we are relative to where we've been, where we were when the

Paris Agreement was developed? Or are we meeting the nationally determined contributions? And how much more do they need to be tightened if we want to stay on it well below two degrees Celsius trajectory. They're also going to be other discussions there around things like loss and damage. You know, what do we do about the fact that there already are places on the planet that are suffering impacts there, relative of past emissions. And I think that particularly developing countries are going to want that to be high up on the agenda.

Tracey Matisak: Great deal to talk about Bob Kopp. Thank you so much for making time to be part of this conversation and help us understand this complicated issue better, we so appreciate having you on radio times.

Bob Kopp: My pleasure.

Tracey Matisak: So we've been talking with Bob Kopp. He is a professor and director of the Rutgers University Institute of Earth, Ocean and Atmospheric Sciences. Our producers on Radio Times are Debbie Bilder and Paige Murray-Bessler. Diana Martinez has been our engineer. And I'm Tracey Matisak, filling in for Marty Moss-Coane. You're listening to radio times. on why.