Leah Stokes (00:00):

In 2002, officials in El Salvador reported an unusual, startling trend among rural farmworkers. Thousands were coming down with chronic kidney disease of unknown origin, and many were dying from it. Within a few years, Southern Mexico, Guatemala, Honduras, Nicaragua, and Costa Rica all reported similar outbreaks, then India and Sri Lanka.

Neza Xiuhtecutli (00:26):

We're seeing high blood pressure, kidney injuries, not just kidney injuries, but also kidney disease. And then of course some people end up with kidney failure, needing dialysis every three days.

Leah Stokes (00:39):

What was the cause? Was it pesticides, heavy metals, poor diet, or was it something else, something more mundane, something that used to seem totally ordinary, but in recent years has become much deadlier? Record-breaking heat. If you overlay a map of where chronic kidney disease is increasing with a map of the earth's hottest places, you'll find a tight correlation. Heat is deadly, and climate change is making it worse. So, who's responsible for these deaths? In today's episode, we're going to find out who is to blame. This is A Matter of Degrees, stories for the climate curious. I'm Dr. Leah Stokes.

Katharine Wilkinson (01:20):

And I'm Dr. Katharine Wilkinson.

Leah Stokes (01:22):

We've already warmed the planet by almost 1.2 degrees Celsius, and the effects are getting worse with each year.

Katharine Wilkinson (01:29):

It's true, and it feels like every year we break a new record. For example, in 2021, the US had its hottest summer since the Dust Bowl.

Leah Stokes (01:39):

And in today's episode, I want to take us on a kind of detective quest to understand what is happening to these farmworkers on the front lines of climate change. I want us to figure out who is responsible, who is to blame?

Katharine Wilkinson (01:51):

And I don't want to be flip because this is an incredibly serious topic, but it sounds like you're teeing up for us, Leah, a bit of a climate murder mystery. Is that right?

Leah Stokes (02:01):

Yeah, a sort of whodunnit.

Katharine Wilkinson (02:02):

Yes, and so I do have to wonder if I am Dr. Watson in this scenario.

Leah Stokes (02:10):

I think so. Dr. Watson, Dr. Wilkinson. It seems pretty clear who you are here. So, I guess that makes me Sherlock Holmes.

Katharine Wilkinson (02:18):

Yeah, I know you would make yourself Sherlock Holmes. All right, Sherlock Stokes, tell me about what is happening.

Leah Stokes (02:28):

Well, out of all the extreme weather events that we've been seeing in recent decades, heat is the most deadly, and our agricultural workforce is on the front lines of its impacts.

Katharine Wilkinson (02:38):

Yeah, there is absolutely no escaping heat when what you're doing is working outside on the land in agricultural fields. It's a really tough environment.

Leah Stokes (02:48):

It is. And to learn more, I decided to call up Neza Xiuhtecutli, the director of the Farmworker Association of Florida. He's been studying how heat impacts farmworkers since 2016, but his connection to this work goes much farther back.

Neza Xiuhtecutli (03:04):

I'm an immigrant and my dad did some construction work when we were new to this country, and he had an accident. After his accident, he wasn't able to return back to doing construction work, so he went through vocational rehabilitation, and out of that program, he sort of reoriented his way of making a living and he started selling stuff,

just like trinkets. He'd go to a flea market, and then somebody suggested to him that he go out to the H-2A, which is the guest worker program, farmworker housing, and sell to farmworkers some of the stuff that they consumed on their days off, which was just basically Mexican food, queso fresco, chorizo, Jarritos, all that stuff that we already consumed at home, so it wasn't like something new.

(03:52):

And he lost a lot of strength and a lot of his mobility to his accident, so he needed a part-time hand to help him on the weekends, and so I became that part-time hand. And most weekends I would go out with him to the fields, and that was my first exposure to the agriculture system in the United States, this highly mechanized, very intensive labor agricultural system. And so, at that point, I guess those seeds of awareness and justice started being planted.

Leah Stokes (04:25):

That highly mechanized, labor intensive system comes with a lot of costs, particularly for farmworkers.

Katharine Wilkinson (04:32):

Atlanta is a good bit north of Florida, but still, it gets so hot in this region, particularly in the summer. And I saw an estimate the other day that South Florida is expected to have 60 or more days next year that are a hundred degrees or hotter, and that comes with humidity. So, by mid-century it said that'll increase to around 105 days.

Leah Stokes (04:56):

Any kind of exertion in that kind of heat can be really dangerous, but these workers are doing heavy strenuous labor outdoors for many hours a day, for decades. And that exposure to heat stress, it adds up. Neza has studied how this affects farmworkers' bodies.

Neza Xiuhtecutli (05:15):

We recruited farmworkers to wear some equipment and go out to work, and we would take some biosamples, some urine and blood, and through that we would be able to get a sense of how the heat was affecting their bodies.

Leah Stokes (05:29):

What are some of the big findings of that study? What are you finding is the effect of heat on people's bodies?

Neza Xiuhtecutli (05:37):

Well, extreme dehydration, kidney injury. They work all day and then the following day, they don't really seem to have enough time for their body to recover from the previous day because what we are seeing is that about half of them are dehydrated before they even go to work. So, by the time they get back from work, about three quarters of them are dehydrated. So it's like their bodies are just constantly taking on this stress to just be exposed to heat and not having a good chance to recover and rehydrate. We talk to them often about the symptoms that they can be aware of, which are nausea, slurring their words, cramps, and those are the immediate symptoms to be aware of, but if they get dizzy, if they start slurring their words and they can actually have a heat stroke and lose consciousness, and even die. And those are the most immediate effects, but being exposed to heat over time, that can have really adverse consequences on their bodies.

Leah Stokes (06:36):

And as Neza told me, many of these workers are paid under the so-called piece rate system. That means they're paid by the bucket or the box, not by the hour, which creates problematic incentives for workers.

Neza Xiuhtecutli (06:49):

Some of them are working 12 hours a day and they don't even want to take a break because they're working in a piece rate system. So, the piece rate system is really competitive because for every moment that they stop to pick, that means that that's money they're not earning, but it's not just that they stop earning money, it also means to them that the person who is next to them is going to be picking what they would be picking. So, it becomes really a competition, even within a crew. Even if the crew works together, they're really competing against each other.

Katharine Wilkinson (07:22):

God, it's a really hard bind that these workers are in to keep picking, keep picking, keep picking even when the heat is doing kind of toxic things to their bodies.

Leah Stokes (07:33):

Yeah. And as Neza told me, working conditions are brutal. Farmworkers can be waking up at 4:30 AM just to get ready for work, and by the time they arrive at the fields and start picking, it's already 80 degrees with high humidity.

Katharine Wilkinson (07:47):

And with this piece rate system, I imagine that even if it's suffocatingly hot, you just want to keep picking as much fruit as possible as fast as possible, so you're working at a pace that is upping the heat in your body at the same time.

Leah Stokes (08:03):

A lot of workers don't even want to stop to just get a drink of water. Maybe the water station is a five-minute walk from where you're working, and then you've got to get there and back, so you've lost 10 precious minutes, and at this point it's 90 degrees out and the sun is blazing and you start to feel dizzy and headachy, but that happens on most days, so you just keep going. And you don't realize it, but your internal body temperature has been at a hundred degrees for a few hours now.

Katharine Wilkinson (08:31):

So you've basically been running a fever for a good portion of the day every day.

Leah Stokes (08:36):

Yeah, and then you go home late and you don't have a lot of time to rehydrate all that sweat you've lost and you don't sleep well because of all the nausea from the heat exhaustion.

Katharine Wilkinson (08:46):

And then you have to go out and do it all again the next day. I mean, it sounds beyond exhausting. It sounds frankly brutal.

Leah Stokes (08:53):

Yeah, it is, and it adds up over the years. Over time, many farmworkers working under high heat develop high blood pressure and chronic kidney disease. Both are deadly conditions.

Katharine Wilkinson (09:04):

Yeah, I can imagine that the body simply can't take it anymore, can't cope.

Leah Stokes (09:09):

When Neza started to study these impacts on farmworkers' bodies, the results were really heavy. Almost all the participants in Neza's research reported symptoms of heat illness on a typical workday, nearly a third showed signs of acute kidney injury. Neza told me about how he saw the impacts of extreme heat on workers' health.

Neza Xiuhtecutli (09:33):

There was a man who we found out about, he had been a farmworker and he ended up with kidney disease and he was suffering from dialysis. He had been a farmworker in Mexico, and he worked in the fern fields in Florida for 20 years before we found out about him in the study, and we spent about two years taking him to get dialysis three times a week. Because of his health condition, he had a hard time retaining a job. Because he couldn't retain a job, he couldn't hold down an apartment and he ended up becoming homeless. He stayed at one of our offices for a while, and then one day he just kind of left and we tried tracking him down, but he just disappeared. He had been talking about going back home, but it was heartbreaking because this man had given his body for us, for agriculture, and then he just... we couldn't do really do anything for him. And because he didn't have an address or anybody else who knew him anymore, we just didn't know where he went.

Katharine Wilkinson (10:43):

This story is really wrenching, Leah. People should not be homeless or unable to access healthcare or dying because of their work. This just shouldn't be acceptable.

Leah Stokes (10:58):

Farmworkers should not have to sacrifice their bodies just to put food on our tables, but even if we got rid of the piece rate system, even if employers did more to support workers, even if we radically restructured our agricultural system, there'd still be a problem because the planet is still getting hotter.

Katharine Wilkinson (11:18):

Unfortunately, it is.

Leah Stokes (11:20):

Which brings us to our next step in this mystery, who is responsible for burning the planet? To understand why the planet is getting hotter and killing people in heat waves, I called up a friend of ours, Dr. Kate Marvel.

Katharine Wilkinson (11:36):

Dr. Kate Marvel. Well, if I am Dr. Watson and you're Sherlock, what does that make, Kate? I don't know.

Leah Stokes (11:44):

Helpful. I think it makes her helpful for this murder mystery case.

Katharine Wilkinson (11:48):

Yeah, she's certainly brilliant. So, what did Kate have to say about all this, Leah?

Leah Stokes (11:53):

Well, Kate is a climate scientist, as you know, and she runs these scenarios in computer models to estimate how much the earth's temperature will rise in the future. I asked Kate to explain to me what she had learned from her research about why the planet is getting hotter.

Kate Marvel (12:09):

It's not unusual to have a hot day. It's not unusual to have a hot year, but it is really unusual to have a couple hot decades, and it is extremely unusual to have a sustained increase in the global mean temperature, like we've been experiencing since the industrial revolution. Most of the universe is really boring. There's only one good planet that we know about in all of space, and we live on it. And so I started getting really interested in how I could use my physics background to study the only planet where all my friends live, and so I became an earth scientist.

(12:54):

So, climate models are basically toy planets that live on computers that you get to do incredibly messed up things to. You can do experiments in a climate model that you could never do in the real world. You can set off a volcano in London if you want to. You can get rid of the Rocky Mountains. And that's really fun because that allows you to learn about how interconnected everything is and why the climate is the way it is. So that's a really fun aspect of my job. Climate models produce a giant amount of data, and a lot of my job is sifting through that data, not just from climate models, but from satellite observations, from land-based observations, from paleo climate data sets, and really trying to make sense of what's happening.

Leah Stokes (13:46):

And for a long time, scientists used both models and observations to know with certainty that burning fossil fuels was increasing carbon in the atmosphere, and that was causing the planet to warm up.

Katharine Wilkinson (14:00):

Right. These are the big trends that have been very clear for decades.

Leah Stokes (14:05):

But for a long time, scientists like Kate had trouble linking a specific event to climate change. This heat wave, was it caused by climate change? That's a new area in climatology, and it's called extreme event attribution science.

Katharine Wilkinson (14:23):

It may not be the catchiest name, but these studies that link a specific extreme event, like a heat wave or a hurricane, to climate change, this is major breakthrough stuff.

Leah Stokes (14:34):

And what these scientists are doing is asking, would this event have happened if we had not already warmed the planet by almost 1.2 degrees Celsius? Would we have seen this heat wave without climate change? It's a huge advancement in climate science. Here's how Kate described this area of research.

Kate Marvel (14:56):

For a very long time, a lot of the scientific community's research was in attributing long-term, large scale changes. So, we said temperature, check. We know that's being caused by human activities, shifts in large-scale rainfall patterns, check. That's being caused by human activities. Changes in cloud cover, changes in the salinity of the ocean, ice melt, sea level rise, all of those things we have really robustly attributed to human activities. But when it comes to individual events, that's more difficult because individual events are a lot more noisy. There's a lot more variability at small scales than large scales. It's not unusual to have a heat wave in some part of the planet at some given time. So, for a long time, the focus was really on those long-term changes because we could say very, very definitively this could not be anything other than human activities causing this.

(15:57):

With the advent of new statistical frameworks, new and better models, we have been able to look at those individual events and say, "Here is how much more likely climate change made this particular event." The first published event attribution study was attributing the heat wave in Europe in 2003 to anthropogenic climate change, to humans. That was an incredibly deadly heat wave, especially because in France, it happened during August when a lot of people were out on vacation and a lot of elderly people were left alone. Nobody was checking on them, they didn't know what to do for help, and the death toll was in the tens of thousands. It was absolutely staggering.

Leah Stokes (16:45):

That heat wave that Kate was talking about, the first heat wave that was directly linked to climate change, Europe hadn't reached temperatures that hot since the year 1500, and in 2003, those temperatures created particularly lethal conditions.

Katharine Wilkinson (17:02):

It's really amazing that scientists can now figure out for almost any weather event if it can be attributed to climate change. So, heat waves, but also flooding, heavy rainfall, you name it.

Leah Stokes (17:14):

These studies can get really detailed. Scientists can now say things like, "Climate change made this heat wave 54% more likely." I asked Kate to explain how this is done in practice using the example of the brutal heat wave that hit the Pacific Northwest in 2021. So, let's take for example, the heat dome, that really extreme heat wave that hit the West Coast and cooked like a billion sea creatures or something and buckled cables and led to all these problems, really unprecedented temperatures in a part of the planet and a part of the United States. How do scientists figure out that that specific event was likely caused by human climate change?

Kate Marvel (18:02):

So, we can use climate models for that. Now, obviously, we don't have a control planet. We can't ask everybody to go move to Mars for 200 years while we do some experiments on this planet. So, in order to explore that “What if?” – that kind of counterfactual scenario – we can use climate models. So, you can run climate models a bunch of different times without human activities. So, with greenhouse gases, with aerosol levels, with land use changes fixed at their pre-industrial levels, and you can see “Okay, what happens to the climate?” And what you can see is some years are hot, some years are cold, most years are kind of in between. Sometimes you get a heat wave, sometimes you don't.

(18:44):

And so that gives you an understanding, our best understanding really, of the full spectrum of what the climate would do without us. Then you can take those same models and you can say, "What would the climate do if greenhouse gases were at the levels that they are now?" And you can compare those two results and you can say, "Oh, hey, look, in the climate model where I've allowed greenhouse gases to

increase as they are today, those heat waves that I see in this region, it's far more likely to get those heat waves." And in fact, in the case of the Pacific Northwest heat wave, that is an attribution that's so robust that we think that heat wave would've been practically impossible without climate change. You never see something that bad in one of the control simulations.

Leah Stokes (19:34):

Yeah, because such an extreme event, if we can remember our statistics 101, weather has a distribution, like you're saying, sometimes it's hot, sometimes it's cold, often it's just average. And the most likely thing is an average year. But sometimes you get a really hot year and sometimes you get a really cold year. But these events aren't even falling within that range of what the historical climate would look like. They're coming completely, what we would say, several standard deviations, meaning really, really far away from the range that we would see historically. Is that a big part of how it's done?

Kate Marvel (20:11):

Yeah. So that's an example of detection. This is weird. This is really far outside the range that we would expect with just natural climate variability. We know that, for example, in California, it gets drier every time there's a La Niña event in the Pacific. We know that it gets wetter every time there's an El Niño event. But if you look, for example, at the current drying, the long-term aridification, I don't even want to say drought, in California, that is so far outside of what a La Niña could produce, and same with the Pacific Northwest heat wave. That's so far outside the range of anything we know that could naturally produce that event.

(20:55):

So, we feel very confident in saying we have detected something. This is weird. This is unusual. Now that's the detection part. The attribution part is can we explain it? Can we explain it by putting greenhouse gases in our model? Can we explain it by using what we know physics tells us greenhouse gases do? And in this case, yes, we can explain it. Climate change makes heat waves more likely, and in this case, climate change definitely made the Pacific Northwest heat wave far more likely.

Katharine Wilkinson (21:31):

That heat wave back in 2021 was so extreme. I remember reading about it at the time, and frankly just being stunned. Not only did more than a billion sea creatures die in the extreme heat, but about 1,400 people died, too.

Leah Stokes (21:46):

Those stats are unbelievable, yet true. Extreme heat, the kind that we are seeing with climate change, it's deadly for all kinds of vulnerable people, farmworkers like we've been talking about, but also the elderly and unhoused people.

Katharine Wilkinson (22:03):

Given how much we have already warmed the planet, I imagine that scientists are beginning to say that pretty much all extreme heat waves can be traced back to climate change at this point.

Leah Stokes (22:12):

That's right, Katharine. As Kate told me, at this point, we can see the effects of climate change all the time.

Kate Marvel (22:20):

I think a lot about climate's effect on extreme weather in the same way that I think about doping in sports. So, take Lance Armstrong or your favorite doping cyclist, if we find out somebody was doping, we don't go back and say, "Well, in that race he would've come in 17th, and in that race he would've been 32nd and in that race he would've been second and that race he would've won." We don't do that. We say, "Hey, you were doping. We know what doping does, and so we feel justified in taking action. We're going to take away your medals." And that's the way that I think about climate's impact on extreme weather. We know that we are doping the weather, we know that records are falling, and we know what that doping does. Now, there are some things, like the Pacific Northwest heat wave, that's like me entering the Tour de France and winning. If that happens, that is real suspicious, real weird, that just doesn't happen.

Leah Stokes (23:20):

You are definitely cheating is what you're trying to say.

Kate Marvel (23:23):

Definitely. If I win the Tour de France, throw me in jail immediately. There's something real, real sketchy going on. But when you think about climate attribution, for me, it doesn't necessarily matter that climate change made a particular event 17% more likely or a particular event, 32% more likely.

Katharine Wilkinson (23:44):

What matters is that human activity, specifically burning fossil fuels, is making the planet warmer, a lot warmer.

Leah Stokes (23:52):

And that's killing people, particularly in heat waves. I imagine that a lot of our listeners have read this book by Kim Stanley Robinson called *The Ministry for the Future*.

Katharine Wilkinson (24:02):

I'm kind of covering my eyes here, Leah, because to be honest, it's still on my to read list.

Leah Stokes (24:08):

Well, that's okay because I can tell you and our other listeners a little bit about it for those who haven't read it. The novel starts out with an imaginary heat wave that hits India in 2025. It's such an extreme event because of the combination of both high heat and high humidity. That's called the wet bulb temperature, and it gets so hot that in his imaginary story, this heat wave kills 20 million people. It's a shocking piece of fiction, but it's also a scary potential future. I asked Kate to explain to us, what does this term wet bulb temperature actually mean?

Kate Marvel (24:48):

The wet bulb temperature is literally what it sounds like. It's if you take a thermometer and you wrap a wet handkerchief around the bulb and you take the temperature, that is the wet bulb temperature, and that is a measure of joint atmospheric heat and humidity. We all know that it's much more unpleasant to be in humid heat than to be in the same temperature of dry heat. And the thing about the wet bulb temperature is it's increasing because not only is the temperature increasing with greenhouse gases in the atmosphere, but the atmospheric humidity, the atmosphere's ability to hold water vapor is increasing as well.

(25:26):

So, it's getting hotter, it's getting more humid, and the reason that is so dangerous is that there is a threshold. There is a wet bulb temperature threshold beyond which you cannot cool yourself off in the normal way. The way that the human body naturally cools itself off is by sweating. If the wet bulb temperature increases to a particular critical threshold, you are not going to be able to cool yourself off by sweating. And what that means is that even a young, healthy person who's lying

down in the shade is going to die if they are outside for too long. So that is why it is so incredibly dangerous.

Leah Stokes (26:08):

Kate told me that in climate models, we are seeing increases in the number of days with extreme wet bulb temperatures.

Katharine Wilkinson (26:16):

And that's the kind of heat that farmworkers are on the front lines of, and it is particularly deadly.

Leah Stokes (26:22):

The science is clear, abundantly clear. Burning fossil fuels is putting carbon in the atmosphere, and this is leading to warming. It's leading to extreme heat waves, which is killing people, particularly vulnerable people.

Kate Marvel (26:37):

So, in the United States, there's actually evidence that you can see the effects of redlining in the effects of heat waves. There was a study that came out in 2020 that was looking at heat waves aggregated in the United States, and in areas that were subject to redlining, historically Black neighborhoods, temperatures can be up to seven degrees Celsius hotter during a heat wave. So, I think there probably should be an untranslatable German word for that feeling you get when you're really excited because science is cool, but you're also really horrified by its implications. So, whatever that German word is, I feel it all the time.

Katharine Wilkinson (27:17):

Yeah, whatever German word that is, I think I feel it too. I definitely remember feeling it when I was reading about the temperature differences in New York City, just between neighborhoods on the side of Central Park and neighborhoods in Harlem, and it was a shocking difference.

Leah Stokes (27:34):

Yeah. This research is amazing. Scientists have made such big breakthroughs, and they can show us things like the racial impact of extreme heat. Kate has helped us answer a question in this mystery pretty clearly. What is causing all of this deadly heat? It's burning fossil fuels. That is what is warming the planet, and now we know

that all that carbon pollution can be linked to specific heat waves that are killing people.

Katharine Wilkinson (28:05):

So, I think this brings us to the next question in this detective quest, who is responsible for these deaths? Who has blood on their hands, who should be held accountable?

Leah Stokes (28:17):

Well, to get to the bottom of that question, I called up Richard Heede. He spent the last 20 years gathering evidence to pin down the culprits. Katharine, you know that statistic that you hear sometimes, that just 90 companies have contributed nearly two-thirds of all greenhouse gas pollution since 1750?

Katharine Wilkinson (28:37):

I mean, I think it's one of climate nerds' favorite stats around, Leah Stokes.

Leah Stokes (28:43):

Yeah, I see the statistic quoted all the time, and we only know this fact, this stubborn fact, because of Richard's tireless detective work over decades.

Katharine Wilkinson (28:53):

This is amazing to hear about the man behind the stat.

Leah Stokes (28:57):

And he started by asking what seemed like an impossible question at the time: could he figure out how much carbon pollution a single company had emitted over its lifetime?

Richard Heede (29:09):

I was meeting with a friend and a colleague who had started an initiative called the Climate Justice Program in London. He was looking for someone to do the first quantification of a single company over its history. We wanted to know which companies had extracted how much fossil fuels in millions of barrels and cubic feet of natural gas and tons of coal over its entire corporate history, so that we could quantify its percentage contribution to atmospheric change and total human caused greenhouse gas emissions. We looked at one company from its beginning in the 1882 as Standard Oil under Rockefeller in the 1880s, and tracked their corporate history from annual reports as far back as history as they published them, to what

became ExxonMobil 120 years later. So, we quantified their extraction of fossil fuels, and we did that historically from 1882 to 2002 and came up with a figure that they were roughly responsible for 4% of all fossil fuel emissions since 1750.

Katharine Wilkinson (30:19):

Wow. So, one company alone is responsible for 4% of all the human caused carbon pollution in modern history. This is a stunning insight.

Leah Stokes (30:30):

It is. It's like Richard devoted himself to solving what might be the greatest, most complex organized crime in human history.

Katharine Wilkinson (30:38):

Truly.

Leah Stokes (30:39):

I asked Richard to tell me how exactly he figured out which companies are responsible. And so, can you tell us how you actually calculated these numbers? I understand you had to go to different archives in different parts of the world. Can you sort of tell some of that story?

Richard Heede (30:57):

Yeah, that's right, Leah. There's no central depository of all the annual reports that I would want to peruse. So, I contacted colleagues and graduate students around the world. I traveled to several libraries in the United States myself to go through dusty, uncatalogued, disorganized collections of annual reports going back to as early as I could, often back to the 1930s for the big oil, gas, and coal companies. But I often didn't have annual reports, for example, for African companies, many European companies, many Asian companies. So, I asked colleagues around the world to go to their business library and see what they could photocopy for me and send to me either by paper or by digital access so that I could then convert their self-reported company annual reports. And they have to tell shareholders by law ever since the US Securities and Exchange Commission required that companies, publicly owned companies, report to their shareholders what they produced during the year.

(31:57):

For an oil and gas and coal company, that's pretty obvious. And I would just enter that into Excel worksheets so I could track each company's production by fuel type, by rake of coal, for example, so that we could figure out how much carbon is in each

quantity reported, deducting for non-energy uses, and then quantify annually how much they contributed to atmospheric CO2 through the products they refined, distributed, and consumed as intended by all the world's fossil fuel users of gasoline and diesel and coal-fired electricity, et cetera. So, it's a comprehensive database, millions of data points I would imagine by now, 220 worksheets all linked together to produce the end result of how much each company has contributed over its history, which we can then parse down if somebody's interested in particular subsets of companies, European companies, for example, over a narrow period of time, 1988, for example, to the present. We can do that. And all this information is published on our website at climateaccountability.org.

Katharine Wilkinson (33:02):

Okay, I love this. Richard assembles an international squad of sleuth-y academics and scientists from all over the world. They send him dozens of annual reports from oil, gas, and cement companies, and he gathers all of this evidence up to nail them.

Leah Stokes (33:18):

As we often discover on this show, the spreadsheet is mightier than the sword. Ba-dum ching! So, thanks to Richard's work, we now have a stubborn fact: there's really only a few companies, just 90, who are responsible for the lion's share of this climate crisis.

Katharine Wilkinson (33:36):

I mean, I don't really think we need to bring lions into it, Leah, but we should name names. So, with this information, I think we can hold these big polluters accountable.

Leah Stokes (33:48):

Yeah, and that's exactly what Richard started doing with his work next. Over the past few years, researchers have started to use his data sets to calculate exactly what portion of a particular extreme event, like a heat wave, that each big polluter is responsible for.

Katharine Wilkinson (34:06):

So, if there is a specific extreme event, scientists can combine the attribution science that Kate talked about with the work that Richard's done and say for example, ExxonMobil is responsible for 4% of the damages from that mega deadly heat wave.

Leah Stokes (34:24):

Right. And these companies, they're not just responsible because of the products they sold, they're also responsible because they lied. They knew the truth about climate change, but they intentionally hid it from the public.

Richard Heede (34:41):

The fossil fuel industry was itself beginning to be informed on the issue of climate change from the 1950s onwards. And even some oil companies like Exxon and Mobil had scientists working on the issue in the 1970s on the impact of fossil fuels on the economy and on the impact of fossil fuel production and sale on the future of their company. There was a huge issue, transferred up to management, that their products would be a problem for future development and sale of fossil fuels. And their whole strategy was to invest in climate disinformation and denial in order to delay congressional action on climate change, and to confuse the public along the way so the public didn't realize the importance of electing knowledgeable members of Congress that could deal with the issue that we're now confronting. And we know that the American public is increasingly concerned about the impacts of increased storms and flooding and hurricanes and wildfires and everything else we can attribute primarily to human inputs on climate.

Leah Stokes (35:50):

Richard's work is the final piece in the puzzle of who is responsible for these heat waves.

Katharine Wilkinson (35:56):

His research helps us solve the mystery of who should be held accountable for deaths in heat waves and other extreme climate events.

Leah Stokes (36:04):

Yeah. And you know, Katharine, that's starting to happen. Take for example, the court case against the German energy company RWE. In 2016, a Peruvian farmer and hiking guide named Saul sued that company. He alleged that RWE should pay for new infrastructure that would protect his home from flooding, his home in Peru.

Katharine Wilkinson (36:27):

Okay, wait, so a guy in Peru sues a company in Germany for flooding in a place that the company's never operated.

Leah Stokes (36:34):

Strange, I know, but it makes sense, because climate change is causing the glaciers above Saul's land to melt rapidly, and because RWE is 0.47 percentage points responsible for climate change, Saul claims they should also be responsible for 0.47 percentage points of the cost of adapting to it.

Katharine Wilkinson (36:55):

And we know that 0.47 percentage points because of Richard's number crunching.

Leah Stokes (37:00):

Exactly, and without that data point, this case would not have made it nearly as far. There are cases like this now in courts all over the world, and you can actually track every single climate related lawsuit online with a tool called the Climate Change Litigation Database. It's from Columbia's Law School.

Katharine Wilkinson (37:19):

Fascinating. So, are any of the folks on the front lines of climate change winning with these corporate accountability lawsuits?

Leah Stokes (37:28):

Well, at least in the United States, the city and county of Honolulu has maybe the best success story so far. They're seeking damages from a long list of oil companies on the grounds that these companies polluted, knew the consequences and purposely misled the public.

Katharine Wilkinson (37:44):

So essentially the same argument that's been used against big tobacco from its operations in the nineties.

Leah Stokes (37:50):

Yeah, and that argument won in the courts. So far, the judge in this case in Honolulu has denied the oil companies multiple arguments to dismiss the suit. When it comes to climate, local and state courts are aware we've got to fight. And once we win, Richard's data will help determine who has got to pay up.

Katharine Wilkinson (38:11):

I guess the big downside, Leah, is that suing takes a long time and climate change isn't going to take a break while we take oil and gas companies to court.

Leah Stokes (38:21):

Extreme heat is unfortunately a reality right now. So apart from stopping polluting, the other thing these big polluters should be doing is helping people on the front lines of heat waves to adapt. When Kate and I were talking about the problem of heat, she raised the point that adaptation can make a big difference. It can help reduce impacts.

Kate Marvel (38:43):

We need extremely strong mitigation actions in order to limit global temperatures as much as possible, but we also need to adapt to the climate that already exists, and those adaptation strategies include things like justice considerations, they include things like trying to rectify historical wrongs. And I think that is really important for policymakers to consider moving forward.

Katharine Wilkinson (39:12):

What Kate's talking about here, rectifying historical wrongs, this is really important. These big polluters should pay for adaptation that is now necessary because of the way they operated.

Leah Stokes (39:24):

That's right. And adaptation can be extremely expensive. These polluters should be held accountable. They should be responsible for footing part of the bill.

Katharine Wilkinson (39:33):

And some of that could happen through these court cases we've been talking about, and some could also happen through government policy. But the heat, Leah, is here and now. So what can folks on the front lines of heat do to protect themselves and to keep themselves safe?

Leah Stokes (39:48):

Well, that's something I asked Neza about in terms of his work with farmworkers. I wanted to understand what things he thought were necessary to help adapt to the heat, and he talked about the need for fundamental policy changes in agriculture.

Neza Xiuhtecutli (40:03):

Yeah, I would say that the very first one that needs to go is the piece rate system. Let's just pay workers on an hourly wage, and that way nobody's exerting themselves more than they should because they want a few extra cents per box, per crate, per

bunch, or whatever the measuring unit happens to be. Also, I would say that the other thing that we need to do is have scheduled breaks, like once an hour or once every two hours. Just give them 10 minutes to drink some water and just make everybody stop, because even when we've tried to get workers working in the piece rate system to stop, to take a break, nobody wants to because somebody else is working, and that has been one of the biggest hurdles in getting those water breaks implemented. So, everybody should get a water break and make it just across the board, everybody. Everybody in the crew should stop working and take a drink of water.

Katharine Wilkinson (41:01):

These sound like really simple and really powerful changes that we need to make.

Leah Stokes (41:06):

That's right. California and Oregon already have protective measures in place that other states could follow. Basically, when the temperature reaches a certain point, it triggers mandatory water breaks in the shade for workers. Florida tried to do something similar. Neza told me about a bill called the Heat Illness Prevention Act, but unfortunately it died in the state senate in March.

Neza Xiuhtecutli (41:28):

This bill had bipartisan support and it ended up passing through that one committee and they never even got put in the agenda of the other committees, but it's the farthest along any of these bills have come. And so, I think it means something. It means we're making progress. It means that people are starting to pay attention and realizing that we need to actually protect workers. And that bill wouldn't have just protected farmworkers, it protected all outdoor workers. It also included construction workers, roofers. It had no penalties, no enforcing mechanism. It was really more about education. If that's what we need to do, then... but let's do it. Let's actually make some change.

Katharine Wilkinson (42:05):

Okay, so these are some nascent solutions to protect farmworkers in the US. What about other people and people who aren't working in agriculture?

Leah Stokes (42:15):

Well, remember that 2003 heat wave in France that we talked about, the one that killed thousands and was the first climate event attribution study?

Katharine Wilkinson (42:24):

Yep.

Leah Stokes (42:25):

Well, an even hotter heat wave struck Europe in 2019, but this time people didn't really die at the same rate, and that was because of sweeping education and policy changes. The death toll was way lower than in 2003. The French government took heat advisory seriously and they warned people in every way possible: TV, internet ads, pamphlets. It literally saved thousands of lives.

Katharine Wilkinson (42:50):

Heat education is key for outdoor workers especially, but also joggers, commuters, people who don't have air conditioning, first responders who are taking heat stroke calls. When it gets that hot, everybody needs to know how to stay safe. And like Kate mentioned, heat hits marginalized communities, including communities of color, the hardest.

Leah Stokes (43:11):

Yeah. Immigrant farmworkers make up the vast majority of our country's agricultural labor, and nearly 50% of all farmworkers in the US are undocumented, meaning they don't qualify for work authorization. Even workers who come here on temporary H-2A Visas don't receive the same workplace protections that regular employees do. That's why employers keep up these low wage and dangerous practices like the piece rate system.

Katharine Wilkinson (43:39):

And it's a lot harder to speak up on wages or working conditions when you've got fear of losing your income or even having to leave the country looming in the background.

Leah Stokes (43:49):

Which is why Neza and the Farmworker Association of Florida educate farmworkers about more than how to adapt to heat in the field. They also teach folks about their rights and help them organize to make demands and brainstorm solutions.

Neza Xiuhtecutli (44:04):

Another solution that we talk about, and it is kind of like the pie in the sky, but it would be to change our agricultural system from this really extractive industry to more of a

community-based agricultural system where communities grow what they need. And I'm not talking about putting farmers out of business, I'm talking about just small farms, especially family farms. We're putting the family farms out of business, and we have been doing this for a long time, but just investing more in allowing those small growers, small family farms, especially people of color who have lost their land historically over the last 200 years, give them also that opportunity to grow food that would be culturally appropriate to what they're used to and have communities just feed themselves.

(44:51):

We live in a very complex society, economically complex, so not everybody is going to be a farmer, and not everybody needs to be a farmer. We just need to rethink about how we grow food so we're not thinking about shipping food overseas where we think it'll fetch a better price than just sending it into the next town over where there are people who are low income and don't actually have access to high quality, nutritious food. All they have access to is highly processed, high fructose corn syrup food, and that's really the basis of their diet. I mean, it definitely ties into health equity and access to resources to make sure that families and communities live healthy.

Katharine Wilkinson (45:37):

So you've taken us through quite the mystery in this episode, Detective Stokes.

Leah Stokes (45:42):

Why thank you, Dr. Wilkinson, aka Dr. Watson. We sure make quite the pair of climate sleuths.

Katharine Wilkinson (45:49):

I dare say we do. And if I were to summarize what we learned today, here's how I would put it: we are seeing more and more heat waves, and they are killing people. If we ask who is responsible for these debts, we can use the tools of climate science and good old fashioned round the world searching through archives to figure out who is responsible.

Leah Stokes (46:10):

The answer is about 90 companies. These fossil fuel companies have created around two-thirds of all human carbon pollution. Not only did they know that what they were doing was wrong, they knew that it would kill people, and they lied about it.

Katharine Wilkinson (46:27):

These companies can, and must, be held accountable. They must stop polluting and, quite frankly, they should be paying for the costs of adapting to this hotter and much more dangerous world. And in the meantime, we need to protect people who are on the front lines of growing heat crises by passing laws that make it safer, particularly for farmworkers.

Leah Stokes (46:48):

That's right, Katharine. And as you know, there are some reasons to be hopeful. California passed a bill in September that will finance what are called “climate resilience districts.”

Katharine Wilkinson (46:59):

That sounds cool. How will that work?

Leah Stokes (47:01):

The program is meant to ensure that communities will have the power and funds to develop projects to cope with extreme heat and other climate impacts.

Katharine Wilkinson (47:09):

This sounds like another promising solution that other states could take up.

Leah Stokes (47:12):

Totally. And you know, this bill, it didn't come out of nowhere. It really was decades of community and organizer-led pushes for environmental justice. State senators and assembly members helped take this bill over the finish line. So, it's just another reminder that if we join together, we can create change.

Katharine Wilkinson (47:30):

And together we can help hold fossil fuel companies accountable for the harms they knowingly created, because we do know who's to blame.

Leah Stokes (47:38):

Right. We were able to solve today's mystery, thanks to all these hardworking climate detectives who have been on the case for years.

(47:51):

A Matter of Degrees is co-hosted by me, Dr. Leah Stokes.

Katharine Wilkinson (47:55):

And me, Dr. Katharine Wilkinson.

Leah Stokes (47:57):

We are a production made in partnership with FRQNCY Media, the 2035 Initiative at UC Santa Barbara, and The All We Can Save project.

Katharine Wilkinson (48:06):

Thanks to our funders and supporters who make the show possible, Energy Foundation, Northlight Foundation, McKnight Foundation, Bloomberg Philanthropies, and the 11th Hour Project.

Leah Stokes (48:15):

If you're digging the show, please hop on Apple Podcasts or Spotify and give us a five-star rating or leave us a review.

Katharine Wilkinson (48:24):

Jordan Rizzieri is our producer. Catherine Devine and Emily Krumburger are our associate producers. Enna Garkusha is our supervising producer, and Michelle Khouri is our executive producer.

Leah Stokes (48:36):

William Cagle and Ellie Katz wrote the script, and Isabel Moncloa Daly, Becca Godwin and Jessica Olivier were script editors. Matthew Ernest Filler is our lead audio engineer, mixer and sound designer, with dialogue editing and additional mixing by Claire Bidigare Curtis.

Katharine Wilkinson (48:53):

And session engineering by Dante Hodge.

Leah Stokes (48:55):

Rose Wong designed our new show art. Sean Marquand composed our theme song. Additional music came from Blue Dot Sessions. Research, fact checking, communication and production support by Daniela Schulman, Amarachi Metu and Madeleine Jubilee Saito.

Katharine Wilkinson (49:10):

Come back soon as we tell more stories for the climate curious.

Kate Marvel (49:18):

All right, my rant about Lance Armstrong, that is going to get us sued and/or canceled. It was great. Sorry, we have to have it.