Medium Rare: What’s Next For Meat?

https://www.climateone.org/audio/medium-rare-whats-next-meat
Recorded on June 12, 2026

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Kousha Navidar: Ariana, what did you have for dinner last night?

Ariana Brocious: Oh, um, I had a white bean and Swiss chard stew.

Kousha Navidar: Yum.

Ariana Brocious: Yeah, it was pretty good. Yeah, you know, speaking of white beans, I've recently learned of a group that I wanna be a member of. Um, it's top secret.

It's called the Leguminati.

Kousha Navidar: Like beans, like legumes?

Ariana Brocious: legumes, yeah. So people who are in this super secret awesome group ... uh, apparently like to eat beans, try to eat beans at least once a day, and I think I could join their ranks, you know?

Kousha Navidar: Oh, me too. I do eat beans once a day.I need to- I, I... They, maybe they sent me a, a membership card in the mail. That's so funny. It's

Ariana Brocious: in the mail,

Kousha Navidar: mm-hmm. Oh my gosh, that's so funny. Um, I, so I had beans last night as well, but I also had chicken, and the reason I asked you is because today's episode is about meat. And I wanna get one thing out of the way right at the top. Like the majority of Americans, I eat meat.

Ariana Brocious: Yeah. You know what, Kousha? I do, too. Not a lot, but I do. And so one important thing as we get the show underway, we are not here to judge.

Kousha Navidar: I think that's important because today we're going to talk about meat, its impacts on the climate, and some potential alternatives. And sometimes listening to this kind of content can feel grating, because I think people who eat meat feel like they're about to get lectured.

Ariana Brocious: And that's part of what makes it so interesting to dig into. Few things are more personal than what you eat. Food is tied up in culture, family, identity, economics.

Kousha Navidar: Nearly all of our meat comes from factory farms. Those are generally bad for the animals, bad for the workers, and for the communities who live close to them.

Ariana Brocious: And then… there's the climate piece. Livestock agriculture and related deforestation is responsible for roughly a quarter of global greenhouse gas emissions.

Kousha Navidar:- WAIT, we said we're not going to lecture.

Ariana Brocious: Right

Kousha Navidar: Telling people not to eat meat isn't exactly a winning strategy, even when the message is coming from Billie Ellish.

Billie Ellish: Y'all not gonna like me for this one. Eating meat is inherently wrong. And then the other thing is two things cannot coincide. I love animals. I love all animals so much, and I eat meat. You just, they're just, you can't do both. Sorry. You can eat meat. Go for it. You can love animals, but you can't do both.

Kousha Navidar: Tell us how you really feel Billie…

Ariana Brocious: Yeah, she got a lot of heat for her comments to Elle magazine. So given the tension around this topic, how should we approach what's on our plate?

Ariana Brocious: One solution that seemed to be gaining steam a few years ago is plant-based meat.

Kousha Navidar: Like the Impossible Burgers and the Beyond Meat stuff.

Ariana Brocious: Yeah, it felt like those brands were suddenly everywhere. Burger King introduced the Impossible Whopper, Carl's Junior had the Beyond Burger. Grocery stores had an entire new section with plant-based nuggets and hot dogs…whatever you'd like.

Kousha Navidar: There was also serious money flowing into the industry, from people like Bill Gates and Marc Andreesen. And it was exciting, the idea that we could just swap out the meat and nobody would have to change anything. (beat) And then… it kind of stalled.

Ariana Brocious: Right**.** Some of the early buzz faded. I can still find Impossible and Beyond in my supermarket. But nationally, sales have been falling. And it turns out that creating an imitation meat product people will actually keep buying, not just try once, is really hard to do.

Kousha Navidar: So what happened? And how are we going to meat the moment?

Ariana Brocious: That's a tough pun to swallow…

Kousha Navidar: Hey, nice!

Kousha Navidar: Later in the episode we'll hear one possible solution: cultivated meat – growing

actual meat cells in a lab or brewery. But before we get there, our first guest has been covering the plant-based meat space for years.

Ariana Brocious: Robbie Lockie is the CEO and founder of foodfacts.org, a UK nonprofit focused on transparency in the global food system. He grew up on a farm in Zimbabwe eating lots of meat, then went fully plant-based about thirteen years ago, and now thinks a lot about how people decide what to eat.

Robbie Lockie: Our life and our diet consisted of a very heavy animal, product-based, diet. And I, at the time, really growing up, had no idea that people could live without eating animal products and meat. Um, it was only really until my, I suppose, early thirties did I explore the idea of plant-based diets, and it actually came out of pure desperation. I was experiencing quite a lot of health problems: bloating, skin conditions, eczema. and I went on a bit of a, I suppose, an adventure, watching documentaries, reading books. and I wanted to understand, you know, how my diet might affect my overall wellbeing. And it wasn't until the time that I completely cut all animal products, including dairy, out of my diet, that I noticed an almost overnight shift in my overall health. I was sleeping better, my sinuses cleared, I was able to breathe through my nose. Uh, the psoriasis and eczema on my arms cleared up within six, six weeks or so. and I think, I guess one of the biggest things I noticed was just my energy levels. I generally felt very sluggish for most of my life, always very tired all the time. Um, and yeah, switching to a plant-based diet made such a huge difference to my overall wellbeing, and it's been thirteen, I think thirteen years now that I have been fully plant-based.

Ariana Brocious: Wow. That's, that's compelling. Yeah, there are a lot of health benefits to eating less meat, at least, if not excluding it. So I wanna go back about 15 years to a time when plant-based meats were making their debut. What climate or environmental arguments were being made for these products, and what was consumer interest like?

Robbie Lockie: In the early days, consumer interest was incredibly excited. There was a lot of buzz around these alternatives. But I think what's interesting about plant-based meat, and I think there's this notion that they're a relatively new phenomenon, and they actually aren't. Thousands of years ago, Chinese monks were making seitan from wheat gluten, which resembled meat, and Buddhist monks have been making and consuming plant-based, uh, or meat alternatives for millennia. But it's only really, I suppose, as you say, in the last fifteen years that a, a mainstream commercial, kind of industry was born. and I think, I mean, if you speak to a lot of the founders of these organizations, many of them created these products out of frustration with what is a, a deeply dysfunctional food system, but also the environmental impact of, um, industrialized animal agriculture.And so there was this huge, I guess, gold rush, plant rush to, you know, to, to, to produce products that tasted like meat, that performed like meat, and, and were familiar. And I think that's one of the biggest things. Consumers were looking for familiar formats in places like burger chains, supermarkets, convenience foods, um, and family meals.

Ariana Brocious: Yeah, and I think that's interesting because it is attempting to, to be a substitute, right? So as opposed to simply eliminating meat from your diet, these products really are trying to stand in for the meat. And, and largely we're talking burgers, chicken nuggets things like that, kind of already somewhat processed things.and they really began to be present everywhere. In twenty nineteen, Burger King launched the Impossible Whopper made with the Impossible Burger. About the same time, Carl's Jr. began offering a Beyond Burger. Now it's really common to find a vegan burger alternative at a lot of restaurants. So would you say that, you know, plant-based meats have arrived?

Robbie Lockie: I would say that they certainly had their-- have had their heyday, but I think we're

in a state of correction essentially, I think as a, as an industry. There's been this sort of burst of growth, and I think weaker products or weaker brands have kind of really been exposed. One of the most important topics that I don't think is spoken about enough is macronutrient parity.

It's all very well offering, say, a salmon steak, plant-based salmon steak, but then if you compare plant-based salmon steak to a, to a, an animal-based, fish-based steak, often the macro parity is quite different. Uh, and I think a lot of these types of products that came on, uh, really monopolizing on the novelty factor have faded away, and the products that do have macronutrient parity have stayed because consumers are obsessed with protein, obsessed with macronutrients. And, I think plant-based products that can meet or surpass their animal-based counterparts are always gonna be potentially attractive to, you know, a wide variety of consumers.

Ariana Brocious: Let's get into that because as you mentioned, in the last several years, there has been a downturn of fortunes for n- a number of these companies. Sales are falling in the US and the UK. Why did consumer attitudes change?

Robbie Lockie: I think it's a bit of a perfect storm, in my opinion. In our current economic state, take the UK for example, we're living through the worst cost of living crisis in over 70 years. People having to choose between eating and heating their homes. And when they walk into a supermarket and, and see a pack of, plant-based meat, for example, or plant-based bacon, the price is considerably different. So pork bacon is about six British pounds per kilogram, and plant-based bacon is 29 pounds per kilogram. So there's a, a, there's a stark difference in the price. When it comes to beef burgers and plant-based burgers, then the story is slightly different. I think potentially because the popularity of the product, due to economies of scale, more plant-based burgers are being sold than ever before. Uh, but also the cost of agribusiness is skyrocketing, and so, you know, plant-based meats are not quite on price parity with beef. But they are, they're approaching price parity. And I think as the climate crisis bites, and more large agribusiness starts to divest from animal agriculture, I'm hoping to see more, um, giant agribusiness invest in more alternative proteins as an, as a, as a solution.

Ariana Brocious: Yeah, there has been some of this so far. I know some of these major agribusiness brands have already bought up some of these smaller plant-based brands or are investing in them as a component part of their business. The costs are real. You touched on the macronutrients, and I think consumers, you know, we're all subject to the sort of whims and fads that come with every, you know, new cycle of nutrition. And so, uh, at present, there's a fixation on fiber, which is good and protein. Again, these are important macronutrients along with all the others. However, there does seem to be this kind of inordinate focus on protein. And so on foodfacts.org there's an article titled "High Stakes: Why Young Men Are Eating more Meat." And I found this really compelling. So can you kind of summarize the findings of that and, what it means for who is choosing plant-based over meat right now?

Robbie Lockie: Right. So what we're referring to, and I'm sure we've all heard this phrase, the manosphere, uh, which is I guess, a collective of men online who, essentially are building somewhat of a sort of a community, and it's a v-it is very much a sort of anti-woke, anti-progressive, anti-liberal, kind of mindset. And with that comes this idea that masculinity and meat consumption are deeply entwined, and that for a man to be manly, to be masculine, to be strong, uh, they must consume meat. And I think it's not necessarily about strength, I think more about image and, uh, showing signs of, uh, showing, examples of wealth when people can go to a restaurant and order giant steaks and, you know, massive racks of ribs. In a way, these kinds of, you know, showy statements are also, kind of peacocking, someone might-- some might say, showing off wealth. You know, when we look at history, meat consumption has always been associated with upward mobility. It's always been associated with middle classes. Lower income families would eat a lot less meat because they

couldn't afford it, and so their diets were higher probably in fruits and vegetables. Now we're seeing the reverse where, low income families are surviving on ultra-processed foods and of course, super cheap ultra-processed animal products. But going back to the iden-identity and the culture, I think it's, it's such a fascinating sp-space to sort of look at because in a way I think young men, their identities are being hijacked by this idea that meat consumption is essential to their manhood. But I think also it's worth adding in that industry is aware of this connection. They're aware of this relationship between manliness and meat consumption, and in our recent report we did with the Rooted Research Collective, we looked at many, um, uh, nu-nutrition and health influences, and many of them are being paid by industry, are getting very large checks from, example, the Beef, Beef Checkoff program to push, to push certain conversations about meat and to sort of keep meat relevant, within the manosphere, which is a very loud and, uh, kind of influential collective.

Ariana Brocious: That's interesting. It's sort of akin to the, uh, industry support, uh, for influencers for gas stoves, which is another thing we've talked about here on Climate One. You touched on ultra-processed foods, and that's been a component of this discussion too. So one of the biggest arguments I hear being made against some of these plant-based products is that they're highly processed and that that is bad. What's your assessment on that?

Robbie Lockie: So I think the ultra-processed backlash, um, is an important conversation to be had, but I think it's much more about emotion than anything to do with nutrition. There's this idea that a long ingredients list is, uh, is a warning sign of whether a product is healthy or not, and that's completely not true. It's about looking at what does the product actually contain and in what amounts, um, and what are we trying to replace in our diets. So, you know, a plant-based burger is not exactly the same thing as a, you know, a lentil or a mushroom burger, um, or a veggie burger. But we can't always compare apples for… You know, apples for-- apples, apples and oranges. What the ex- What's the expression?

Robbie Lockie: Apples to apples. Yes, they're very different. It's a very different product with a very different agenda, I suppose. But each one of these foods are gonna be very different depending on the formulation.Sooften when the media talks about plant-based, it talks about it in a way that suggests that all plant-based burgers are created equal, and they're absolutely not. But, you know, if we look at a plant-based burger, we are talking about zero cholesterol, um, more fiber, no saturated fat. So just because a product has a long ingredients list, it doesn't necessarily mean it's automatically bad for you. And again, not to harp on about industry, but industry's done a very good job at scaremongering certain ingredients that are used in these products. For example, binders like methylcellulose, which sounds very scary, but it's a product that's used in food and has been for decades.

Ariana Brocious: Generally speaking, there are fewer ingredients, but there are other components that get into that beef, correct?

Robbie Lockie: Yeah. I think when we try and compare food, that's where it gets tricky, 'cause people often say to me, "Is a plant-based burger healthy?" And I'll say, "Well, compared to what?" I think it's important to understand that health is a spectrum. If we want a super healthy patty in our burger bun, we're gonna want something made from whole foods. But the mouthfeel and the fat and the salt, you know, it's not, we're not gonna get that same meaty texture that we're used to if we've grown up on meat. and so this is where, this is where plant-based burgers came in. But then obviously, as I say, if you compare it to, a beef burger, which is, depending on the cut of the beef, is gonna be substantially higher in, um, saturated fat and cholesterol, so. And then obviously, you know, beyond nutrition, there is a huge conversation to be had about the environmental impact of beef. And, and also other concerns like antimicrobial resistance, because of concentrated animal feed operations and factory farms. There's a growing conversation about how when we rear animals

in this way, we increase the risk exponentially of an additional pandemic. And, you know, no one wants another pandemic. I certainly don't.

Ariana Brocious: Yeah, no, definitely not. So plant-based meats are, you know, better for the environment in terms of climate emissions, in terms of pollution. Plus they eliminate concerns around ethical animal treatment, which is a substantial concern for a lot of people. In your opinion, how do they compete on Taste

Robbie Lockie: Taste is a good one to question, uh, because I think, you know, when we buy a product from a supermarket, we see the word burger, and so we have an expectation. and I think many products have fallen down on this because when you label a product burger or like a beef burger, that is a huge...bar to, to hit. personally, Beyond Meat, Impossible Meat, As someone who grew up eating beef with- several times a week, I was blown away when I first tried these products. The texture, the flavor, the way that they sizzle on the pan. You know, these, these products really blew me away.And there have been times over the years where I've been to a restaurant and been served a Beyond or an Impossible, and I've had to check, is this beef or is this You know? And so they have performed well. But what's so fascinating about these products, these meat analogues, as we call them, is that perception has a huge power over whether someone enjoys something or not.The number of times I have been out for dinner with friends and they have not realized that they were eating something that was vegan, like a, a plant-based meat, and then once they've found out that it's a plant-based meat, they've suddenly shifted from really enjoying it to no longer enjoying it. Or the opposite, where you serve someone a plant-based meat product, you don't tell them it's plant based, they eat it, they enjoy it, they, they rave about it. They say, "What a delicious meal." And then you tell them it's plant-based and they were completely blown away. They can't fathom that they enjoyed a product so much. So I think when we lead the witness, as some might say, it really alters people's perception, and this is why a lot of brands now are not putting vegan or plant-based on the, on the front of their products. They're moving more towards phrases like climate-friendly or animal-free food there's a real move towards shifting away from these ideological phrases like vegan and plant-based because they are caught up in the culture war that we see going on in the media and on social media every day. And, this colors people's perceptions of these products. And I personally believe it's played a huge role in the great pushback, I suppose, of plant-based meats, uh, globally.

Ariana Brocious: Diet is an incredibly personal choice that ties into a lot of values for people, a lot of sense of identity, as we've talked about. So I don't think it's easy to kind of come to a landing place on what people should eat necessarily. But I'm curious what you think is the future for plant-based meats.

Robbie Lockie: think if we can see price parity, then we'll continue to see growth in the sector. I mean, if we look at some of the numbers, uh, according to the Good Food Institute, the plant-based retail market reached seven point nine billion dollars in twenty twenty-five. There is obviously a huge opportunity because, you know, these products c-can fill a space in people's shopping baskets every week. Um, but they--they're only going to succeed if we can bring... if the prices can come down. but they're up against a lot when it comes to culture, when it comes to identity, as we said, and when it comes to taste. People have huge expectations of these products. and this is where the conversation around alternative proteins is so big. You know, cellular agriculture, precision fermentation, uh, and also blended products. We haven't touched on that. I think there's, there's a huge, uh, opportunity for brands to be mixing plant-based proteins with animal proteins and produce, say, a patty that might be ninety-five percent plant-based and five percent animal-based. The five percent might bring, uh, a lot more flavor and, mouthfeel to the product, a bit more, bit more animal fat, and then the rest is plant protein. And in fact, I think McDonald's already does that. McDonald's, for many decades, has been including soy protein in their beef burgers to, you know, bulk them out, but most people just didn't know about it. Yeah, you know, elsewhere in this episode

we discuss cultivated lab-grown meat as it's called. and so you're, you're a proponent of that. I was curious what your opinion is. I have gone back and forth, uh, over this topic for, for a while, um, mainly because I've spoken to so many different people, and there's so many varying opinions on whether this is going to work or not. Millions of dollars have been poured into R&D over the last few decades. But again, culture and identity has had other ideas when it comes to cell-based meat. If we could scale it, and provide facilities globally that could produce enough animal-based products, whether that's cheese, eggs, fish, chicken, you know, it could be a great solution to, to, to provide protein, healthy, low-fat, low, low cholesterol protein to millions of people. But the idea of natural versus unnatural remains a very powerful, and formidable, I suppose, enemy to the, to the, to the cell-based conversation.

Ariana Brocious: When you think about climate impacts, animal impacts, our place as humans in the world, what do you think we should be eating?

Robbie Lockie: It's a complicated answer because if we all had access to the same amount of money and education and resources, then a whole food plant-based diet, uh, I believe according to the science, according to the EAT-Lancet planetary diet, is the healthiest diet. Um, a diet rich in whole plant foods, nuts, seeds, legumes, fruits, vegetables. This is shown time and time again to be a major reducer in some of the leading killers of human beings, such as heart disease, which kills thousands of Americans every year. These lifestyle diseases are caused in part by consuming large quantities of animal products. However, it's not that easy to suggest that everyone should be eating a plant-based diet because there are many parts of the United States where people don't have access to fresh fruits and vegetables. and if they do, they're incredibly expensive. and so the playing field isn't level. So it's, i-- there's the diet where we should be heading towards, and everyone knows that we should be eating more fruits and vegetables. My philosophy is don't tell people not to eat meat. Ask people to add more fruits and vegetables, and eat the rainbow is my mantra. Adding more diversity of plants to your plate every single day is going to dramatically increase, uh, your levels of fiber. This is gonna improve your gut microbiome, and it's-- and it will absolutely improve your well-being. And I think with the right knowledge, with the right access to information, a whole food, a predominantly whole food plant-based diet or perhaps like a Mediterranean diet is, is a diet that's, healthiest for most humans.

Ariana Brocious: What's your favorite meal?

Robbie Lockie: My favorite meal, super simple. I like to have a Buddha bowl with lots of, uh, marinated tofu, steamed broccoli, red rice, and, uh, lots of lashings of tahini and lemon and a few drizzles of olive oil, uh, and maybe a sprinkle of, pumpkin seeds as well. So you're getting your good fats, your, your, your lean protein, and of course your green vegetables, and some nuts and seeds as well for, for iron and minerals. So yeah, like to, like to eat a plate with lots of different things on it, with lots of different textures

Ariana Brocious: That sounds delicious. Robbie Luckie is CEO and founder of foodfacts.org, a UK nonprofit dedicated to bringing clarity and transparency to the global food system. Thank you so much for joining us on Climate One.

Robbie Lockie: My pleasure. Thank you so much for having me.

Kousha Navidar: Coming up, solving the climate problems of industrial animal farming will require more than one approach.

Michael Grunwald: You've got your vegan people, you've got your beef people, then you've got your regenerative people and your industrial people. There's a lot that these different groups can

learn from each other

Kousha Navidar: That’s up next, when Climate One continues.

Ariana Brocious: This is Climate One. I’m Ariana Brocious.

Growing food and raising livestock account for roughly a quarter of global climate pollution – from fertilizer use, to methane from cows, to deforestation. And that deforestation is likely to get even worse. By some estimates, we’ll need to expand food production by 50% by 2050 to feed the growing global population.

Michael Grunwald is a journalist and author of We Are Eating The Earth. He says we need to figure out how to make more food with less land.

Michael Grunwald: Our cities and suburbs only cover like 1% of the earth's land, and farms and pastures are now nearly 40%. We're losing a soccer field worth of forest to agriculture. Every six seconds. And that really is at the heart of our water pollution problems, our water shortages, our biodiversity problems, and increasingly our climate problems. So it's, it's a really big deal.

Ariana Brocious: So how do we begin to address this? The scale you're talking about is intimidating. I mean, how do we make more food with less land?

Michael Grunwald: Yeah, well I think, you know, it's sort of a two part problem, right? Where we have to, you know, eat foods that take up less land, and that is mostly meat, Uh, 'cause

Ariana Brocious: Meaning we need to eat less meat.

Michael Grunwald: Exactly three quarters of our agricultural land is either pasture or it's growing crops that we feed to animals before we eat them. Um, so yes, so we have to eat less meat. And also on the demand side, we need to waste less food, right? Because we waste about a quarter of our food. That means we waste about a quarter of the land we use to grow the food. We use a landmass the size of China to grow garbage. Uh, but then as you said, you know, this isn't just gonna be solved on the demand side and we are going to have to make more food with less land, and that means we are gonna have to increase our yields. 'cause when we make more food per acre, we don't need as many acres to make the same amount of food. And so that leads to some uncomfortable places, right? For people who would like these kind of like all organic, uh, you know, regenerative. Sort of low yield, kinder and gentler farming. Well, it turns out that that often makes less food per acre and needs more acres to make the same amount of food. It eats more of the earth. So we really do need highly productive food, whether that's done with chemicals and pesticides and fertilizers, and gene editing and GMOs, , it can, you know, sometimes lead us into uncomfortable places.

Ariana Brocious: Yeah, So you cover a lot of this in your book. There's so many things we could talk about, but could you provide a list of, let's just say three of the most important changes or policies or I don't know, pivots we could make that would begin to help here

Michael Grunwald: Sure. I mean, really we need to eat less beef, lamb too. Uh, but, uh, but beef is really the baddie. Uh, we need to waste less food, uh, because when we waste food, we waste all of the land and fertilizer and water we use to grow that food. And then we need to make more food with less land, which means higher yields, making more food per acre so that we don't need as many acres to make the same amount of food and we don't eat as much of the earth.

Ariana Brocious: So you touched on beef cattle, which are, you know, kind of a staple for many Americans. They use nearly half of the world's agricultural land to produce just 3% of its calories. As

you noted, factory farms are far more efficient than free range cattle. There are other impacts to consider here. I don't wanna totally gloss over, like animal health and welfare, manure handling disease, things that can come from concentrated animal feeding operations. However, from an efficiency standpoint, they are much better. Does that make them good?

Michael Grunwald: It doesn't make them good. Right, because, and you mentioned a lot of reasons why, right? They treat people badly. They treat animals badly. They use too many antibiotics. Their politics usually suck. And those are, those are real issues, right? The fact that they could contribute to the next pandemic is something we have to keep in mind. But for a lot of people that means like, oh, we need to get rid of factory farms. And the one thing that factory farms do, do, like other factories, is they manufacture a lot of stuff. and we are going to need 50% more calories. By 2050 and we're gonna have to do it with less land and fewer emissions. Right now we're on track to deforest another dozen California's worth of land by 2050, factory farms. By making more food with less land can help us avoid that kind of problem.

Ariana Brocious: Yeah, that is a staggering statistic. You know, we've talked about the Amazon Rainforest as an example of this. clearing of the Amazon to plant soybeans, which then go to feed cows, which then go to feed people. And that just a highly inefficient system that's doing more harm than good, I think is a, is a fair assessment. I mean, the major revolution of like the 1950s was synthetic fertilizer, right? I mean that really improved. Yields made a huge difference at that time. And so we're maybe on the cusp of another revolution or several. So what do you think is real? and what do you think is hype?

Michael Grunwald: You know, I wrote about dozens of pretty promising solutions in this book, and none of them really have any traction. At least not yet. You know, we've, in many ways, we have not solved the fossil fuel problem, but we do know how to solve it. Right. We need to electrify the global economy and run it on clean electricity. Um, and we've made some progress there, right? We're in the, we're having this in incredible clean energy revolution where 90% of the new power plants built in the world last year were wind or solar or some other zero emissions technology. While with food and agriculture, it's still getting worse. , And we really don't know what to do. So we need to test, we need to figure out what works and then we need to deploy what works just like we did with solar and wind and, and electric vehicles. In some ways the most promising technology I've seen isn't much of a technology at all. It's essentially more efficient pastures. It's, you know, I went down to Brazil and I saw some degraded ranches where there would be like one cow for every 10 acres and the cows would look like they were on hunger strikes. And then I'd see upgraded ranches where they had invested in better grasses and they fertilized the pastures. And yeah, some of them had feed lots, but you'd see one cow per acre, and that meant they were using only one 10th as much of the Amazon, so they were eating a lot less of the earth.

Ariana Brocious: Yeah. So this idea, this uh, uh, pasture intensification, I think is what you're describing, right? SoHow does that compare to, rotational grazing, because this is something I've heard about for years cows are really not good at, um, protecting their own interests. They eat the good stuff and leave the bad stuff, and then just kind of hang out. And so rotational grazing helps them move around in a way that other animals and other livestock do, where they make better use of the plants there.

Michael Grunwald: I'm so glad you mentioned that because it's funny, as you can imagine, a lot of people who hate factory farms get very angry at me. But it turns out that some of these regenerative practices can also help. And rotational grazing is a great example and integrating cattle in with, with your crops, um, and with cover crops and often with, uh, with no-till crops. and, you know, I went to, I went to some of these ranches and they look like industrial ranches and like I said, they're fertilizing their pastures, which Michael Pollen would not approve of. And they do have feedlots,

right? Ooh, boo. Bad. Um, but they are doing a lot of regenerative practices, not because they wanna save the rainforest or even save the Serato, but because they found that it can help their yields and it can help their soil.And good soil can help make good crops and, uh, and it can help make more beef. And I think that's great. I think in the food world and the ag world, people tend to get into their silos, right? So to speak, right? Excuse the pun.

Ariana Brocious: Yep. Uhhuh.

Michael Grunwald: Yeah. You've got, but you've got your. You know, you've got your vegan people, you've got your beef people, then you've got your regenerative people and your industrial people. But it does seem like there's a lot that these different groups can learn from each other. Um, and certainly food and agriculture, there is a lot of ideology and. And, uh, and sort of politics involved with it. But these are really practical questions, um, where, you know, more science and, uh, and more research can really help us get to good answers that can be, you know, sort of good for everybody. , You know, we all, we all vote on these issues three times a day, right? so we all have an interest in, in, sort of sustainable food and a sustainable planet.

Ariana Brocious: There is though a growing demand for meat in terms of the global diet. People who are, you know, becoming less poor, want to eat meat, that's a good thing that people are becoming less poor. but five or six years ago, plant-based meat companies, like impossible and beyond Meat were kind of all the rage. What happened?

Michael Grunwald: Well, the short answer is the dogs didn't like the food. Right. Um, you know, uh, plant-based meat, uses 90% less land than meat-based meat or certainly beef based meat. and obviously it, uh, kills a hundred percent fewer animals, which is also great. It's in many ways a remarkable technological achievement that these companies have created meat out of plants that tastes like 80% as good as the real thing and only costs 50% more. Um, and that was enough to encourage people to try it and find that it actually was better than those old, you know, veggie burger hockey puck, but it wasn't as good as meat. So they didn't keep eating it. the good news is that while the cow is a pretty mature technology, , fake meat isn't, um, whether that's meat made of plants or made of fungi, or made out of animal cells in a, in a kind of brewery, um, I do think that there is, there's still a lot of hope. Human beings don't seem to be really great at making big sacrifices for the good of the planet. But we're pretty excellent at inventing things and uh, I assume that, even if fake meat hasn't yet taken over the world, someday it could.

Ariana Brocious: Hmm. Yeah. You know, I try to avoid eating meat most of the time, and I've had a number of these fake meat burgers. And I will tell you, there have been at least two occasions where I actually asked the server if they would confirm that it was not meat, because it was so, the way it was prepared, and, you know, I know some are better than others, but I, I was, I was fooled, you know?

Michael Grunwald: Well, there's no longer any reason really to have a, a chicken nugget. I mean, and who even knows what's in a chicken nugget, right? I mean, but, uh, but in blind taste tests now, the plant-based nuggets beat the, uh. Alleged chicken based nuggets. Right. And they're just mostly vehicles for sauces anyway. And you're starting to see some of the burgers come close where there's really still a long way to go is with the kind of the whole cuts, whether it's, you know, the beef tenderloin or the steaks or the, uh, you know, the pork chops. Um, the more complex cuts, and there I think some of the cultivated meat made from actual animal cells. They may be more promising in the long run.

Ariana Brocious: Michael Grunwald is a journalist and author of We Are Eating The Earth. Thank you so much for joining us.

Michael Grunwald: Appreciate it Ariana.

Ariana Brocious: So Kousha, imagine this: What if you could have a burger without killing a cow? Or fish and chips without hurting any cod? you were at a restaurant and the meat on your plate was made from real animal cells, but no animal was ever slaughtered?

Ariana Brocious: I know, it sounds like science fiction, but it's increasingly science fact. Cultivated meat - sometimes called lab-grown meat - takes a small sample of cells from a living animal, places them in a nutrient-rich environment, and helps them develop into the kinds of meat we're used to seeing at a store.

Kousha Navidar: So you're saying it's genuine animal tissue, just grown in a lab instead of a pasture or out in the water?

Ariana Brocious: Yes. And it has the same protein, fat, and texture as the "real" thing. And I found out what it really tastes like myself.

Ariana Brocious: My friend Rebecca and I went to the Kingfisher Bar and Grill in Tucson, owned by Chef Jacki Kuder. She took a moment to explain what was on my plate – a "cultivated salmon" from a company called Wildtype.

Jacki Kuder: So we've prepared it, as a vegan option, 'cause I do have some vegan guests who are willing to eat it. So we've got it, in a roulade, and it's gonna be stuffed with vegan cream cheese, agave syrup, chive whole grain mustard, and that's gonna be, uh, set on top of a little frisee salad with green apples and a honey mustar- agave mustard vinaigrette and, uh, some crostinis.

Ariana Brocious: Okay, I'm excited to try it, but before we do, I wanna know, what inspired you to put this? This is a restaurant known for its high quality seafood, which in a place like Tucson, which is pretty landlocked, can be a rarity. Why did you decide to add this?

Jacki Kuder: Uh, well, one, I'm a big nerd. Um, two, I've been following kind of the sustainable seafood movement, um, ever since we took over, you know, I've just been looking at different ways to, reduce our carbon footprint, kind of make the restaurant more sustainable. So we look at more locally sourced, like, produce options and things, and I've been following wild type for, gosh, probably seven or eight years just personally. Um, so, uh, it coincided that in, you know, about three years ago when we were really taking over and, kind of making the restaurant our own, uh, they got FDA and USDA approval to sell.So I just reached out to them and I was like, "Hey, uh, you know, I know we're not super fancy, but we focus primarily on seafood and I'd love to introduce a more sustainable option." So I think it's wonderful, just to have the option for guests who are a little more, um, environmentally conscious or even just willing to, like, explore and try new culinary things, kind of both ends of the spectrum.

Ariana Brocious: And do you have a sense of how it's performing on the menu?

Jacki Kuder: Yeah, it sells just about as well as our other appetizers. It is a little bit more pricey probably than the other appetizers just because of the cost of goods. Um, but, uh, we get really good response on it. people seem to enjoy it.

Ariana Brocious: Um, you said that you're a nerd, so I'm using your word. What makes you intrigued, as a chef and as a restaurant owner to, to introduce ingredients like this?

Jacki Kuder: Uh, I think it's important to make people a little bit uncomfortable all the time as a chef. So, I feel like food is an art, right? It's the only art form that we experience with all five senses.

uh, art is supposed to make people uncomfortable, I think. It's a part of growing. It's a part of, um, learning about each other. Uh, it's part of exploring kind of our humanity and bounds of creativity. So, um, you know, I wanted to introduce it not only just for, like, reasons of, uh, overfishing, sustainability, fish is getting incredibly more expensive and harder to find, but also just to broaden people's ideas of what's acceptable. You know, I've had folks who, in never in a million years, just based on their, mm, political and socioeconomic backgrounds, who would... Like, have gotten to try this, who are like, "This is amazing. This is great. I'll order it again." So it's really, gratifying for me to see that and to, you know, know that, like, okay, I opened someone's world up just a little bit, which is very cool.

Ariana Brocious: it's still a very nascent industry. Um, but do you hope or have plans to add more items?

Jacki Kuder: Uh, absolutely. So I know there's a place out in Europe doing ahi tuna. Um, so I've been reaching out to them. It's not quite settled how we might get that across, uh, borders at this point. But, uh, I'm keeping an eye on the industry and definitely, like, interested in exploring options. Um, I don't think at this point it's meant to replace anything on the menu, um, just sort of expand options for us.

Ariana Brocious: Thank you so much. Enjoy. Thank you. Let's try. Okay, so we're taking a crostini, and then a little piece of apple. And some salad

Speaker 4: Frisee

Ariana Brocious: Frisee. Okay, and then the little roulade here. it looks pretty much like regular smoked salmon. It's very nice, kind of pinky orange.

Rebecca Primeau: Yeah, I think it looks beautiful, fresh.

Ariana Brocious: Okay, let's give it a shot, Mm-hmm. Delicious. Yeah. The honey mustard There's a lot of flavors, so it's a little hard to taste the salmon, I would say. It does seem to have kind of the mouth feel though that you would get from normal smoked salmon. And it's kind of amazing because part of me thinks it's odd, and then part of me is like, "Oh, it's just normal, delicious."

Speaker 4: Mm-hmm.

Kousha Navidar: Coming up, what if we could have the meat that so many people love, but without needing to take the life of an animal? That’s the promise of cultivated meat.

Claire Bomkamp: meat is cells, and cells can be meat. so why would we not kind of take advantage of, of this opportunity for, for both more efficient production of foods we love and also, opportunities for innovation from a culinary perspective

Kousha Navidar: That’s up next, when Climate One continues.

Kousha Navidar: This is Climate One. I’m Kousha Navidar.

Kousha Navidar: Some brands of cultivated meat have cleared regulatory hurdles in the U.S. and Singapore. And prices have dropped significantly from early prototypes. But there are still real questions: How much energy does it really take to make the meat? How do you get it to scale? And the big one: will people actually eat it?

Claire Bomkamp is a senior lead scientist for cultivated meat and seafood at the Good Food Institute.

She walked me through how this technology works, and where it stands today.

Claire Bomkamp: Yeah, so the idea with cultivated meat is it's real meat that's gonna deliver the same sensory experience and the same nutrition as meat that you're used to eating. The difference is it's made from cells rather than from an animal. So just like you can take a cutting from a plant, and the cells within that cutting sort of know how to make more stems and roots and leaves and things, animal cells sort of know how to make meat. And so if you can give them the right environment and the right cues, they can, um, do exactly what they would do within an animal and, make a tasty product

Kousha Navidar: So if you had to say the actual process, maybe what are the steps involved with it, uh, the, the quick version?

Claire Bomkamp: Yeah. So the quick version would be, you're taking a small sample of cells from an animal. you're putting those cells into an environment where they are comfortable and where they can grow and replicate and make more cells. So we use something called culture media, which is essentially, you can almost compare it to like Gatorade for cells.

Kousha Navidar: Oh, cool.

Claire Bomkamp: So it's got, you know, your salts, sugars, amino acids, which are the, um, the sort of building blocks that make up proteins, maybe some lipids in there. and those are going to kind of, you know, provide, you know, the environment that the cell is used to, living in when it's inside of an animal. And so you're just doing that kind of externally. Um, and then you're giving them cues that will induce them to become muscle and fat cells. You're harvesting that product, and maybe there's some sort of post-processing at the end, depending on the product you're talking about. and in the end, you get, essentially animal tissue that comes from cells instead of an animal

Kousha Navidar: It sounds like a really, uh, souped-up version of brewing beer

Claire Bomkamp: Yeah, it's a lot like brewing beer. So down to, you know, in, in some cases the just physical appearance of the tanks that you would be growing the cells in. Um, and of course there are, there are a lot of bioreactor designs that people will nerd out about. But, you know, in a, in a very basic sense, it's, it's the same thing.

Kousha Navidar: Uh, you, you, it, it's interesting that you brought up temperature. what about the energy that is needed to keep the vat, like I'm imagining a stainless steel vat, just like for, for beer. what energy does it take to keep that vat at the right temperature?

Claire Bomkamp: Yeah, so energy use is, is one thing that, um, that people are definitely thinking about when they're developing cultivated meat processes. and one thing that's a huge, a huge factor when you talk about how well cultivated meat performs from an environmental perspective, just in terms of, you know, carbon footprint. So the energy source that you're using is really important. Are you using a decarbonized energy source? Because it is going to take a fair amount of energy to produce these products, but if you're using something like solar or wind, um, the carbon footprint comes out, quite reasonably. So that's a, that's a huge factor that, you know, as, as this industry is growing, we really

Kousha Navidar: take a lot of energy, you're saying?

Claire Bomkamp: It does take a fair amount of energy. There, there are certainly opportunities to reduce that energy burden and make the process more efficient. Think about, you know, is there one part of your process that needs to be heated and another part that needs to be cooled, and you can

kind of bring those together, and have kind of heat exchange between those. How can you increase the efficiency? We've heard people talk about, you know, designs where if you have a process that's producing a lot of heat and needs to be cooled, maybe you're locating your facility very close to, you know, an ocean or somewhere else where you have kind of an abundant source of cooling. So I think there are a lot of opportunities to bring down the actual energy usage of cultivated meat production. and then also making sure that the electricity source y- that's going into that process is one with, um, low carbon emissions,

Kousha Navidar: It's interesting that you brought up just even the physical space where the production is happening that, that makes me wonder where is most of the cultivated meat production happening right now?

Claire Bomkamp: Yeah. So, the main places that have regulatory approval to sell cultivated meat are the US and Singapore, but locating, production facilities because they take so much less land, locating them potentially, in some cases, closer to urban centers where the products would be consumed.

Kousha Navidar: And I think one of the most important decisions there is just what cells you're gonna use. Like, how do you vet the animals?

Claire Bomkamp: Yeah, that's a, that's a really important factor because, you know, a small difference in the, um, the speed at which s- the cell line you're using is able to replicate, can have a big impact on the efficiency of the process. And so you can look at kind of the regulatory dossiers that some of these companies have submitted to the FDA. The FDA actually publishes these online. Um, you know, certificates of, you know, um, yeah, like, "Hey, um, I'm, you know, so and so veterinarian, and here's my, like, stamp of approval on, like, this cow looked healthy." So that's one step. And then on the kind of cell performance side of things, honestly, a lot of it is just going to be, trial and error. So you, you know, maybe you have one sample of cells, or you have a few samples of cells. You're going to grow up a bunch of different cell populations and have kind of several cell lines that you evaluate, and then you can test which of these grows really well. do they have any difference in how the final product tastes if you, if you grow those cells up and mature them? Um, is one of them, you know, really good at producing, tasty, pork or beef or, or whatever product you're making?

Kousha Navidar: Let's put a wrap around this. It sounds like cell replication ability and also awareness of the cell itself on top of all of the other qualities all kind of are in this, um, matrix of factors that you and other scientists are looking at to determine, hey, what strain do we actually want? And your approach is kind of trial and error, where you get a healthy cell, you put it in the right environment, you gauge it on all of these factors, and you put it next to a bunch of other alternatives and see which one is kind of gonna bring up the best quality along a bunch of different pieces. Is that the right, like, narrative there? Are we thinking about it the right way?

Claire Bomkamp: Yeah, I think that's exactly right. and I would say the key thing is smart trial and error, So having kind of early stage, you know, doing, doing the necessary testing and kind of knowing what to look for so that if there is an issue with one cell line or another, you don't put a bunch of time and resources into it. and you can, you know, very, very quickly say, "Okay, this one has kind of a problem. We need to, you know, focus on, on other cell lines that are, that are going to perform better."

Kousha Navidar: Cool. Okay, now that the cell lecture is over, and thank you very much…

Claire Bomkamp: I'm so sorry.

Kousha Navidar: No, no, no, I'm, I'm the one asking the questions here. Maybe we're ready to talk about the actual beef. Like, one of the marketing shortfalls that I'm aware of, of plant-based meats, so not what we're talking about right now with cultivated meats, but plant-based that we might all be more familiar with, is that they can't really replicate certain meat cuts. I'm thinking like filet mignon. I'm thinking like, beef tips, like th- these things that you go to the grocery store, you're like, "I wanna get this specific cut." Can you make the equivalent of filet mignon with cultivated meat?

Claire Bomkamp: I don't know of anyone who's actually doing filet mignon specifically. but the idea is certainly that you would be able to replicate all of these different cuts. And I think that's, that's one of the parts of cultivated meat that's so cool, where there's just, you know, there's some fundamental cell biology that, somebody needs to kind of, you know, spend a lot of time in the lab to work all, to work all of these things out. Um, and then companies need to be spending a lot of time in, in their R&D labs to figure out kind of how that all translates into, into actual finished products that people are going to be able to eat and enjoy.

Kousha Navidar: So when we think about it from the climate level, what other inputs need to be considered when calculating the climate impact of cultivated meat?

Claire Bomkamp: Yeah. So the climate impact is like everything, it's a lot of things, but two main things. One is the amount of energy used on the source, and the other is the, um, the feed that, that you're going to be feeding to the cells. So your, your glucose, your amino acids, all of the kind of energy inputs. and you can break that down into how efficiently are the cells using the media. So if you give them, you know, a certain quantity of glucose and amino acids, are they doing a really good job of turning that efficiently into meat, so I think there, there's a lot of opportunity on that front. So that, that can be, you know, adapting your, adapting your cells to the media. It can be adapting the media to the cells so that they have, um, kind of the exact, um, types of, of nutrition that they're looking for at a particular stage. and then there's also kind of the sourcing of the media ingredients themselves. Is one going to be a lot more climate efficient than the other?

Kousha Navidar: And I'm sure that you've gotten to taste at least a couple times this actual meat. So I gotta know, as somebody who's so interested in it, how does the taste of it, of lab-grown meat, of lab-grown fish, how does it compare to the real thing? Does it seem the same?

Claire Bomkamp: Yeah. So, um, I would say on the taste front, it's-- my impression was that it was kind of qualitatively similar, but maybe a little bit more mild than conventional salmon.

it felt a little bit like, you know, this is, this is version one of a product that's going to be really, really good. And it's, like, just such an exciting moment too. You know, this is something I've been kind of living and breathing for a long time, and then actually, you know, trying it is, is a, is a huge, a huge thing.

Kousha Navidar: You mentioned taste. What about other factors like, uh, appearance, texture? Are there other elements that really stand out in your mind when you compare it now?

Claire Bomkamp: Yeah, so the, the appearance, um, yeah, it, it looks like a piece of salmon. And the, the texture, um, I think, you know, it, it was maybe close, but again, you know, this is version one. There's lots of room for optimization, so, I'm excited about where this is going essentially

Kousha Navidar: Yeah. but I wonder if you're ever at dinner parties and you're, like, describing what you do for work, do people ever have, like, an ick issue with it? Or they go like, "Ooh, that sounds gross." Do you feel like there's an image challenge there to overcome?

Claire Bomkamp: I think that's definitely a reaction that some people have, and honestly, you know, a reaction that I think I had the first time I heard about it.

Kousha Navidar: I was gonna ask, yeah.

Claire Bomkamp: Yeah, I was working in a cell culture lab at the time, and, you know, you very much, like, don't lick the science. And so I heard about this on a podcast, and I kind of was like, "Wait, really?" Like, you know, you don't lick the science in, you know, your typical cell culture lab because nobody's, you know, intending for any of the stuff you're working with to be, safe to consume, and frankly, it probably wouldn't taste very good. Um, but if you, if you do have kind of all the right, food safety controls and checks in place, then absolutely. meat is cells, and cells can be meat. So why would we not kind of take advantage of, of this opportunity for, for both more efficient production of foods we love and also, opportunities for innovation from a culinary perspective? I think that a lot of people are going to be a little bit skeptical when they hear about this for the first time. Um, but, you know, there have been a number of polls that, you know, ask people, "Have you heard of cultivated meat?

Would you try cultivated meat? Would you pay for cultivated meat?" All of those questions. And, you know, the num- the numbers will vary a little bit, but, but they pretty consistently show there's some skepticism, but there's also a lot of openness. I would try it, I support you.

Kousha Navidar: Thanks. Um, okay, so there's the image-- potential image problem, but just, like, the awareness that needs to be made. So, so that's, like, a marketing aspect. And then there's the operations aspect too, or, or like the pricing aspect, because like you said, it's V1, and with most products, most tech that is V1, it is also very expensive. So prices of cultivated meat, they have dropped precipitously from the first few burgers that were made. But from what I could find, cultivated meat right now costs between, I think it was, like, 30% more and up to twice as much as traditional meat. So how do you expect that to change over the coming years?

Claire Bomkamp: I think there's still a lot of opportunity for reductions in cost. So, you know, just very basic improvements to the efficiency of the cells that people are using, the design of the media, the types of bioreactors that are being used. Um, you know, can you come up with designs that are going to be more efficient, more continuous processes?

There are a lot of ways in which you can continue to bring those prices down. So I-- when you mentioned the costs dropping precipitously relative to the, you know, kind of first cultivated meat burger, that was kind of the very, very low-hanging fruit, like the fruit was on the ground, relative to kind of a, a true lab-scale process going to something that is, you know, becoming an, an actual commercial product, but still at a very small scale. There is still a lot of low-hanging fruit and then just economies of scale.

Kousha Navidar: How do you get to scale? Like, what would it take to get from the brewery to mass market production?

Claire Bomkamp: A lot of steps. So you, you know, you design your process and then you learn a lot from that. what works, what doesn't work, probably a lot of things that don't work. Um, and you kind of optimize from there. And then based on what you learn in that process, you build a bigger bioreactor or a bigger facility and you have efficiency gains from just operating at a larger scale, at least up to a certain point. And then you might have fairly substantial cost reductions just from the sourcing of the ingredients.

Kousha Navidar: Yeah, so it sounds like in this case, like many other cases, we are kind of just

talking about economies of scale, and once it enters the market and gains demand, then the, the price curve will allow it to-- or at least the production curve will allow the price to decrease. Last question I have for you then is about an area that I know you're excited about, which is hybrid food products. And listeners, that's like a burger that's made from mostly plant proteins and a little bit of actual meat. So why do you think that has so much potential, and do you feel like consumers will go for that?

Claire Bomkamp: Just to first clarify, when we say hybrid, hybrid products, we're actually talking about a combination of plant-based proteins and cultivated meat.

Kousha Navidar: Cultivated meat. Yeah. Cultivated meat. Yeah

Claire Bomkamp: So why we're so excited about that is GFI focuses not only on cultivated meat, but also plant-based proteins, um, fermentation, so using yeast or other microbes to produce food products. We have kind of scientists who specialize in all three of those areas. and when you get our team together, nobody's, nobody's talking about, "Oh yeah, cultivated meat is the solution to this." "No, plant-based is the solution." Like, that's not the vibe at all. Um, the one area that we all kind of agree is maybe the most exciting is the intersection of those different production platforms. And the reason for that is they all kind of have their strengths, and then they all have the areas where they have a little bit more of a challenge. So if you think about the plant-based products that are on the market today, getting to true sensory parity with conventional meat is a real challenge. There's been a ton of progress that's been made, you know, just in the last ten years, in terms of how well plant-based products can replicate meat. So I don't, I don't wanna down-downplay that in any way. And then, uh, if you look at the cultivated side, the sensory is maybe a little bit more, baked into the technology, but the cost is really challenging, as we've talked about. So if you can bring those together, and kind of not look at it as I'm making a plant-based product, I'm making a cultivated product, but just I'm making a meat product, and I wanna make something that is affordable to regular people, and also that's as tasty as it can possibly be. Why would you limit yourself to just one technology or the other? And also, you know, what, what combination of ingredients is going to give you the best environmental impact? so kind of allowing yourself to think a little bit more outside the box rather than just I'm going to make a product from this one technology or this other technology. I think that, that can give us a, a much quicker, and more sustainable path to, sensory and, and price parity,

Kousha Navidar: feel like it's a great place to, to, to end it. Claire Baumcamp is senior lead scientist for cultivated meat and seafood at the Good Food Institute. Claire, thanks so much for sharing your work with us. It's so fascinating

Claire Bomkamp: Thanks, Kousha. This was a fun conversation.

Kousha Navidar: And that’s our show. Thanks for listening. Talking about climate can be hard, and exciting and interesting -- AND it’s critical to address the transitions we need to make in all parts of society. Please help us get people talking more about climate by giving us a rating or review. You can do it right now on your device. Or consider joining us on Patreon and supporting the show that way.

Ariana Brocious: Climate One is a production of the Commonwealth Club. Our team includes Brad Marshland, Jenny Park, Austin Colón, Megan Biscieglia, Kousha Navidar and Rachael Lacey. Our theme music is by George Young. I’m Ariana Brocious.