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needed to grow their food, or is the methane that they produce with their solid waste?

Z.A.: It's a combination. Brazil is a major beef-producing country, and many, many acres of previously forested land have been cleared to create room for livestock production, and you see that in countries around the world. Forests are cleared to make room for agriculture, but especially livestock.

Methane production through the cow's flatulence is also a very substantial contributor. Methane is a much more powerful greenhouse gas than carbon dioxide, by a factor of 34 times.

E.G.: *Is there any way to keep cheeseburgers on the menu?*

Z.A.: There are some ways folks are exploring reducing the emissions from beef production, including adding supplements to cattle feed during production. There are synthetic additives, but also natural ones, like oregano, which when added to cow feed has been shown to basically increase the efficiency of their digestive processes, thereby reducing the amount of methane that's produced.

You can actually breed for more efficient production. By choosing cows that have been measured to produce less methane over the course of even just a few generations, you can improve, pretty substantially, the efficiency, and therefore reduce emissions from beef production.

There is a theory that has real potential to it – raising all of your cows under a giant tent, basically, and capturing the emissions through a tube at the top where the methane would gather, so basically finding ways to capture that methane and either reuse it or even just flare it, which means burn it, not for the purpose of heating anything, but for the purpose of converting that methane to carbon dioxide, which potentially reduces the greenhouse gas impact.

I have also heard that some people think there are ways to raise beef that can actually balance or reduce greenhouse gas emissions, and that would be through a lot of creative land use and grazing practices that would also include some potential crop rotations and lots of very advanced soil management practices. But I think that needs to be explored a lot more before we start celebrating.

E.G.: *How is it that local beef can emit more greenhouse gases than even fruit flown from halfway across the world?*

Z.A.: Fruit and vegetables that are coming from far away are often shipped by boat, rather than by plane, and shipping by water, over thousands of miles, can be a much lower impact than shipping fruits and vegetables, even very short distances. So in Portland, for example, if you are getting produce from Northern California, shipped by truck, that might be a higher greenhouse gas impact from the transportation than getting bananas from Central America by boat. And that's a common misconception. Eating locally is generally a good idea, in terms of carbon emissions, but usually not

**WHAT'S A HAMBURGER?**

■ The average American eats **90 pounds** of beef each year, representing more than **1 ton** of greenhouse gas emissions.

■ **1 quarter-pound hamburger = 6.4 miles** of driving

■ To offset the emissions from **15 hamburgers**, plant one tree and let it grow for **10 years**

■ That same tree would offset the emissions of **286 eggs**

■ If an average American stopped eating beef, it would be the same greenhouse gas reduction as driving **2,300 fewer miles** each year

■ Calories from a quarter-pound burger = **2 beers** (representing **1/3 the emissions**), **3 cooked eggs** (**1/6 the emissions**) or **3 apples** (**1/14 the emissions**)

SOURCE: ZAK ACCUARDI; PHOTO BY BY BURGERLOUNGE/WIKIMEDIA COMMONS

as big as folks think. The estimate from scientific literature is that eating produce that's produced locally instead of from far away reduces that food's greenhouse gas impact by about 5 percent. This only applies to an apples-to-apples – pun intended – comparison, and wouldn't apply to something like bananas, that don't grow in the Pacific Northwest, for example.

E.G.: *That's really surprising.*

Z.A.: Yeah, it is really surprising, and it's counter to a lot of the conventional narrative. Also surprising is that producing organic produce can actually be more carbon emission intensive than so-called conventional or non-organic produce – in some cases. One of the really big challenges for consumers is that it's very hard – if not in many cases impossible – to know, if you're choosing one carrot versus another carrot or one type of fish versus another, what the relative impacts are. That's a huge barrier to consumers making informed choices about their diet. That makes it hard in some cases to give really descriptive guidance on making food choices. It's sort of restricted to knowing the more general truths, and this general hierarchy, which the graph in the climate report (City of Portland's 2015 Climate Action Plan) is intended to convey: that greens and starchy vegetables tend to be fairly low impact, other fruits and vegetables are a little bit

higher, dairy and cheese are higher still, chicken is then higher, and then some types of fish, and so on and so forth on up to beef. Those general principles hold in most environments, but once you get more specific than that, it's really hard to make educated decisions as a consumer.

E.G.: *I hate to even ask, but how is it that organic farming can emit more carbon?*

Z.A.: Pesticides and industrialized agricultural practices enable greater production efficiency, by which I mean increasing the crop yield per acre of land. But that comes at the expense of many other things, and I'm not an expert in the many adverse impacts the use and overuse of fertilizers and pesticides can have on our water system and on nitrogen cycles, and those are important to consider. Climate and reducing greenhouse gas emissions is not the only thing that's important here, all the other environmental impacts are essential to consider as well. I am by no means saying people should take a message that organic isn't always better than non-organic in terms of gas emissions and take that to mean they shouldn't eat organic.

E.G.: *In terms of the way we are producing food right now, what does a low-carbon diet look like?*

Z.A.: One of the really great things I was thrilled to learn, and that was consistently reinforced throughout the literature I reviewed, was that a low-carbon diet looks a lot like what nutrition experts define as a healthy diet. In fact, for the Project Drawdown report, we may actually call this solution a "healthy diet" rather than a "low-carbon diet" because they seem to basically be the same thing.

In practice, what that means is that you're eating more vegetables, less animal products and less processed food. You're also not eating too much. There are three ways to think about reducing the impact of our dietary choices. One is choosing fresh food and foods that tend to be low impact, according to the general hierarchy – which is that some foods just tend to be lower impact than others.

The second is not eating more than you need to sustain yourself, and that's something that people don't often talk about in this context, but that can make a big difference. If you're in the habit of overeating by say, 20 percent, and then you just go back to eating what you need, you've saved a substantial amount of emissions by making a choice that's also going to make you healthier.

The third is the trickiest one, which I sort of mentioned already why it's tricky, but choosing specific foods from low-carbon sources. If you're choosing one potato versus another potato, then choosing the potato with a lower carbon impact, but like I said, that can be very hard to do in an informed way as a consumer.

E.G.: *Have you switched to a low-carbon diet yourself?*

Z.A.: Yes, I have. I'm not a perfect angel when it comes to low-carbon diet, but I do make a strong effort. I was a strict vegetarian for almost four years, up until about two years ago, and since January

2014, I've adopted a diet I describe as 98 percent vegetarian, wherein I basically cook vegetarian at home, when I go out to a restaurant I order vegetarian food, but if I am guest in somebody's home and they're cooking meat, or if I am traveling and I want to taste a particular regional specialty – like I went to Texas for the first time a year ago; I couldn't leave without tasting Texas barbecue, so I make exceptions for those sorts of things.

It's essential that folks understand that even though we do need to make very substantial changes to our dietary choices, these choices don't mean we can't eat one food or another, but it does mean we do need to eat less of some foods. In general, no foods are going to be off the table entirely, but we're going to need to do a very substantial amount of moderation, assuming that we don't find some sort of magic formula that lets us produce any kind of food that we want with negligible impact. Right now Americans eat almost a quarter-pound of beef every day on average. That's one cheeseburger every day. So people like me, who eat one cheeseburger on average maybe every year, are offset by people eating two cheeseburgers a day on average. And that's a totally unsustainable level that's going to need to get down to maybe a cheeseburger a week, maybe more like a cheeseburger a month. Maybe less than that; it's hard to say.

HOW DO WE COMPARE?

Countries with especially high meat consumption can emit nearly 50 percent more greenhouse gases per capita than those with low meat consumption.

Most emissions: Iceland

The diet of the average Icelander emits 6.8 kilograms of carbon dioxide per day, more than any other nation.

Most efficient: Japan

Of developed nations, Japan emits the least, with an average of 2.7 kilograms of carbon dioxide emitted per person per day.

United States: No. 22

The U.S. is the 22nd-highest per-capita emitter, at 4.6 kilograms of carbon dioxide per person per day.

Our neighbors

Canada emits about 10 percent less than the U.S.

Mexico emits about 40 percent less than the U.S.

SOURCE: ZAK ACCUARDI