

Climate Change and Agriculture
Farms, Food and You Episode 29
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Agriculture is, of course, affected greatly by storms, droughts, floods, heat and cold, and that makes it vulnerable to climate change. Experts discuss how climate changes affects North Carolina ag, how ag affects climate change, and how the industry can help address it.

Dee Shore (00:03):

As we all know, weather can wreak havoc on a farm. In a blink, droughts, floods, cold and heat can destroy crops. That's why agriculture stands to lose more as the climate changes than other economic sectors do.

But when it comes to climate change, is agriculture a good guy, a bad guy, or both?

I'm Dee Shore, of North Carolina State University's College of Agriculture and Life Sciences, and in this episode of Farms, Food and You, a state climate expert, a North Carolina State University economist, and two university soil scientists weigh in on climate change's impact on agriculture.

They also talk about farming's impact on climate change and agriculture's role in helping address the problem.

[Music]

Dee Shore:

While it used to be debated, scientists have determined that climate change exists and that it's changing our planet.

Its effects are being felt differently in different locations, but worldwide glaciers are shrinking, sea levels are rising, and plant and animal ranges have shifted.

In some places, impacts on agriculture are already taking place and are projected to get worse.

Rebecca Ward, assistant director of the North Carolina State Climate Office, explains.

Rebecca Ward (01:31):

Agricultural production is really highly sensitive to weather and climate. The things that come to my mind immediately are droughts, heavy rains, and flooding and cold snaps in the late spring. These are things that farmers might have to deal with on any given year, and that's without adding climate change to the picture.

But climate change is here, and it's altering this world that we live in. Our temperatures are getting warmer, our precipitation is falling as more extreme events, and all of us on this Earth are having to deal with it. But agriculture, especially, is at the interface and going to be dealing with it a lot.

Dee Shore (02:07):

In North Carolina, the most dramatic effects of climate change are seen in ghost forests. Its dead trees are striking: no leaves, few limbs, just gray trunks where living, life sustaining trees grew along the coast, estuaries, rivers and creeks.

Ecologists and forestry experts say that the trees are dying for several reasons: Insects weaken them, temperatures and precipitation levels are changing, and the intrusion of saltwater from rising oceans is essentially poisoning them.

Carl Crozier, a professor emeritus of soil science at NC State, describes factors that contribute to saltwater intrusion.

Carl Crozier (02:57):

If there's a long period without rain, there's less fresh water flowing down the river and creeks so the saltwater moves up that channel. If people are withdrawing more fresh water from the shallow aquifers, through their wells, that's less fresh water in that ground aquifer, and seawater can move into those spaces. Likewise, if we drain land, that's close to the coast – and particularly some of the organic rich soils which are out there – when we drain them and farm them with annual crops, that soil basically settles down, or consolidates or oxidizes, and the soil level actually lowers. And those all make it easier for saltwater to move in. And if sea level rises that favors the movement of saltwater into the coast.

Climate change is very closely correlated with more rapid rise in sea level that we've seen in recent decades or probably since the Industrial Revolution. That changes the base sea level, which makes it easier for water to come in, and then it also can change the intensity of storms, so if we have a stronger storm with a higher tidal surge associated with it, then that can drive saltwater farther in.

Dee Shore (04:23):

You may be wondering what ghost forest and saltwater intrusion have to do with agriculture. Crozier says that saltwater is toxic, not just to trees, but also to some crops.

Carl Crozier (04:37):

Just like we can't drink salt water, most of our crop plants can't tolerate high-salinity water. The other thing is many soils, when they're high-salt concentrations, the soil can basically form almost a sealed surface where it becomes less permeable. And that makes it harder for any rainwater to flush through the soil and rinse salt out.

And if there are bare ground areas within a field, if you have the vehicle traffic on bare ground, it tends to pack it even harder, and then that makes it even harder for the next year's crop to grow.

Dee Shore (05:19):

Along the creeks and rivers that empty into the Pamlico Sound, the salinity increase has led some farmers to abandon fields where they've lost crops. If the trend continues, it could have an even more significant impact on farming in North Carolina's Tidewater region.

Carl Crozier (05:40):

The slow trend of environmental change, even without human impact, was slow rise in sea level since the last glaciation. And that has sped up, I think, with the human impact, so if those are not reversed, a noticeable change. It is not dramatic a year at a time, but certainly I think every generation of farms is going to find it harder and harder to maintain the practices that they're using now, so they will have to look for some alternative way to become a farm business going.

We're definitely trying to make more farmers aware of it, how serious it could be.

Dee Shore (06:24):

While climate change affects farming, agriculture also contributes to greenhouse gas emissions that cause climate change. Rebecca Ward offers data from the Intergovernmental Panel on Climate Change.

Rebecca Ward (06:40):

Agriculture, forestry and other land-use activities account for globally about 23% of total net anthropogenic emissions of greenhouse gases. That's a pretty big contributor globally. And if we associate the pre- and post-production activities into that global food system, then that becomes a little bit larger. Coming more to the U.S. – this is from the Fourth National Climate Assessment – the agricultural sector accounted for about 9% of the nation's total greenhouse gas emissions in 2015. That's the most recent number I could find. So reducing emissions in the sector could have a really significant impact on our total emissions.

Dee Shore (07:24):

The experts I talked to said that agriculture emits three greenhouse gases: Rice paddies and livestock manure, for example, emit methane. Fertilizers contribute to the buildup of nitrous oxide in the atmosphere. And just as it does in cars, the combustion of fuel in a tractor engine adds to carbon dioxide levels.

On the flip side, scientists say agriculture also helps with climate change. Here's what Rod Rejesus of NC State University's Department of Agricultural and Resource Economics has to say.

Rod Rejesus (08:08):

What's the saying in elementary school? Plants inhale carbon dioxide and exhale oxygen, so since it absorbs carbon dioxide, it helps mitigate the carbon dioxide in the atmosphere, but also certain agricultural practices, like soil health practices, helps cover the soil and also helps sequester carbon in the soil.

Dee Shore (08:33):

In fact, some scientists think that if more farmers adopt what are called climate-smart practices, agriculture could absorb more carbon than it emits. These practices include planting crops to cover soil between growing seasons, rotating crops, integrating livestock and crop production, and improving water management.

Enthusiasm for such practices seems to be growing – so much so that companies are paying some farmers to increase the carbon stored in soils. Federal legislators have also pushed for it. And so has President Biden. But there are scientists who questioned whether these practices will make a difference when it comes to climate change. That’s why they are calling for more research.

NC State’s scientists are already making headway in reaching conclusions. An anonymous donor interested in soil, carbon sequestration and greenhouse gas mitigation strategies gave \$1.3 million to fund some of this research.

Alex Woodley is one of the soil scientists involved in the funded projects. He’s digging into questions related to how management of agricultural soils influence greenhouse gas emissions.

While most researchers look at losses over a season, Woodley is pioneering ways to use above-ground chambers equipped with monitoring systems to measure emissions in real time. At the Cherry Research Farm in Goldsboro, he’s also comparing how emissions differ among conventional, no-till, and other soil management practices. He conducts that regionally specific research as part of the Center for Environmental Farming Systems, or CEFS.

Alex Woodley (10:34):

We have these chambers embedded in these long-term systems. The amazing thing about CEFS is that we have these 20-year-old management systems. We're seeing depending on how you manage the land, if you add poultry litter and they're organic, it shifts when the losses are happening. The story is not out on which one's the best. It's very complex. And then in 2020, unfortunately we had to pause the collection with COVID, but we're ramping back up for this year. We're going to look at more focused work on carbon sequestration strategies and inputs, such as using things like biochar.

Dee Shore (11:05):

Biochar is created from agricultural byproducts, like wood chips that are heated to high temperatures until they turn into what looks like charcoal. It's used as a soil amendment. Woodley's also incorporating biochar into another study related to the painful three-year period when farmers shift to organic production but their crops aren't certified yet as organic.

Alex Woodley (11:34):

We're looking at a rapid soil health study where during that transition to organic agriculture, if you do an additional investment of adding high amounts of carbon, either through composts or biochars, do you really boost your soils? When you come out of this, do you have a really high functioning soil system? And we're comparing that to farms that have been in organics for 15 to 20 years. Instead of saying, "Can we short circuit that, and are these soil carbon inputs really going to show a lot of improvement in terms of yield and soil health function?"

Dee Shore (12:07):

At the Sandhills Research Station in Jackson Springs, Woodley's team is measuring soil-water content to see how it's affected by rye cover crops, rolled and left on the soil surface as a residue. Data from 2020 showed that cereal rye provided greater water storage to the system. That'll be important if this area has more rainfall variability and more intense droughts.

At the Upper Mountain Research Station in Reidsville, a long-term experiment on corn and soybeans has shown that in hot, dry years, healthier no-till soil showed far higher corn yields compared to yields achieved in degraded tilled soil.

Alex Woodley (12:56):

When it's really dry, you get really a huge benefit. When everything's perfect, the benefit's not quite as large, as you want to have a safety net of your soil being healthy enough to absorb inclement weather or more extreme changes. That gives us some inferences about future climate change. We're going to expect more of these non-ideal years. Having a healthier soil and a more stable soil is important.

Dee Shore (13:21):

To help ensure that his work yields results farmers will adopt, Woodley works with other scientists – data scientists, animal scientists and horticultural scientists – as well as economists like Rod Rejesus.

Alex Woodley (13:36):

Doing this research from an agronomics standpoint – so you're adding all those carbon; that's great for the atmosphere and global warming potential and carbon sequestration. But if you're going to get yield losses, or complicate your system, it's not going to be widely adopted. So getting the kinks out in terms of productivity and yield, and then economics with Dr. Rejesus, is important.

Dee Shore (14:01):

Whether farmers adopt the strategies under study will help determine the answers to the question we posed at the beginning of this podcast: When it comes to climate change, is agriculture a good guy, a bad guy or both?

And it appears that agriculture may turn out to be a hero in the struggle to stop and reverse climate change. As U.S. Agriculture Secretary Tom Vilsack recently said, "With the right tools and partnerships, American agriculture and forestry can lead the world in solutions that will increase climate resilience, sequester carbon, enhance agricultural productivity and maintain critical environmental benefits."

In other words, agriculture can make a significant difference in ensuring we tackle climate change challenges that threaten the future of our planet and our society.

At the same time, with the kind of research that's occurring because of climate change, farmers could acquire even more knowledge and develop technology to help agriculture overcome food insecurity, another one of the greatest global challenges.

Rejesus sums up well why we all – farmers and consumers alike – should care.

Rod Rejesus (15:24):

Remember the slogan, “If you ate food today, thank a farmer.” That in itself answers the question.

Agriculture is critical to the food that everybody eats every day, and economists will say, “It’s supply and demand,” right? If climate change affects agriculture, then it will impact the amount of food available, the supply, and, of course, prices would go up. If prices go up, the price that consumers have to pay goes up as well.

It might reduce the amount of food available for them to eat, and eventually you will affect food security of countries. So it’s all interrelated.

Climate change is one of the biggest societal challenges of our generation and perhaps the next generation. And the search and research for ways to mitigate and adapt to this phenomenon needs to continue, especially if we are to have a robust agricultural sector – not just in the U.S., but worldwide – that could help meet food demand of a population approaching 10 billion people by 2050, and I hope NC State, and me, will be part of that moving forward.

[Music]

Dee Shore (16:52):

Thanks for listening today, and we hope you'll join us for the next episode of Farms, Food and You. I’m retiring soon, so this will be my last episode as producer and host. There’ll be a new host soon, and in the meantime, I’d like to wish you well and encourage you to visit our website at go.ncsu.edu/farms to find earlier episodes. While you’re there, send in your ideas on topics you’d like for us to explore in the future.

[Music]