When Science Finds a Way

Season 4, Episode 9

Is tackling super pollutants an emergency brake for climate change?

Show notes

Episode description:

We may think of carbon dioxide as the main culprit in climate change, but could tackling "super pollutants" provide an emergency brake for global warming?

Dr Tom Grylls tells Alisha Wainwright how we already have the tools to reduce these gases and particles, and Bidya Banmali Pradhan describes a successful effort to do just that by re-engineering brick kilns in Nepal.

But this isn't only a question of climate. Professor Zorana Andersen explains air pollution's impact on our bodies, and we hear how a holistic view of climate and health could help slow down global warming and save millions of lives.

Mentioned in this episode and further reading:

- What are super pollutants and how do they impact our health? - Wellcome (https://wellcome.org/insights/articles/what-are-super-pollutants-and-how-do-they-impact-our-health)
- Why reducing super pollutants isn't just good for the climate – Clean Air Fund (https://www.cleanairfund.org/news-item/reducing-super-pollutants/)
- Building cleaner brick kilns in Nepal - CCAC (https://www.ccacoalition.org/projects/building-cleaner-brick-kilns-nepal)

Transcript

[00:00:00] **Tom Grylls:** I think one way to put it is it's like the emergency break that we can pull on climate change.

[00:00:07] **Alisha Wainwright:** Have you heard of Super Pollutants? Honestly, I hadn't before I sat down with Tom Grylls for this episode, but it is something we really should be paying attention to. It's a term which helpfully groups together, a bunch of short-lived, under explored pollutants like black carbon, methane and tropospheric ozone where scientists have spotted an opportunity, an emergency break. By reducing emissions, we can potentially have a quicker impact on global warming than decarbonization alone, while also bringing health benefits by improving the air we breathe. It sounds like a win-win. In this episode, Tom, Head of Super Pollutants at the Clean Air Fund is going to break down super pollutants, impact on our health and the climate, why they are rising up the scientific agenda and the huge opportunity for joint action.

[00:01:08] **Tom Grylls:** If we just used all available technology around the world and finance the solutions, we could reduce black carbon emissions globally by 80%.

[00:01:17] **Alisha Wainwright:** Welcome back to When Science Finds a Way, a podcast about the science changing the world.

I'm your host, Alisha Wainwright. Let's get into it. Hi Tom. Thank you so much for joining us today.

[00:01:31] **Tom Grylls:** Hi, really great to be here.

[00:01:33] **Alisha Wainwright:** So, Tom, for something that could have such a big impact, I've never heard of super pollutants. So how long has this been on the scientific agenda and and is this a relatively new focus?

[00:01:46] **Tom Grylls:** So the more technical term and the grouping and the language around this has been evolving, um, over the last few decades and in particular over the last few years, is short-lived climate pollutants or short-lived climate forces.

[00:02:01] **Alisha Wainwright:** That doesn't have such a fun buzz. Uh,

[00:02:04] **Tom Grylls:** Exactly. And I think that's the key. That's, that's the reason that this language has really emerged over the last few years is to package up what the science community has been thinking about and has shown up in all of the international panel on climate changes assessment reports over the years into something that we can communicate effectively with, with different types of stakeholders, be that the public, be that policy makers.

So super pollutants is basically a way to, to package that up.

[00:02:35] **Alisha Wainwright:** So let's start there. Why don't you tell me what is a super pollutant?

[00:02:40] **Tom Grylls:** So super pollutants are the gases and particles in the atmosphere that have a climate effect bigger than carbon dioxide per ton. So that's black carbon, tropospheric, ozone, methane, HFCs, and nitrous oxide.

And what that categorization does is it brings together three really important and powerful characteristics of what's going on in the atmosphere and how we, what solutions we can implement to drive climate and health benefits. So super pollutants as a grouping are responsible for half of global warming to date with the other half attributed to carbon dioxide.

They are responsible for millions of premature deaths per year, um, due to air pollution. Many of them also last in the atmosphere for a much shorter amount of time than carbon dioxide, which means that some of the benefits we can see by tackling these super pollutants, um, can be realized much more quickly.

[00:03:42] **Alisha Wainwright:** I feel like that's sort of the PR problem with climate change and climate health is that to fix carbon dioxide, this generation or perhaps the next might not get to see the results, but with something like a super pollutant within someone's lifetime, if you made improvements in this space, you could see some of that gain.

Is that kind of a way to think about it?

[00:04:07] **Tom Grylls:** Yeah, for sure. I think one way to put it is it's like the emergency break that we can pull on climate change. So by tackling these super pollutants, we can. Avoid the temperature increase within the next decade. And on the health side, you can immediately and visually see the benefits from tackling these.

So from an air pollution perspective, um, policies and measures like low emission zones or transitions to cleaner industrial processes, you can sometimes visually see in the city that the amount of pollution coming out the back of a tailpipe or the plume of smoke coming out of the um, the brick kiln that you might live nearby has reduced.

And so both in terms of how we are seeing the climate change and how much warming happens up to 2040, up to 2050, but also in terms of how our communities feel like safer and cleaner and more enjoyable places to live, and those affected by asthma and COPD and other things able to, um, live healthier and, and longer lives.

[00:05:15] **Alisha Wainwright:** Something I, in my research for this episode, I found really interesting, and it might be so obvious to everyone else, but I just didn't put two and two together, is that air quality and air pollution and things that can affect climate change or accelerate global warming, they might not necessarily be the same thing, but that super pollutants do both of those things.

So air pollution can have negative impacts on our health. Global warming and climate change can have impacts on our health in a very long-term way, but super pollutants fit in this sort of Venn diagram in the middle of doing both of those things. So super, I feel like is fairly accurate because it is really negatively impacting people on both fronts.

[00:06:05] **Tom Grylls:** Yeah, and I think the Venn diagram is a great way to, to visualize this. So if you took all the different gasses and particles that are in the air where we are right now, where the listeners are right now, there's different levels of all sorts of different gasses and particles and they're interacting with each other in, in complex ways.

And if we just set them out into. It's Venn diagram where in one circle you have the pollutants that are, we know affect climate change, and on the other circle we have the pollutants that affect air pollution and therefore our health, our crops, our forests. You can see that it doesn't make sense always to kind of separate these into two separate boxes.

So you have often we talk about it like there's the greenhouse gases, which have these long-term global warming impacts, as you say. And then we have these particles and other toxic pollutants, which we understand that when we breathe them in, they will be detrimental to our health. But actually within the chemistry that's happening in the atmosphere, within the sources that are producing these pollutants, there's loads of overlap.

So one way to put it is that air pollution and climate change share the same sources. So coming out of the back of a tailpipe of a car, you have carbon dioxide, but you also have black carbon. But then they also share the same species, so in particular, pollutants like black carbon and tropospheric ozone, they're both harmful air pollutants for humans to breathe in, but also when they're in the atmosphere, they contribute to global warming and they have other complex interactions with the climate system. So this is one of the key key benefits of basically looking at that Venn diagram and overlaying a different filter.

And that filter being the definition I mentioned of super pollutants because it focuses in on. What's happening in the atmosphere in a way that doesn't silo climate change and air pollution, and there's loads of different benefits to that. There's benefits in the way we can communicate about it in the way that we can talk about local benefits as well as global benefits, which is often an important driver in different parts of the world to take these actions, to reduce these emissions. When we think about the economic benefits of taking action, often the calculations are done, uh, saying this is an air pollution measure so we know if we reduce this, okay, we see these health benefits, we might see, uh, a, uh, increase in productivity, some reduced healthcare costs, um, some longer lives lived, and that adds up to a big economic benefit. And then you might do a different calculation with climate change, where you're looking at what's happening in terms of temperature, what that means for extreme heat, for flooding and other things. But actually often these solutions can benefit both. And if you combine the economic benefits of both, suddenly, the case to take these actions becomes much more compelling. Um, and there's one really interesting statistic that came out of a Lancet study in 2019 that says the economic benefits associated with clean air would outweigh the costs of delivering on the Paris Agreement. So this is, there's a few numbers behind that, but basically the, the amount it would cost for us to deliver on the Paris Agreement of keeping the world to 1.5 degrees, the way in which that would actually help clean, like, clean up the air.

Would outweigh those costs over a fairly long period, but it shows that the economic case can really value from not siloing these two issues.

[00:09:51] **Alisha Wainwright:** Can you give us a bit of context about the intersection of air pollution and climate change when it comes to super pollutants?

[00:10:01] **Tom Grylls:** Sure. So methane, tropospheric, ozone, and black carbon all contribute to outdoor air pollution.

Black carbon and tropospheric ozone themselves, when we breathe them in, they have different effects. Black carbon, for example, not just has an effect on our lungs, but are these very small particles that can get into our bloodstream and are increasingly linked to cardiovascular heart problems and also cognitive problems.

On the whole, these are two important pollutants that make up the suite of air pollution. And air pollution as a whole is the number one environmental health risk. Globally, it contributes to 8 million premature deaths per year. Billions of dollars of economic costs through reduced productivity, healthcare costs, um, shorter lives.

And that number really doesn't tell the, the, the real human story of the impacts these are having, where in practice it goes way beyond that 8 million, uh, premature deaths to affecting people's day to day-to-day lives in so many different ways, particularly those who are particularly at risk, such as, older people and people with asthma.

So it's not just. That stat, but also the respiratory issues, the hospital visits, um, that create this burden that we're in almost everywhere in the world we're exposed to, uh, air that exceeds the world Health organizations guideline limits on air pollution. So pretty much wherever you are in the world, it's likely that one of these pollutants is above the safe level as deemed by the World Health Organization.

So this is a. Yeah, a pervasive health problem and as we've been touching upon, is something that we should and could be talking about more in the context of climate change and tackling these two problems together.

[00:12:09] **Alisha Wainwright:** Agreed. So coming up, we're going to talk about an intervention focused on tackling black carbon specifically in the brick kiln industry.

But can you tell us a bit about the climate impacts of black carbon? Uh.

[00:12:25] **Tom Grylls:** Black carbon for me is probably the pollutant that sits most at the heart of that Venn diagram. So it's a component of fine particulate matter pollution, which is the main form of pollution that is harming our health and that governments are tackling worldwide.

And then it's also basically soot. So it's the kind of dark city material you can, unlike most pollutants, you can, you can literally see it. There's been campaigns done where people have put sheets, uh, alongside busy roads, and over the course of a day you see the change of the color of the white sheet to a darker color.

Um, and this and that stuff is, is black carbon. And what that means is it's also on the climate side of the Venn diagram because in being a darker color, it has these light absorbing properties. So black carbon in the atmosphere, like if you're wearing a black t-shirt or a white T-shirt, it's changing your retention of heat.

So in the same way these, these black carbon parts cause are absorbing heat and warming the surrounding air. So contributing both to global warming and also locally to extreme heat. And then even more interesting through the same characteristic, they have this forcing on snow and ice, so black carbon emissions that are coming from lots of sources, which I'll get onto later, can be deposited onto glaciers onto the Arctic, uh, sea ice, they darken the color of the snow and ice, and therefore again, they in increase its capacity to warm up and therefore increase the rate of melting. So you have this quite distinct forcing on the climate which is actually different to how greenhouse gases are retaining heat in the atmosphere, um, but is also significant and something that generally has kind of fallen between the cracks of air pollution and climate policy.

One final story to explain just the power of how that that characteristic of this particle can, can have a, a forcing on, on the climate is, uh, their stories of an Arctic Explorer, um, maybe in the 19th century heading up into the Arctic sea ice and getting their ship stuck in the ice and they had uh, gunpowder on the ship and they were thinking, okay, I can use this gunpowder as an explosive, put it on the ice, crack the ice, free the ship, and return back to my home.

And they tried this and it wasn't working, and the days were passing and, um, they are beginning to run low on foods and they, the, the problem is becoming more and more urgent. So they have a brainwave and they think of a different thing to do with the gunpowder, the material they have on the ship, which is just to place it on the ice in a line, and again, because you are darkening the color of the snow, you are increasing the rate of which it melts. You leave it there for a day, the next morning you wake up and the ice has potted because of that effect that you can have by changing the color of snow and ice. So there's this really powerful forcing on glaciers and and sea ice that we can get at with black carbon, as well as all those health benefits that you can see from alongside a busy road.

[00:15:48] **Alisha Wainwright:** Glaciers just seem like such a fickle thing, and they seem so robust and vast, and at the same time, you could just line some gunpowder or black soot on it and, and, and crumble and separate it and, and it's also too, when I think about global warming and the glaciers. I'm thinking about it from such a big picture perspective that general warmth is what's melting the glaciers, but when you layer that factor in with black soot and particulate matter, that's creating a film on the glaciers that is also having an intense detrimental effect. So the combination is creating that acceleration. I think that's such a really crystal clear example of how these super pollutants work in sort of twofolds like to be able to make situations so much worse.

[00:16:46] **Tom Grylls:** Yeah, exactly. And I think it shows that this interesting relationship again between air pollution and climate, but also that black carbon is a great example of like, this is a global problem, but it's also so local to home.

So we often talk about global warming and points of degrees of Celsius, of warming it can be quite hard things to capture, but when you get into some of the details of how things like black carbon are affecting our health and our climate, you realize that there's also a, a regional and local element to to this.

So with black carbon, because it's so short-lived and it's not mixing itself evenly through the atmosphere, some in some ways the solution, like when we implement solutions, we see the benefits closest to where we've reduced those emissions, if that's the ships operating in the Arctic using heavy fuel oils, the proximity of those ships to the Arctic Sea ice just means that we get more of this black carbon deposition.

But the same applies for um, communities who are living close to busy uh, busy streets where there's lots of heavy duty vehicles and diesel vehicles or for households who are reliant on burning biomass or perhaps burning waste in the community. So the, these impacts have this locality, which often and doesn't apply to long-lived greenhouse gases, which I think is also a powerful message and potentially another incentive for governments to, to act. Um, and it comes to this disproportionate burden of these emissions as well. So with black carbon, the sources is basically when we have incomplete combustion or where we're using particularly heavy or dirty fuels, and when you map that out against the kind of sources you see that often this is disproportionately affecting low and middle income communities within a national scale, but then also disproportionately affecting lower and middle income countries who perhaps have less electrification.

So there's a a strong equity element and potential for poverty eradication in terms of some of the solutions that can help reduce black carbon emissions as well.

[00:19:09] **Alisha Wainwright:** Well, let's talk about one of these solutions and interventions. Tom has already mentioned brick kilns. As an example, source of black carbon brick kilns are big business across South Asia.

It's also the second largest coal consuming industry with about 150,000 kilns. Across the region. In 2012, the International Center for Integrated Mountain Development launched the Brick kiln project to tackle emissions. But it was when an earthquake struck Nepal in 2015 that they were presented with a unique opportunity amidst the tragic circumstances in collaboration with the kiln owners, they started working on a new design that would be earthquake resistant, whilst also improving efficiency and reducing pollution.

Senior atmospheric environmental specialists, Bidya Banmali Pradhan, who is based in Kathmandu and led the project, tells us what happened.

[00:20:15] **Bidya Banmali Pradhan:** Suddenly in 2015, this, um, you know, devastating earthquake happened in, uh, Nepal and Kathmandu Valley was most affected. And all the brickland around a hundred, 102 Brickland were in Katmandu Valley.

They were all demolished. So we started talking with the government and also, uh, with the bricklin entrepreneurs, like we need to rebuild these bricklin in a very energy efficient and cleaner technologies and the government said that either you have to take all these bricklin out of Katmandu Valley or you need to build in a earthquake resistant, uh, design.

So we were having discussion and the timeline was not much because April, uh, the earthquake happened and the brick season starts in, uh, November, December the firing starts. So we all came together and started working on the design. And during that phase we had a very robust kind of, uh, you know, meetings.

We didn't have, uh, just the engineers and architects to rebuild the cleans. We had the bricklin entrepreneurs, so with the practical knowledge and with the engineering, uh, design, we made a design book for natural draft as Zig Kilns. And, um, Force Draft. Force draft is we have a fan to suck the air, to blow the air, and in natural draft it's the natural wind that uh, you know, um, and that would fire the coal and ignites the bricklin to bake this bricks. No, but, uh, as there were some, uh, brick entrepreneurs while designing this, uh, you know, overall process, so they had the full confidence that, okay, this bricklin would work for us. That's why this was so popular and the adoption was so fast.

What uh, the Bricklin owner set was, you know, um, they really benefited. They were not worried about the pollution level because they're all business people. So they were saying that the quality of brick cleans, um, bricks was really good. Now they got more of the A grade brick around 90% and less brick breakage.

So they were really happy with the brick quality. And the other, uh, part is that the coal consumption was less. So they were very happy on that front. But for us, like for the environment, it was, uh, the black carbon was reducing around 60% and also the particulate matter was reducing around 40%. So that was, and you could visibly see from the smoke itself.

It was more of a white smoke coming out. And also in the volume, it was really, really less. Than the previous one. So the benefit was win-win to both of the entrepreneurs as well for the environment.

[00:23:17] **Alisha Wainwright:** Hmm. Wow. Bidya brought so many things to mind in her discussion about the Brick Kiln project. The first thing it made me think of actually is how incredibly impactful it is to notice when something is different for the better.

And I also love that they are able to find a solution in which we're making the environment safer and cleaner and the businesses are also happy because that is a long lasting solution. If both sides feel like it's a win-win.

[00:23:53] **Tom Grylls:** It's a amazing story from a really sad starting point of course. But so the resilience and the positive outcome in a small way post that earthquake that they were able to change, change that industry, and generally, I think coming at the problem from black carbon as a starting point helps to find some of these solutions that we already know how to reduce these emissions. So looking at like maximum technical, feasible reduction pathways, which is like the way of saying if we just used all available technology around the world and finance the solutions, we could reduce black carbon emissions globally by 80%.

So it, the technology already exists to, to rapidly reduce black carbon because of this association with inefficient burning and open burning. Um, but business as usual from that same study suggests that we'll reduce it by 3%. So the big question is how are we able to support and finance these solutions to stay sustainable?

That brick count project is. An amazing example, as you said, where the companies and the business model works and is being scaled up and is being looked at elsewhere.

[00:25:17] **Alisha Wainwright:** I was thinking about, you know, this brick kiln project. It came as a positive from this very terrible earthquake. Do you think that these innovations would've existed?

Like how do you go into an industry and enact radical change if there's not some sort of extenuating circumstance forcing it to happen?

[00:25:45] **Tom Grylls:** Yeah, I think there's, it really depends on, on the solution that we're talking about.

[00:25:50] **Alisha Wainwright:** Sure.

[00:25:50] **Tom Grylls:** I think lots of the sources of black carbon come down to household and community activities where there's a really important element of understanding the cultural, social, economic drivers for why people might be using that fuel or burning that waste.

Um, and that kind of project requires, uh, I think a different type of intervention and much more of a, um, a people's oriented approach to understanding like, systematically, what is the reason for this? Often burning practice to, to create a sustain, sustainable alternative. And to think about what that means at like the household level.

And that applies to things like lighting and cooking and heating of people's homes. Um, and then you have other solutions on black carbon like off-road machinery is one, so, uh, we often talk in climate mitigation about the transport sector and about electrification of the vehicle fleet and lots of progress is being made in, in lots of places around that.

So from the construction side, you often have businesses who are controlling large fleets of these, this machinery. So if you can convince those companies on the viability and the option to convert to cleaner, more efficient machines, which have a lower running cost, then suddenly you can achieve that, that at scale.

But then if you look at the agricultural side and tractors, often that's run, uh, by individuals and farm holds. So the approach to scaling up that change is very different. So I think. Uh, it

really comes down to thinking about the, the specific sub-sector and what the kind of political economy is of that emission source.

So there's very different ways to approach it, but as a general rule on black carbon, I think there's a huge responsibility to think about the the people and the decisions that people are making because it's not always that this is your first choice is to do this practice, right? There's often underlying systematic things that are leading to that, and that's why there is this sustainable development and poverty eradication piece to some of the things we can do on black carbon and why therefore, there's a good link to be making to other sorts of finance around development on these, on these solutions too.

[00:28:22] **Alisha Wainwright:** Okay, so let's get a bit more granular here. I asked Zorana Andersen, an environmental epidemiologist from the University of Copenhagen. To give me an overview of what we know about the specific health impacts of black carbon, a major component of particulate matter or PM 2.5.

What do we know about the mechanisms and where is new research needed?

[00:28:51] **Zorana Andersen:** Research in black carbon as a component of pm 2.5 has been more recent, but epidemiological evidence has really emerged, uh, quite substantially in the last 10 years or so. I would say we have seen number of very good, uh, studies.

There is even a meta-analysis on black carbon and mortality, which finds clearly that there are association between black carbon. There are about 12, 13 good studies, and when you summarize all of these, you see clear association with black carbon leading to premature mortality in line of evidence we have with PM 2.5, as well as cause specific cardio, respiratory, lung cancer, mortality, diabetes, and so on.

We see also more and more studies on outcomes such as COPD, asthma, lung cancer, ischemic heart disease, autism, and asthma in children. We see also more and more studies on specific mechanistic effect. How does black carbon reach the organs in our body and how does it then cause the relevant health effect?

So we have that basic understanding from PM that the major impact here, that small particles that enter our lungs. Through our lungs and alveo our bloodstream, and by that can reach all our organs. The inflammation is the key mechanism here, similar to smoking particles and inflammation in our lungs can trigger asthma and COPD.

This is same for PM and for black carbon as a specific component. But of course we would like to see a few more studies on the specific components, understand better, and to mention as a last thing in in response to this increasing evidence and, and call for more substantial review of evidence to lead regulation of black, uh, carbon.

WHO had a review in 2012, has now, uh, commissioned a new review that is currently ongoing and it's supposed to be coming out this year. This will be important new summary that will really point out to enormous, uh, health effects of black carbon and, and its independence for PM 2.5. So, uh, we should look out for this.

[00:30:55] **Alisha Wainwright:** So the way Zorana Andersen made it sound is that we have some information, but not enough to actually. Affect policy.

[00:31:04] **Tom Grylls:** So I think we do know enough for, for policy to act on this already. So one of the main international treaties on air pollution is the Gothenburg Protocol, which is for the UNECE region, so North America, Europe, and some, uh, of Central Asia.

And in 2012 it was updated again to include particular matter. And at that point it had a, a specific line to mention within our efforts on particulate matter, let's try prioritize major sources of black carbon. And that was acknowledging where the health evidence was there and also referencing these wider environmental impacts of black carbon through its climate, uh, forcing.

So that shows that we, we know enough through which to elevate this through international coordination on air pollution. Many countries are measuring black carbon levels. So there is, we're not starting from scratch

[00:32:06] **Alisha Wainwright:** Sure.

[00:32:06] **Tom Grylls:** From a policy perspective.

[00:32:07] **Alisha Wainwright:** Mm-hmm.

[00:32:08] **Tom Grylls:** Um, but what Zorana Andersen mentioned in terms of this World Health organiza, uh, organization, systematic review, this is such a useful piece of analysis from an international body um, who can provide clear science into policy recommendations. So we're expecting the out come of that review to be released in 2026. And as Zorana Andersen mentioned, I think that can really help answer this question where at the moment, basically there's some evidence that suggests black carbon could be a more toxic component than particular matter more broadly.

Um, but there's not enough that consensus has been brought. So these systematic reviews are really important towards scientific consensus on this, which can then inform the the policy decision.

[00:32:56] **Alisha Wainwright:** So with all these studies to inform regulation, I'm curious from your perspective when you, uh, in your experience with policymaking, how, how are you utilizing these, uh, research tools basically.

[00:33:13] **Tom Grylls:** I think one of the things we can do collectively on super pollutants is build the case for additional action, increased ambition, increased finance, and in order to do this, we need to assess the, the literature there is out there in terms of the health impacts of these super pollutants, in terms of the climate impacts of these super pollutants and aggregate that together to bring together.

This emergency break and climate and health story. As we are doing that, I think it's critical to identify what the evidence gaps still are. In particular on the health side, there is a need for more dense monitoring networks of ozone and of black carbon, which can, uh, inform. More and it's strengthened health evidence base.

And then on the climate side, because these are so short-lived, we need to also look at climate change at a regional as well as global scale. So some of the like indirect health

impacts of, for example, black carbon emissions are how it is changing uh, monsoon patterns and the glaciers and what that means for flooding and rainfall changes, et cetera.

And global climate models are designed to to look as best we can at how the global climate system is changing. But the resolution of those means sometimes we miss what's happening at the regional scale. And as we start thinking about these short-lived climate forces, it's important to also be, uh, supporting more regional modeling studies. And I think that evidence is again, important to add to the story that we're able to tell on climate change in different parts of the world. Um, so I think overall there are, there is a need for more data that we know, enough that there solutions we're pointing towards. Should be no regret actions.

Right.

[00:35:17] **Alisha Wainwright:** I like that term. No regret actions. Yeah. You're never gonna lose out on reducing these emissions. And I'm curious, is there, from a policy perspective, are there challenges navigating sort of these two sections of climate change and air pollution? Or do you feel like they should be more interlocked than they are currently?

[00:35:38] **Tom Grylls:** I think they should be more interlocked. I think there's some interesting structural, political reasons for why they often are dealt with so separately, especially like the international scale. I think there can be a hesitance to bring in the evidence behind the, the health impact that these emissions are happening alongside this story on global warming that's happening, two huge environmental crises, and if you successfully add them together, the case of action becomes stronger. But sometimes there are barriers to letting that happen in terms of how, for example, the cop negotiation is happening or how the, uh, regional frameworks on air pollution are dealing with these problems.

And to mention a few other kind of systematic challenges with taking integrated action on climate change and air pollution. We have the metrics used, so particulate matter is a great way to understand the impact of health of these particles, of these aerosols in the atmosphere. But that definition means nothing for climate change because basically it's looking at the size of these particles and the mass of these particles in a volume of air. This is a really good way for us to understand what's happening to our bodies,

[00:36:57] **Alisha Wainwright:** right

[00:36:58] **Tom Grylls:** but from a climate side. We need to know what is making up those particles.

Which aerosols? Is it black carbon, right? Is it organic carbon? Is it sulfates? So you have this metric, which has made a lot of progress on the air pollution side, but can be basically meaningless to climate stakeholders. And that's another thing that I think working on methane, working on black carbon, working on tropospheric ozone can do, it can be a tactic through which the climate community is thinking about and understanding what black carbon is doing to the climate, but also on health. So you are, it's kind of a Trojan horse into the climate space for action on air pollution. And likewise, thinking about methane from an air pollution perspective, is bringing this really important greenhouse gas into what the air pollution community is talking about and creating an additional lever to pull because in some parts of the world, air pollution is higher up the political agenda and countries might be more

willing to act and in some parts of the world, air pollution might be lower and climate change might be higher. And I think methane ozone, tropospheric ozone and black carbon are a great way for us to basically stitch these two huge issues together.

[00:38:13] **Alisha Wainwright:** Wow. That is a fantastic note to end on. I really appreciate your time in expanding my. Knowledge about super pollutants and also sort of how they intersect these two mega topics of climate change and air pollution. Thank you.

[00:38:31] **Tom Grylls:** Thank you so much.

[00:38:34] **Alisha Wainwright:** That is it for this episode. Thank you to our co-host, Tom Grylls, and to our contributors, Bidya Banmali Pradhan, and Zorana Andersen for sharing their expertise.

I was really struck that despite the scale of this challenge, Tom was hopeful about the opportunity we have to tackle it. It seems like lots of the science policy ideas and tools are already there. We just need to figure out how to deploy it at scale. If you enjoyed this episode, make sure to follow When Science Finds a Way wherever you get your podcast.

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See you next time.