

GEH Global Environmental Health Chat  
Climate, Food, and Nutrition Transcript

**Narrator:** This is the Global Environmental Health chat, the podcast that explores environmental health issues that transcend national boundaries. This podcast is produced by the National Institute of Environmental Health Sciences.

**Narrator:** The more we learn about climate change, the better we understand its wide-ranging effects. Our changing climate will affect agriculture, and, in turn, changes to food supply and quality may affect our health.

**Narrator:** In this episode, we speak with plant physiologist Dr. Lewis Ziska, associate professor of environmental health sciences at the Columbia University Irving Medical Center. He was formerly with the Agricultural Research Service of the U.S. Department of Agriculture. Dr. Ziska has also contributed to several reports of the International Panel on Climate Change.

**Narrator:** Agriculture is always sensitive to weather, but climate change could create permanent shifts in crop production. Plants, such as staple food crops, can be overlooked in the discussion of climate change and human health. For Dr. Ziska, they are key.

**LZ:** Plants affect every aspect of your lives: from the food you eat, to the medicine that you take, to the air that you breathe, to the quality of the water, to the fuel in your car. And as we change CO<sub>2</sub>, and as we change climate, that will come to affect all different aspects of plant biology, both in terms of public health, but also in terms of the environment and ecosystems.

**Narrator:** Rising temperatures, altered precipitation, and more extreme weather events are having dramatic impacts on how well food crops grow. Changes in crop yield could affect food availability in different parts of the world.

**LZ:** If you were to look at it from a crop perspective, one of the things that climate can do is causing these extreme events, extreme heat events. One of the things we see, and from a plant biology perspective, is that when the plant flowers, it's very sensitive to temperature. And if the temperature is too high, high at the time that it flowers, the pollen can become sterile.

As a result, you can get lack of any yield in terms of a seed crop, like corn, like wheat, like rice, which we refer to as the big three, because half of the global calories are represented by those three species. So that is a direct effect in terms of yield and production. Other extreme events, wind, hurricanes, tornadoes also have an effect with respect to production. But having that condition, where you have very high temperature occurring during the flowering period, especially if there's a drought, can really cause a lack of yield, because it impacts the crop so forcefully.

**Narrator:** Yield is not the only concern. Climate change can affect which crops are grown where. Heat and rising carbon dioxide concentrations are also likely to affect the quality and nutrition of food.

**LZ:** When you start looking at food, we often look at it from the perspective of production, how many bushels per acre do you get. And that's important, but there are other aspects that are equally important relating to the nutrition, nutritional quality, but also food safety. Climate change, and rising CO<sub>2</sub>, is likely to affect all three aspects.

Let me give you some simple examples for each one. When you start looking at production, and if you have a stable climate, then it's easy to plant one variety of wheat or one variety of corn, because the climate is stable. But if the climate becomes unstable, then having that one variety, that one single set of DNA, being able to deal with climate change is not going to work out well for you. What's likely to happen is that production is going to be adversely affected.

In addition, that same climate, that same increase in carbon dioxide is going to have its own effect with respect to biological constraints, insects, weeds, diseases, are also going to be affected. And that in turn is going to affect your production as well.

**Narrator:** Crop production is important. But there may also be changes in the quality of food crops and in nutritional value. A food plant's ability to produce proteins, minerals, or vitamins can be reduced by too much carbon dioxide in the atmosphere.

**LZ:** When we look at food nutrition, there is work that I've done, work that many others have done, showing that as carbon dioxide rises, it affects plant chemistry so that the protein levels of rice of, wheat, of barley, potatoes are going to go down. In addition, there's also a number of indications that elemental analysis will change. Iron that you need from your food, zinc that you need from your food, will also decline. And finally, when you start looking at food safety, this is really a no brainer because we know that pathogens, everything from E.coli to Clostridium to salmonella, like heat. And when you increase temperature, you're more likely to cause a greater outbreak of those pathogens. There's more an incredible need to begin to look at food safety in the context of climate change as well. So production, nutrition, safety, are all going to be adversely impacted with respect to rising CO<sub>2</sub> and climate change.

**Narrator:** Foodborne illness is caused by the ingestion of contaminated food. Contamination from pests, fungi and mold growth, or bacteria can occur throughout the food system. Most common pathogens like norovirus, salmonella, and E. coli can produce symptoms including diarrhea, fever, and abdominal pain.

**LZ:** When we talk about food illness, we often refer to it as food poisoning. According to the CDC, about one in every six individuals in a year in a given year, undergoes, the typical issues related to taking in bad food, you get sick you throw up, you have all kinds of consequences as a result of that. Those are related in large part to the kinds of pathogens that can occur within the food.

**Narrator:** Dr. Ziska went on to explain how these safety concerns can be affected by climate change.

**LZ:** When you start looking at temperatures an obvious environmental variable, that's going to have a direct effect for a number of these different pathogens. Drought is another one. Let me give you a quick example. One of the things that is recognized globally, as being a threat from food is related to

mycotoxins. These are toxins that are produced by fungi that are basically breaking down the food, as it sits there waiting to be consumed. And of all these toxins, aflatoxins are recognized globally as causing liver cancer; they're a carcinogen. No question anybody's mind, what happens when you have higher temperatures, what happens when you have a drought is that the degree of mycotoxin infection goes up, not just a little, we're talking orders of magnitude, or at least an order of magnitude. And, as a result of that, the degree of mycotoxin that increases is phenomenal.

And so understanding how rising temperatures, how drought are going to impact these aspects in regard to food safety is extremely important. And in my humble opinion, we have not done nearly enough to understand how climate change is going to impact not only mycotoxin. But the other pathogens that we know are affected by temperature.

**Narrator:** In the U.S. and most other higher income countries, food safety is less of a concern than in other parts of the world. But countries may face new challenges for controlling pests, bacteria, and mold, as Dr. Ziska described. In some parts of the world, food quantity and quality issues may contribute to a concept known as hidden hunger.

**LZ:** We have both the best of times and the worst of times. The best of times is that the agricultural sector is able to grow enough food for everybody in the world. It's a phenomenal achievement, that the Ag, the land, the processes, the way we harvest food, the amount of food we can harvest is phenomenal, unprecedented in human history. And yet, we have in the worst of times, not enough food to go around to the ones who need it the most. As part of not having enough food, we also have an issue with respect to quality.

When you start looking at things like zinc, which are related to malnutrition, though the absence of zinc, the absence of iron, the absence of some of the essential amino acids and other quality, quality parts of the food, that's referred to as hidden hunger. You may have enough food, but you don't have a quality of that food that will support the lifestyle that you want. It can happen in urban areas; it can happen in poor areas., It's really a consequence of diet, as well as access.

**Narrator:** Fewer nutrients in essential food crops due to increasing carbon dioxide can have important implications for global health.

**LZ:** What I do know is that as a result of rising CO<sub>2</sub>, and the effect of CO<sub>2</sub> on plant chemistry, because plants, most plants, 90%, or more, don't have optimal levels of CO<sub>2</sub>. What's happening is that CO<sub>2</sub> is causing plants to grow more. But because the soil nutrients are not increasing in step with what's happening to atmospheric carbon dioxide, you're seeing this widespread chemical change in plant biology. As a result, we see a decline, and protein a decline, in elements and potentially a decline in vitamins.

When you break that down and look at particularly poor countries that rely on one or two grains as the primary source of calories, then there, those countries are particularly risk for any climate and or carbon dioxide shifts with respect to the dietary composition of the food that's being consumed. For example, in Laos, more than 50% of the population depends on rice as a principal source of calories. One of the

things we've seen in a number of studies is that as CO<sub>2</sub> increases, as it's already increased, that it's going to drop the zinc concentration in many of the rice lines that are currently being grown. As a result of that, you're going to have zinc deficiency, that zinc deficiency in turn is going to affect the growth rates for a number of children that are currently being born in Laos and elsewhere, because of the high reliance on a single cereal.

**Narrator:** While we're learning that some food crops could become less nutritious, questions remain. Dr. Ziska says more research is needed to better understand how climate change, especially more carbon in the atmosphere, might affect plants and agricultural practice.

**LZ:** And what we have found is that when you change CO<sub>2</sub>, when you change climate, the crop may not respond. But the wild relatives of the crop, the worst weeds in that crop will respond, and they will grow more. In fact, in some cases, they may be in terms of nutrition, better supplied. So why can't we use that response as a means to begin to understand why? Why are those particular lines those wild lines responding? And can we use a greater understanding of that why to begin to breed to begin to select for crops that do respond to carbon dioxide in a way that both increases the amount of carbon being stored, but also takes more of that carbon and puts it into food.

**Narrator:** With more knowledge about climate-related effects, countries will better determine which crops to grow and how they are grown. Different places will adapt in different ways in their response to a changing climate. Research can inform adjustments to food production and nutrition, along with ways to ensure food safety.

**Narrator:** The National Institute of Environmental Health Sciences funds research to better understand the health effects of climate change. You can learn more about the institute's research by visiting our website at [www.niehs.nih.gov/GEH](http://www.niehs.nih.gov/GEH). Thanks again to Dr. Lewis Ziska for joining us today. You've been listening to Environmental Health Chat, brought to you by the Global Environmental Health program at the National Institute of Environmental Health Sciences.