

**FACING THE GREATEST CHALLENGE OF OUR TIME:
AGRICULTURE'S ROLE IN IMPACTING CLIMATE CHANGE**

Panel Moderator: Mrs. Debbie Reed
October 16, 2019 - 3:20-4:10 p.m.

Introduction

Steven Leath

Member, Council of Advisors, World Food Prize Foundation

Folks, we're going to start our transition to our mid-afternoon panel, and the panelists are making their way up there, which is really great. I will say that this panel is going to take on one of the greater challenges in the world today, and that is global climate change. We're going to look specifically at agriculture's role in impacting global climate change, so if we can get everybody kind of focused and in their seats, it would be helpful. I know you love to talk to each other and visit, and there will be time for that this evening.

All right, for those who don't know, I'm Steve Leath. I'm one of the members of the Council of Advisors in the World Food Prize Foundation. It's my pleasure to introduce this panel, and this panel is going to be convened to talk about how the agriculture industry and the food supply chain and food systems in general can effectively produce sufficient, healthy food while removing greenhouse gas emissions from the atmosphere, so we're not just talking about carbon-neutral. We're going to have a climate-positive type agenda here.

Our panelists include Mr. James Collins, who is the CEO of Corteva Agriscience. He's spent 35 years with Dow DuPont and took over Corteva after the merger of the two companies. We also have David Festa with us, who is the Senior Vice President of the Environmental Defense Fund's Ecosystem Program, previously served as a policy director in the Department of Commerce during the Clinton administration and was part of the Obama transition team. Erin Fitzgerald is joining us. She is the CEO of U.S. Farmers & Ranchers Alliance and has been recognized in Chicago as 40 Under 40 and is an avid voice for sustainability and social responsibility. Rattan Lal is a distinguished university professor of Soil Science and Director of the Carbon Management and Sequestration Center at the Ohio State University. He is also the recipient of the 2019 Japan Prize.

Now, as I said previously, despite having this great group of panelists, they need a leader and we have one in Debbie Reed, who is the Executive Director of the Ecosystem Services Market Consortium. She's worked at the White House in the Council of Environmental Quality as Director of Legislative Affairs and Agricultural Policy. So, Debbie, I'm going to turn it over to you.

Panel Members

Mr. James Collins CEO, Corteva Agriscience
Mr. David Festa Senior Vice President, Environmental Defense Fund
Ms. Erin Fitzgerald CEO, USFRA
Dr. Rattan Lal University Professor of Soil Science, Ohio State University

Panel Moderator

Ms. Debbie Reed

Executive Director, Ecosystem Services Market Consortium

Thank you so much, and, welcome, everyone. As indicated, I'm Debbie Reed with the Ecosystem Service Market Consortium. I want to thank the World Food Prize Foundation for hosting this and for all the work that has gone into setting this up and also for Jim Collins, who started this dialogue last year and promised to come back and kind of give you an update on what we're doing here.

Climate change is, obviously, I think, the most defining issue of our time. It's absolutely imperative that we address climate change. It's an incredibly complex issue and one that I think transcends a lot of the individual issues that we work on, and we're required that we come together to address it.

My issue, the issue's actually incredibly important to me and also my organization, the Ecosystem Service Market Consortium, we're working to develop for the agriculture sector carbon markets and ecosystem service markets to help create an opportunity to pay farmers for the work that they can do to help us actually solve the issue of climate change. ESMC is a member-based consortium, and working for farmers and ranchers first and foremost and recognizing them, rewarding them for their services is what we're built around.

We started in 2017 by really trying to assess the challenges and the obstacles encountered over the past two decades in ecosystem service markets for agriculture. We see it as a tool really to help address climate change, to scale the impacts and the outcomes. Without engaging and enrolling farmers and ranchers in these opportunity sets, we can't possibly hope to scale the impacts that we're all seeking.

Yesterday in my capacity at ESMC, I was fortunate to participate in a dialogue that Jim actually hosted in which the role of agriculture and food production systems was a central focus. And I was really struck by something that one of the participants said – Elwyn Grainger-Jones of CGIAR. I was struck by what he said and how he said it. And I'd like to paraphrase him now, because I think it's actually a good way to encapsulate how we think about addressing a really complex sector like agriculture and creating solutions for climate change.

So I'll paraphrase what he said. I'm using a little bit of poetic license, but he talked about how we have to get away from incredibly compartmentalized solutions to the issues that we are all facing as a society. And climate change is clearly an incredibly complex issue. He talked about how compartmentalized solutions and compartmentalized approaches to problems have allowed issues that are incredibly complex and that transcend some of these problems to grow and that we really need to look for simple approaches, not simplistic approaches but simple approaches that help us overcome these silo'd approaches. And I think we're all guilty of

thinking this way and of working this way. And many of us were actually trained and taught to look at issues and to make them into smaller, if you will, bite-size approaches that we can then address and create solutions for. But I think, as Elwyn implied, we've kind of lost the forest for the trees on major complex issues like climate change. He suggested we need to transcend our traditional boundaries and our siloes, including geography, scale, public/private partnerships, and we really need to embrace the complexities but again look for very simple solutions.

I think that's a nice way to tee up this discussion—right? We're talking about incredibly complex food and agricultural systems, but agricultural systems actually aren't elegant solutions to the issue of climate change.

Before I turn back to the panel, though, I want to emphasize one last thing. This is really “go time.” This is the time we actually need to act. We no longer have the luxury of thinking about what policies, what programs, what approaches we'll take. Scientists have made perfectly clear that a lot of the extreme weather events, the flood, the drought that we have been seeing, the human misery that has been caused by this, will continue and will escalate if we don't address this issue of climate change. Agriculture can be part of that solution and that solution set, and it can actually create additional benefits. You'll hear Rattan Lal talking about the fact that soil carbon sequestration, for instance, is not just good and essential as a draw-down technology but it improves soil health, soil fertility, productivity. It has many beneficial impacts.

So I'd like to turn to the panel now to talk about some of these issues, and then we'll have a Q&A discussion afterwards. Starting with Jim—thank you, Jim.

Jim Collins

Great. Thank you, thank you, Debbie, for those opening comments, and it's a real privilege to be here today. It's especially a privilege to be here with the other panelists. We had, as Debbie said, the opportunity to spend the better part of a day yesterday together exploring this topic, and a big part of what we'll talk about is how we all learn together, and I can say I greatly benefited from the interactions with folks the last few days.

I'm proud to be here representing Corteva Agriscience. As many of you know, the company was recently born on June 1st after a prolonged, three-year journey through a merger and then a de-merger to form Corteva. So for the 20,000 employees that I represent around the world, we're excited to be here.

As President Leath said in his opening comments, a year ago I, during a keynote speech, kind of set out, accepted a challenge that Ambassador Quinn had given me. And that was to, over the next ensuing year, to reach out to the stakeholders in business, government, academic, NGO, communities and others who have really been at the forefront of thinking about agriculture sustainability. The mission of that reaching out and convening was to explore this topic of how could we create a more carbon-negative, or I like to say a more climate-positive agriculture industry around the world. And then Ambassador Quinn invited us to come back this year and to do the readout from all of those discussions, so here we are.

Now, to be honest with you, I wasn't sure what kind of reaction I was going to get by taking on that challenge. After all, so many folks here in this room, so many farmers around the world have already done some extraordinary work in mitigating carbon and developing some incredibly environmental sustainable agricultural practices and technologies. So I wasn't sure

that the world really viewed this as a problem that needed to be solved. I was thinking – would there be appetite to join up with kind of the new guy in the room here with Corteva coming into being, a company that was just a few months away from being spun off.

What I can say, all of my concerns were quickly dispelled. I talked to some of you right here in the room after the speech, and you immediately raised your hand and volunteered, and some of those folks are here on the stage with me. There was a thirst and a passion to collaborate and coordinate so that we could tackle what most folks do acknowledge is undoubtedly one of the biggest challenges of that time – and that’s how do we manage the issues around climate.

So since that announcement, we held convenings in the Netherlands, in Singapore, and in Washington, DC, and as I mentioned yesterday, we convened a fourth session right here at our facility in Johnston. In all of those convenings, we had farmers. We had organizations representing every facet of agriculture and food production, manufacturing, research, education, public policy, environmental sustainability. And like the other meetings, yesterday’s meeting, as I said, was incredibly productive. We at Corteva have come away from all of this more committed than ever to use these multilateral partnerships that we’re building and build on the great progress that we’ve made over this last year.

So, in fact, today I will be announcing that we’re prepared to use our resources as the world’s largest pure play global seed crop protection and digital agriculture company to advance the science behind making our industry more climate-positive. And we won’t do that in 20 years or in 10 years. We’re going to start now. We’ll do so by working with partners who have been diligently addressing this challenge across so many of our disciplines from chemistry to genetics to digital to predictive ag and to other agronomic tools.

And our commitment will expand what I like to call the three C’s. First we *collaborate*, then we *capture* the best ideas, then we *catalyze* them into action. So I mentioned, collaborating with others worldwide to deploy our best ingenuity to capture carbon. And by doing so, we will catalyze, I believe, a much broader movement. This is also about building upon tremendous progress that we’ve learned about. So, we are starting from a position of strength here, and I think you will hear some of that from our other panelists.

And we already know our growers, our farmers around the world, are already the best stewards of their land. In fact, I would say no one really understands the value of sustainability more than a grower. Most farms have been in families for generations, and with that comes this incredible desire to build upon that legacy. In the U.S. alone, no-till efforts were applied to over 104 million acres in 2017, and more than 15% of all U.S. farmland or about 140 million acres is dedicated to conservation and wildlife habitat restoration. So, part of our intent is to highlight our growers’ successes and using their learnings already to accelerate the progress.

As Debbie said in her opening comments, progress will only come if we make this easy for them. Part of that means developing a regulatory environment that rewards our innovation and allows farmers greater flexibility to implement the innovative practices that we have. So, our industry must be given the flexibility and the incentives to develop new seeds, new crop protection products and to help us drive much faster towards more climate-positive. We just need to create the right solutions that are additive and sustainable for all farmers, whether you’re a smallholder farmer in India or Africa or some of the largest farms in the Americas.

We also know that we can't ask others to do what we're not willing to do ourselves. So, we're exploring in our own seed production operations, looking at where we can become climate-positive, as well our role to partner with farmers who work with us day in and day out to operate more sustainably and more profitably.

So our first order of business is to take this climate-positive lens to the millions of acres around the world that we have seed research and seed production facilities on. We believe we can create a powerful model by being a role model and looking at our own carbon footprint.

We're also committed to leveraging the best science and tools inside and outside our system to make measurable progress. So today, in keeping with the transition of announcing good things here at the World Food Prize, we're announcing that we're taking an initial step designed to catalyze this movement going forward. We're going to commit half a million dollars to what we are calling the "Climate-Positive Challenge." We understand the challenges that farmers are facing today around the world – trade, policy, weather, pests. These reasons are the primary drivers why we are announcing this opportunity now. It's to provide some new incentives for those farmers who have a keen eye for experimenting with new practices and are ready to scale those.

This is an initial investment we think will serve as some seed capital to create a fund that will reward efforts focused on offsetting carbon emissions and protecting the environment while sustaining farms and sustaining farmers. We hope to encourage partnerships between growers, production partners, and other allies at the field and the farm level to drive progress and to share their key learnings more quickly and more broadly. This challenge, these incentives will focus on the farm gate, because so many of our farmers, as I've said already, are already advancing very innovative climate-positive practices. So, we want to challenge them to partner with local environmental groups, universities and their other growers around them to help scale their already great efforts beyond their own acres. And we'll be rewarding the most innovative efforts.

We're encouraging other ag companies to support similar efforts to identify and measure and pilot and scale some of these best-in-field practices and again in encouraging other companies in the industry to share their key learnings with others. Now, this very farm- and field-centric initiative will be activated through our relationships. It is also open for innovation across all seed crop protection and digital platforms. Now, this isn't about establishing a new standard or establishing a mandate. Rather, it's an open, voluntary innovation process to bring forth some really great ideas and test them on a broader scale, so we can scale them immediately.

Now, we know none of this, of course, can happen in isolation, and this is why we're creating this challenge. We're asking others to join us in pursuing the goal of catalyzing some of these practices that we'll explore more here.

And, finally, let me be absolutely clear on one point. Our growers today face a growing set of challenges and burdens. And so our efforts will be designed not to add to those problems but instead to be focused on helping them overcome these issues. So we look forward to working with each of you to create a more climate-positive industry. The door is open, the lights are on, and you're all welcome. I look forward to the rest of our discussion today.

Debbie Reed

Thank you, thank you, Jim. And Dr. Lal.

Rattan Lal

Thank you so much, Debbie. It's a great pleasure to work with you since '97. We both are very young. I want to also thank Ambassador Quinn for inviting me and as well congratulate him for excellent achievement that he has made to the World Food Prize and awareness of agriculture.

The global population since 1960 to 2019 went up two and a half times. The global cereal production between the same period went up 3.3 times. Therefore, the per capita cereal production went up 64% over that time period, and this is what I would like to call the "Borlaug effect." That is how it happened. And I think the contribution of this tremendous agricultural achievement, that has never ever happened before, goes to people like Norman Borlaug, [M.S] Swaminathan, Gurdev Khush, [Sanjaya] Rajaram, many other people who made that contribution.

In the same period of time, nitrogen application went up ten times, phosphorus application went up five times, potassium four times, pesticide, I do not want to tell you how many times, because when you divide anything by zero, that will begin in 60 what that number is.

Erosion...one and a half billion hectare by water, wind erosion 0.5 billion hectare. Sediment transport into the rivers and the ocean, 36 gigaton, compared with 16 gigaton before the humanity started working on it. So there is what Barry Commoner said, there is no such thing as a free lunch. There is a price for those morsels we are getting. The question really is how to reconcile – and I want to use the word "reconcile," – the need to feed the 10 billion people with the absolute necessity of improving and restoring the environment. It's not either or. It has to be both, and that "both" part is the one which is very critical to think why.

Since agriculture began about 10-12,000 years ago, landscape – the trees and the soil – has contributed about 550 gigatons of carbon into the atmosphere. Compare that with the fossil fuels in 1750, about 435. Soils have lost 135 gigatons. The soils of developing countries, sub-Saharan Africa, which by the way bypassed the Green Revolution, the so-called "Borlaug effect" or the crop yields in Africa is stagnant, about 1.2 tons per hectare in 1960 to about 0.8 tons per hectare – very stagnant. The reason is because the soils are ignored.

So how do we reconcile that, and one of that part is restoring the soil carbon stock. And at this point I want to first make two statements. One is that the health of soil, plants, animal, people and ecosystems is one and indivisible. If the health of soil go down, the health of the people go down with it, and the health of the environment go down with it. That part must be understood very clearly. The second part is that when people are poverty stricken, hungry, miserable, and suffering, they pass their misery onto the land. You can see it around the world, and you see the similarity between the land and the people. It doesn't matter where you go. They go together. Therefore, soil must be managed in such a way that we restore that balance between people and the land. If that balance is disturbed, then it is very difficult to reconcile the need to produce food and meet the environment.

So, this is what brings me to the question of how to restore the land, and what can be done. There are several global initiatives, 4 Per 1000, adopted by COP21 in Paris. It was, in fact, discussed by Minister La Foll from Paris in my lab for two days, and we discussed how can we balance the soil carbon stock. And he came up with the figure the global need is 3.6 gigatons per

year. I told him that the maximum technical potential, maximum under ideal conditions, ideal is 2.5 gigatons per year in soil - maybe another 2 to 2½ gigatons per year in the forest under ideal conditions. Right now you understand 11 gigatons is emission from fossil fuels. So 2½ gigaton of 11 gigaton... you can work it out yourself. The maximum potential is 20%. So the people ask the question – why 20%? What is that? Absolutely important to understand that there is not possibility to compensate, offset 11 gigaton from fossil fuel combustion, every year, increasing by 2, 3% every year, by storing in soil and trees. So, no carbon fossil fuel alternate sources has to be developed sometime between now and then. But in the meantime, the low-hanging fruit, the most cost-effective option is soil, and vegetation, and the terrestrial biosphere. And that low-hanging fruit, the potential total we between now and 2100 is about 350 gigaton over the next 80, hundred-year period at the rate of about 2½ gigaton per year, and on that depends the food security, the nutritional security. And nutritional security is very different. They got 1 in 7 suffering from food insecurity. You've got almost 2 to 3 in 7 suffering from malnutrition. Water quality, the alga bloom issue, the biodiversity issue – all those depend on the idea of restoring soil health. So the climate is just one part.

So the question really arises – how can we motivate farmers, land managers, to adopt conservation agriculture, agroforestry, biochar, and whatever you want. Everything has a price. The Chicago Climate Exchange and the price went up to about \$4 per ton of CO₂ and collapsed. The actual cost of converting biomass carbon, first, you are asking the farmer to leave the biomass on the land, not use it for any other purpose. That's one cost. The biomass carbon has carbon to nitrogen ratio 80 to 100 versus humus having about 10. There is the addition of nitrogen, phosphorus, sulfur and other inputs required. The cost of that in 2014 at the Chicago Climate Exchange market was \$125 per ton of C. If we sequestered one third of ton in Midwest United States, that's about \$40 per hectare. That's about \$16 per acre. If you want farmer to adopt those practices, that's what the cost is. Otherwise, it's very difficult. Is that cost too high? Absolutely not. If you want to inject CO₂ a mile deep into the ground, you know what the cost is – tremendously high. On the one side of it, we are willing to pay that cost but not pay the farming community. That's a question of policy that we have to understand.

The other part which is very critical is this. We have 700 million hectare under cereal production right now. If we can bridge that yield gap that I was talking about to Africa, South Asia, and other parts of the world, there is no reason why we have to have more than 500 million hectare of land – 200 million go back to nature. Fertilizer consumption at the moment is 200 million tons. If the efficiency can be used and improved properly, there's really no need to have more than a hundred million tons of fertilizer. So the idea is to produce more and more from less and less by increasing efficiency and saving the land back for nature. So there are many, many benefits that really come.

That brings me the question of rights of soil. Soil is a living thing. It breathes just like we do. A handful of rich soil has millions of organisms, more than the biodiversity in the Amazon. So if the soil is a living thing, just as any animal has a right, humans have right, a butterfly has a right, panda has a right, bald eagle has a right, soils also go extinct. Soils are also endangered. Why do not soils have a right? In the United States, we have Clean Water Act. We have Clean Air Act. There is no healthy soil act, none whatsoever. Is it possible to have clean water and clean air without having healthy soil? Impossible. It's about time to think about a healthy soil act. That means anybody who deliberately destroys or ruins soil has a legal implication to that effect.

I also want to share with you a belief that I believe very strongly. Degrading soils, depleting soil organic carbon pool, drying out lakes, rising sea levels, drought and hunger driven migrants, jumping into the Mediterranean, changing the politics of Europe forever are more real threat to global peace than the weapons of mass destruction. Think about it. And that requires a very absolute thinking, how we manage the soil, how to bring the industry to do it.

Soil really, Debbie, is a bridge to the future, and we here are really those to help build those bridges. And that brings me to something. An old man – and that wasn't me – he said,

An old man going down a lone highway,
Came, at the evening cold and gray,
To a chasm vast and deep and wide.
Through which was flowing a sullen tide,
The old man crossed in the twilight dim,
The sullen stream had no fear for him;
But he turned when safe on the other side
And built a bridge to span the tide.

"Old man," said a friendly pilgrim near,
"You are wasting your strength in building here;
Your journey will end with the ending day,
You never again shall pass this way;
You've crossed the chasm, deep and wide,
Why build this bridge at even tide?"

The builder lifted his old, gray head;
"Good friend, in the path I have come," he said,
"There followed after me today
A youth whose feet must pass this way.
This chasm that has been naught to me
To that fair-haired youth may a pitfall be;
He, too, must cross in the twilight dim;
Good friend, I am building this bridge for him!"

Soil is that bridge to the future. That, it is now the time to build, so that the Borlaug effect continues forever, and nothing is left behind.

Debbie Reed

Thank you, Dr. Lal. So thank you for that very impassioned call to action for soil. Building on Jim's similar but different call to action, it sounds like there's a lot of work to do here together. Let's hear from now David Festa with EDF.

David Festa

Well, thank you very much, and it's a great honor to be here at the World Food Prize. Thanks for inviting me, and more importantly, thanks for inspiring me, especially you. I was going to do my whole thing in iambic pentameter, but I think you took care of the poetry part of the program.

I believe we have an imperative to go big on eliminating the barriers to a climate-positive future for agriculture. No one is more focused on the success of agriculture than those of us in this room. We're farmers, scientists, leaders in the business and government sectors, and, yes, even environmentalists. Also, we have a good idea of what practices, if scaled up, can really make a difference. And finally, when we're united, we defy politics – and that means we can get big things done.

In order to unite, I think we have to step out of our comfort zones a little bit. We need to publicly commit to making climate-smart ag profitable and widespread, even as some of us will remain skeptical about government action on climate, more broadly speaking. And we need to let people know that the best thing that we can do for the environment is supporting climate-positive farming, even though it won't solve all environmental problems. And corporate engagement needs to be championed consistently at the CEO level – thank you, Jim. And including by aligning performance indicators with climate-positive goals for all business units, not just the sustainability team.

Here are two specific ideas that I think are ripe for action. The first is removing the financial barriers to climate-positive farming. My organization, Environmental Defense Fund, just released a report with every single one of the 50 state ag directors from across the country. It highlighted the potential of mechanisms like crop insurance discounts and tradeable tax credits. To make climate positive also means bottom-line positive. How can we find more of these and work to make them business as usual?

The second is developing a consensus around what “good” looks like for eliminating fertilizer waste. Fertilizer waste is an expense to farmers, and it also creates air, water, and climate pollution – a lot of it. “Good” is often defined as a set of practices. The problem is that the performance of any specific practice is not the same everywhere for everyone. For instance, a practice called “conservation tillage,” which my organization supports, can under some circumstances actually increase climate pollution. Yet, we treat these practices as being uniformly good.

About five years ago, my organization looked at an old metric called “nitrogen,” or “N” balance. What N balance does is it can tell precisely how much nitrogen is not in the crops. What it can't do so well or couldn't do so well, is tell you where that nitrogen went. The innovation my colleagues came up with is an algorithm that shows how much becomes water pollution and how much becomes climate pollution. Working with ag partners, ag tech partners, we're also bring N balance into the era of big data. We want farmers to be able to see if they have room for improving their yield and their environmental performance by comparing anonymously the N balance on their fields with fields that are agronomically similar to theirs, no matter where those fields are.

I also can imagine tying ecosystem service payments to N balance. That way, farmers are free to innovate and try practices that they think are going to get them most cost-effectively to that N balance target, without being constrained by mandates coming down from above. And we in the public sector can have confidence that we're actually getting what we paid for.

So I think you can see why we're excited about N balance. It could be an easily understood robust metric to quantify reward and then publicly celebrate environmental benefits that we're getting from farms.

If you take away one thing from what I've said, I'd like it to be this. Collectively, we have the power to get good things done. We've got to step out of our comfort zones and go big on a few key ideas. I think N balance and figuring out how we're going to pay for all this are ideas worthy of our best efforts. So I'll stop there, hand it on to our next speaker, and thank you very much again for the chance to be here.

Debbie Reed

Thank you, David, and thank you again. A simple problem to a complex issue that we can all rally around and building on the previous speakers. So we'll turn now to Erin Fitzgerald, who is a powerful force in her own right, works with farmers and ranchers, and hear from you about your work, Erin.

Erin Fitzgerald

We're going to see the video maybe?

Debbie Reed

Okay, yeah, that's right.



– VIDEO –

To be honest, I don't know where to start. I was six when I knew what I wanted to be. You're only two now, but sometimes I swear I thought I see it in your eyes. It was your granddad who got me into it, put me in charge of my own acreage at 16. Boy, I had so many ideas. Heck, I was pretty confident about what I was doing, the innovations, food becoming more and more sustainable. I felt like I was on a mission. And if I'm really honest, I still can't fully wrap my head around how it didn't work. But now we're here at a point where continuing just doesn't make sense anymore. Your mother and I are shelling the corn, every single acre. We talked to the bank, and the [inaudible] are scoring up tomorrow morning. And we, well, we're just going to move to the city because it'll be a better future. And I want you to understand why. It's not just the drought getting worse every year – we were working to stay ahead of that, but costs keep running up and prices keep going down. Then one day you wake up in a place where one bad season can knock you and everyone you care about right over. And that's not a good place. I worry about how much we've invested out here, and at the same time I can't help but think about what that investment brought us. There used to be nothing but desert here, and now there's so much potential in the soil. But it seems like nobody cares. And that's why we're leaving. I don't want to plant a dream in you only for you to find out later that it's not a living and that people don't understand, or worse, they don't care. They just blame everything on you. And you, you start losing your pride. And that's no life. The farm is everything to me, and I want you to know that. But my family needs even more. So everything that I do in the end, it's got to be for you.

[inaudible] the debate over climate change. Does agriculture have a seat at the table, and are we a part of the problem or part of the solution?

Oh my gosh, I think that we are the solution to climate change, and we have not had the conversation that we actually can offset carbon from the fossil fuel sector. And we are cycling carbon [inaudible] biogenic carbon, very, very different than fossil [inaudible].

The potential answer to is [inaudible]. We've been farming for centuries, and we're just now really learning about the ability of the soil to not only hold water and nutrients but also sequester carbon and improve our environment. I'm inspired every day by our peers. We monitor our soils with GPS, and we know to the point how to manage our soils [inaudible] building capacity...

It's really something [inaudible].

...increase crop productivity, and increase carbon sequestration.

The super heroes.

Our time is now, but we only have about 30 carbon cycles left to get it right. That is more important now than ever. I think we... [inaudible]

Let's go home.

Yeah.

It's a very exciting time to be in farming because we will be one of the first industries to have a negative carbon footprint.

Debbie Reed

Well, that says a lot, Erin. Thank you.

So I want to turn to the Q&A Session right now and maybe start with you, Erin, about this very issue of farmers and ranchers and what you think is their understanding about their role in climate change both in contributing to climate change and their ability to really be part of the solution for climate change. You know, you're interfacing with them. I'm sure you hear this a lot, but what is your understanding there?

Erin I mean, Dr. Lal, thank you so much for that Bridge Builder poem—it's one of my favorites—and I think that is exactly what needs to happen. Quite often we're having conversations where it is 70 degrees and fluorescent in this conference room. And yet many of my farmers are on the farm, and, you know, the stories that have been coming in this year have been truly heartbreaking. I call it "sprinter" where winter moved into spring and was relentless. Jay, in the film, two weeks after filming, was struck by two tornadoes that touched down and ripped out his pivots. Megan, the soil scientist and farmer in the room, was struck by a flood in Missouri. The water did not recede until August 15th.

So I think we for a long time have had the conversation about measuring carbon and the impacts of carbon and nitrogen and figuring out all the stuff and talking about it. And these words that we're using often create different worlds. But at the same time that's why we spent so much time in the film with symbolism and hidden meaning.

We are talking about real reality. This is... It's about climate resilient adaptation, and it's happening right now. And the reason why the film was called "30 Harvests" is because if we're even going to get to that abundance of 70% by 2050, we have 30

- years to be able to do that. And for agriculture each growing season, that is a chance to get it right. And with the fragility of what's coming and the technology and all these things have to line up, and the farmer has to be able to steward and manage through that unbelievable, I would say, not only a crazy business model but the leadership complexity to be able to recognize and not only to steward the people that are being entrusted with this but also they have to put their values to work day in and day out and make economics and the business model line up for those results.
- Debbie Thank you, Erin. I agree. We really need to create the tools to allow farmers and ranchers and give them the opportunity to combat this crisis. Their business done outdoors, so they're truly in the crosshairs. Jim, may we turn to you? How is the current ag and food supply system contributing to climate-positive agriculture? And where do you see the most potential to make the greatest strides?
- Jim Yeah, I think it's a great question. We're beginning to really explore that. I liked what I heard in the previous panel. Polly Ruhland talked about, you know, growers tend to be mission-driven. And as Erin talks here and discusses that this is becoming more and more real every day. The climate is moving, it's changing, and growers are doing things. But they know they need help, and they know there's technology out there that can help them. And they're all business people, and they're trying to understand the profit model for that. And so I think that's what we've enjoyed the most about this journey over the last year is, even my own understanding, that there are so many good things that are already happening. And so being a part of helping them get access to that but then also being a voice for them with regulators and with others who would not be so supportive. And I've had an opportunity now to sit down and talk to a number of folks that sit in positions either in the public community or the private community that can be a real voice. And so I think they need the technology. They need some freedom to operate with some new tools. And we're not talking about just the large growers and center-pivot world there. We're talking about a large group of growers in Africa or India or in Brazil or Argentina. So it's a common understanding that there's a need, and they are looking to us for some tools and solutions, and I'm amazed at what we already have on the shelf.
- Debbie Yeah, and you're working to bring other CEOs and other organizations to the table and providing additional opportunities for leadership there, which is imperative.
- Jim Because we know no one company has all the answers. It has to be a collaboration and a partnership, and part of this convening was to raise the awareness. And I'll have the opportunity with other leaders of some of the other large ag companies tomorrow to be on stage to talk about some alignment around these goals and opportunities as well. So, yeah, it will take all of us working together.
- Debbie Right, thank you. Dr. Lal, how about your perspective on that?
- Rattan About how to spread the technology?
- Debbie Well, where is the potential to make the greatest stride, whether it's technology or other opportunities, particularly for agriculture?

Rattan First of all, let me go back and then I'll answer this question. If we were to increase carbon and cropland soils of the world by one ton per hectare in the root zone, that would produce the same management input 30 to 50 million tons additional food per year. So if you can do that in ten years, say 10 ton extra and especially in soils of Africa and South Asia, and that's where that could make a very big difference.

The question is – how do you make sure that people do that? And I think there are three options, maybe four. Let's just take three. One option is stewardship – to make sure that we make people understand that stewardship of natural resources is very important. And one option that might go back to all of our religious groups, and it does not matter what religion you come from, whether it's Islam or Christianity or Judaism or Hinduism, but they all teach the same thing.

I want to just take a very few seconds to say something from Gurubani, that's Sikhism. Wind is guru. Water is father. The greatest mother is the Mother Earth. In one phase it linked all those three things that I was talking about. Each religion says that. So go back to religions.

The second option is education and awareness. Farmers, policymakers, children from kindergarten, elementary school to primary school, secondary – teach them the value of soil, the value of nature, the value of water. Don't take it for granted. And the group, farmers and policymakers, in that teaching and preaching.

The third part of economics – pay them for ecosystem services, and ecosystem services, many times I'm told them we are already paying a subsidy. It's not a subsidy. It's not a handout. It's not a charity. It is we are paying farmers, land managers for doing something that we have asked them to do for the good of the world. And that's a very genuine payment.

And the fourth possibility is the legal law, the rights of soil. I think we can do all four of them. And if we do things properly, I sincerely believe that the potential to make soil and agriculture a solution, not only the food and nutrition security but also climate change mitigation, water quality, biodiversity, everything that you think about. The solution lies under our foot through the power of soil. And we have to create it.

Debbie Thank you, Dr. Lal. And, David, how about you? What do you see as the areas where there's the greatest potential to make strides?

David Well, I think I would just pick up on some of the comments already made and point out that I think what we really need to do is figure out how we're going to monetize these ecosystem services, including the climate service. So if we're going to monetize it, we're going to need good metrics. So that's a key, and to get good metrics that farmers can use, we really have to focus on technology. And I don't just mean a giant \$250,000 piece of equipment. It could be a \$10 cell phone in some parts of the world. In the United States it's increasing rural broadband, for example. I think that would be a huge, huge stride forward on sequestering carbon in the soil. It doesn't maybe sound that linear, but if you follow that logic, monetize metrics, checking data, it's really important.

Debbie Yeah, thank you. And there's been such huge growth in that particular industry, particularly agriculture technology. I think it's really looking at new horizons here to really make a difference, able to not just monetize it but measure what's happening and track it over time and ensure that we're moving in the right direction and moving the needle the way we want to. Rattan, I'd like to talk to you about... You suggested some of this already, but policies and programs, but how can agriculture contribute more with the right policies and programs, and what are those key policies and programs that can increase carbon sequestration, mitigate climate change, and get to some of the numbers to return that much soil or carbon to the soil that you were talking about from what was lost?

Rattan You know, many times people ask - What are the technological options, and we mentioned conservation tillage, agroforestry, cover cropping and so forth. We forget there are 300,000 types of soils globally. So to believe that one technology will work everywhere is kind of being naive. I think the better general principle and general principle is it's sort of like a bank account. If you want your bank account to increase what you put into the bank must be more than what you withdraw. And so for each site we have to know what are the losses of soil. The losses of soil carbon happen through erosion, mineralization, leaching. Erosion and mineralization are the two most common. So those losses, as long as we know that, then we should follow practice which will put an input of carbon biomass more than the losses. And that is how they can evaluate what you... In general, the rates are about half a ton per hectare to one ten in a humid climate. Semi-arid, arid climate, maybe a hundred kilogram or 200 kilogram. But globally it can be very high when done on a global scale. The question really is how do you monitor if you want to pay farmers. How do you monitor it? And that technology, Brookhaven national lab has the technology by [inaudible] and others, it's called inelastic neutron scattering. You could ride behind a tractor and monitor 60 centimeter depth, the total carbon stock. And Los Alamos national lab came up with, several years ago, a technology called LIBS, laser-induced breakdown spectroscopy. It required density measurement. Those technologies did not become commercial – they need to be commercialized – so policy not only to motivate the farmer but also have industry back us up. And industry, I really want to give example of a few. We just heard of one yesterday, Danone adopted... You know, we heard about that. Indigo certainly had declared, Unilever – there are many. I think industry, they make a pledge that they will make themselves carbon-neutral. I think things will move forward. That's where the policy is needed.

Debbie Yes, I agree. I think one of the things we often need to focus on is technologies that we can put in the hands of farmers and ranchers – right? Because it's almost like citizen science if we can give them the tools to measure and monitor what's happening in their field, we would improve our soil carbon libraries. We'd really be able to track over time. And speaking of innovations, Jim. I'll actually ask each of you to answer this question: What are the biggest innovations you see that are either on horizon or that we can develop to really help deliver climate-positive solutions?

Jim The two that immediately come to mind. The first, the work that we're doing in gene editing, the specific crops, is so much more specific, so much more accurate, and way, way broader in their opportunities and implications. And we can find crops around the world that maybe do a better job today on sequestering carbon or

utilizing nitrogen and immediately edit those same attributes into high-performing crops in other parts of the world that haven't evolved that way. And those tools are here today, and we're looking to the regulatory framework to help us accelerate those options. But this would be a great example of a tool that we have that can be deployed to help solve some of these bigger climate issues. So we think the receptivity around those utilizations would be important, and we think we can do that. The other tool we have is already here, and the professor mentioned it is around digital technology. Our granular offering that we have recently partnered with ___ in using a kind of a total digital alignment around a grower, knowing all the inputs and all the outputs and soil types, fertility and water, is able actually in real time in the hands of the grower to calculate that carbon sequestration rate. So it isn't some fancy scanner or analyzer, it's a digital tool we have today. And ___ has now guided that and opened up a clearinghouse. And as a matter of fact, we have a grower that is here with me this week who was one of the first participants in that clearinghouse and is already receiving payments for the credits that he sequestered this last season. So those are two tools that I know we have available right now today.

Debbie Great, terrific. And, Dr. Lal, a big tool that we can, you know, change, if you will, create change on the horizon.

Rattan Can you repeat it?

Debbie Yes. What is the innovation or the tool perhaps that you think can most move the needle in this space?

Rattan I think technology really exists since 1850. The question is—can we have a simple tool that can monitor carbon stock without taking so many samples. And there are airborne systems, I mentioned INS. LIBS would still require density measurement, which is more tedious. We used to have a very good density measurement 'til 9/11. It was based on cesium and then taken away. I think the industry is catching up, very much so, encouragement. And I think that encouragement will come from – we talk about farming for corn and soybean, milk, meat. We can farm carbon, carbon farming. Carbon becomes a commodity that can be sold and bought, and that has to happen. For that then we require the tools, and then the industry will come back to that. So as long as we see that there's a making agriculture a solid solution to the environment, industry will follow.

Debbie Thank you, and David?

David Policy, policy innovations. Some of them are targeted. I talked about a couple. Another one that we are looking at is—can you have loan rates that get discounts on your loan rate based on the carbon in your soil, the trajectory of carbon in your soil. So there's some targeted ones. But I also think there's some visionary ones. I love Dr. Lal's Soil Health Act. But I really think before we can get there, the other innovation we ought to have is in marketing and communications with the broad public. I can't tell you how many times when I say I work on conservation, the person I'm talking to goes, "I think that's fantastic. We need more parks and places where people aren't." Like, well, yeah, I like the parks, but that's not what I do. You know, I work for farmers. And then they'll go to a specific thing, like, "I love organic," or "I hate

- big ag” or whatever. It’s got to be everything. You know, I think there is a generalized set of idealized ideas of what ag is all about, and I think we don't really know that many people in ag if you don't work on a farm. How many farmers are in America, two million?
- Debbie Two million.
- David Yeah, right? In a nation of 300 million. So we’ve lost that connection. We don't know what it’s really like. So getting people just to even grow a garden where they begin to realize, oh, yeah, there’s trade-offs—you know, it’s not an absolute. So those are some of my... I think policy is where we’re really behind. Dr. Lal pointed out we don't have any visionary ag laws. Somebody here may know what the stated purpose of the U.S. Farm Bill is. As best as I can tell, reading through it, there’s one statement at the beginning. It says, “To spend money in the Department of Agriculture,” essentially. So I think there’s these policy innovations that are really going to be key, and some of them are low-hanging fruit if we can pull together and get a bipartisan support for them.
- Debbie Great. Thank you. My next question for you, Erin— What do you wish people knew about agriculture's climate-positive actions and impacts?
- Erin Well, I was going on the innovation thing for a second, but I mean the biggest one, I think, is the people-based innovation. And I come back to, as a consumer, I care about land, air and water, and there are two, we say, sometimes three million people that are stewarding that acreage. They are over that acreage of protecting for land, air and water. And I act think, compared to any other sector, I think the velocity and weight that we can take carbon out of the air, agriculture is the one sector of our economy that actually eats carbon for lunch every day—right? You know, like, because it’s brown and green are the cool things. And, you know, the boots that walk on those fields are really..., they do care about it. And so few... I look. I go to the U.N., and I'm at these different sector events, and I see different sectors setting goals. I think we are the sector who can do this. I think we are the sector who can step up. I think we have the people, the value, the commitment and the know-how to get this done. And the velocity of change when I think about carbon. And when agriculture acts, it has a ripple effect, as you said. And so when we really step up and lead, we can... I'm betting on the people. I'm betting on people-based change. I look at the other sectors and the sustainability. Those companies have to go back and teach purpose. We live this purpose. This is us. And so I guess when I think about climate change, I think about agricultural people—and that is the biggest innovation—and when unleashed across the 48% of the American aggregate lands, we can suck down carbon faster than any other solutions that exist on climate change.
- Debbie Right. One last comment from Rattan, and I think we need to wrap it up.
- Rattan I'd be adding one innovation that we left out was urbanization. We have about 21 mega cities, cities with more than ten million people. By 2030 there will be 28. By 2100 there will be 90 mega cities and more than 10 million people each, Lagos, Nigeria, the largest city. Each city with ten million people require 6,000 tons of food per day. All those nutrients coming into the city need to be recycled—carbon agriculture has to be a very important part of the innovation. All the large cities must

produce at least 20, 25% of the food within the city boundaries to feed themselves and recycling the water nutrients – that has to be an innovation policy.

Debbie Well, I really want to thank you all for your leadership. As you can tell, these are passionate leaders in this space and I think people to watch in the future. Thank you very much.