

**ROUNDTABLE 1:**

**CARBON SEQUESTRATION, SUSTAINABILITY IN AGRICULTURE AND THE RISE OF CARBON**

**MARKETS**

October 12, 2020 - 10:00-11:30 AM

*Roundtable Participants*

<b>Gabriel Carballal</b>	Farmer, Uruguay - Global Farmer Network
<b>Liam Condon</b>	Member of the Board and President, Crop Science Division Bayer AG
<b>Erik Fyrwald</b>	Chief Executive Officer, Syngenta Group
<b>Elwyn Grainger-Jones</b>	Managing Director, CGIAR Institutional Strategy and Systems, and Executive Director, CGIAR System Organization
<b>Dr. Rattan Lal</b>	Distinguished Professor of Soil Science, The Ohio State University
<b>Tamara Marcus</b>	Sustainability Manager, Linn County, Iowa
<b>Debbie Reed</b>	Executive Director, Ecosystem Services Market Consortium
<b>Dr. Sally Rockey</b>	Executive Director, Foundation for Food and Agriculture Research
<b>The Honorable Debbie Stabenow</b>	Senator, Michigan, the United States Senate

*Roundtable Moderator*

**Barbara Stinson**

President - World Food Prize Foundation

Welcome to the first roundtable of the 2020 International Borlaug Dialogue – Carbon Sequestration, Sustainability in Agriculture and the Rise of Carbon Markets. We are here today to talk about climate and food systems and resilience as they correlate around climate variability impact for agricultural productivity and as agriculture contributes significantly to carbon emissions, as we know.

In carbon sequestration, agriculture has the potential and the responsibility to reduce carbon emissions while increasing Sustainability Goals. This has been the work of our 2020 Laureate, and we're so happy to welcome a full roundtable board discussion. Today we're going to consider the challenges and opportunities of carbon market models and payment systems to drive achieving a climate-positive agriculture.

I'd like to now introduce you to each speaker, and you could see their biographies in the Whova platform just below your screen.

First, welcome to Gabriel Carballal. Gabriel is a farmer from Uruguay and part of the Global Farmer Network. Greetings. Debbie Reed. Debbie serves as executive director of Ecosystem

Services Market Consortium. Hi, Debbie. Liam Condon is a member of the Board of Management and President of the Crop Science Division of Bayer AG, calling from Germany. Welcome. Erik Fyrwald is the Chief Executive Officer of Syngenta Group, from Switzerland, I believe. (Erik Fyrwald – Correct.) Dr. Sally Rockey is our Executive Director of the Foundation for Food and Agricultural Research (with a fabulous backdrop). Tamara Marcus is a University of Minnesota PhD Candidate, but she's coming from Linn County, Iowa, as the newly hired Sustainability Manager. And, last, Dr. Rattan Lal. He is the 2020 World Food Prize Laureate and Distinguished University Professor of Soil Science from The Ohio State University. Later in our hour or so together, hour and a half together, Senator Debbie Stabenow is going to join us with a few recorded remarks.

Dr. Lal, I'd like to invite you to open us up with a few framing comments.

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### *Discussion*

Rattan Thank you, Barbara. It's a great pleasure and honor to work with many of these distinguished and very experienced colleagues, many that I know and have worked with for a long time, Debbie Reed, for example. I've known her I think since mid-1990s when she was working with the senator. And since then she developed a program of her own. Sally Rockey was a Buckeye, a very strong program of her own in the FFAR, and many other colleagues who are all here. I am delighted to have the opportunity to discuss carbon markets, which apparently is a subject or theme of interest to all of these panelists. The question is how to assess and provide through appropriate modus operandi, fair, just price to the farmers as a market of a commodity that we can quantify, hopefully, through either measurement and marketing up to modification, verifiable and credible information that is critical.

The next part, which I think is important to discuss, is – What is a fair price? Is a fair price that is determined by the market, demand and supply, and the supply is too much and demand is too less and the market can crash, and the farmers do not get much reward. Or should we be paying them on other criteria, such as ecosystem services that they can generate and strengthen through carbon sequestration? And this is the difference between the two. The market price at the moment, might be very low, but the societal value of the carbon that should be compensated could be very high. And those are some of the discussions, Barbara, I hope, that we can discuss this morning in this panel of very distinguished and experienced colleagues.

Barbara Thank you so much. Let me welcome everyone to the stage now. And did I miss Elwyn Grainger-Jones? I so apologize. So why don't we go to our full view, and let's open it up for a discussion of the conflict in a relationship between food systems, resilience and climate. We're going to take a few comments in order. Erik, why don't you get us started.

Erik Great. Thank you, Barbara. I think it's really important as we start to talk about how we can reward farmers for capturing carbon in the soil that we first have to realize that we're going through a period due to climate change of massive weather extremes that we're seeing every day. We, Syngenta Group, is in over a hundred countries, and every day I hear reports from different countries about dramatic

weather extremes, whether it's drought at the highest temperatures ever recorded... I just had a report today from Brazil about high temperatures and drought. High winds, flooding and new pest invasions that we haven't seen before, whether it's fall armyworm invading Africa and Asia or locust invasions. So we've got to help farmers deal with the problems from these weather extremes and use our agronomic advice, collaborate together, and also use modern technology tools to help farmers do this.

One example is a product that we developed in recent years, called artesian corn seed, where we've taken several genes that help the corn better withstand drought. And under severe drought conditions, we average about 12% higher yields, and under extreme drought conditions about 40% higher yields. So bringing these technologies in – the agronomic advice and helping farmers to deal with these weather extremes – to me is really, really important so that we feed the world.

The second one to me is that we've got to help farmers mitigate climate change. We've got to be part of the solution rather than part of the problem, as you mentioned, that agriculture today contributes - we leave on estimate 12% of greenhouse gases. So how do we do that? One concept that we'll talk about now in this session is carbon farming. We have tools today, we have agronomic advice capabilities digitally enabled, we have products, we have approaches with cover crops, with crop rotations, with no-till, low-till approaches that allow the farmers to keep more carbon in the soil. And what's really important is that we all agree we want to help farmers to do this and make sure that we have consistent measurement systems, that we have digital tools to help farmers do that, and that we are able to certify that farmers are growing things sustainability, so that they can be rewarded.

And I see three key ways that they can be rewarded, and they should get full reward for doing this, because it's so critically important to our planet.

One is subsidies. Today there's about 500 to 600 billion dollars of ag subsidies across the world. Those need to go from other purposes to helping support farmers to grow climate-smart practices. The second is carbon markets. We've got to get these carbon markets going so that, as farmers capture more carbon in the soil, they get rewarded through these carbon markets. And then third is food labeling. We need to label foods based on the climate-friendly agriculture that's used to produce them so that, like organic, that consumers will pay for getting this benefit, this real benefit of climate-friendliness. And if we do all that, I think we can have a major, major impact and take agriculture to climate-neutral.

Barbara Great. Thank you so much. Three great propositions – I'm sure everybody wants to touch on all of those. Let's move to Debbie. Debbie, do you want to talk a little bit about some of the ecosystem management services that are flourishing, beginning and flourishing?

Debbie Yes, thank you, Barbara, and thank you also, and congratulations to Dr. Lal, and it's great to join everyone on the panel.

I want to start by talking about the need for shared action and the role of agriculture in that shared action. I think scientists globally have recognized and understand that it's no longer a debate or a question about which solutions do we bring to the table

to combat climate change. We have to bring every solution to the table. Every sector has a role to play, and what we're here to talk about is the role of the agricultural sector, which is a significant potential source of not only reducing greenhouse gas emissions from soil carbon sequestration but also reduced emissions of other greenhouse gases including nitrous oxide and methane. And not just cropland systems but livestock systems as well.

The other thing I'd like to talk about is – It's not only an opportunity for shared action but the reason we are here and the reason the private sector in particular. Some of my colleagues in the private sector are on this call. The reason they're leading in this area is because we all share in the risk. Farmers and ranchers do business outdoors, and they are in the crosshairs. But anyone who is in the agricultural supply chain, the agricultural value chain, we share in the risk of the impacts of climate change.

So what we need to do to build climate-friendly systems is really build resilient systems. Fortunately, improved soil carbon sequestration, reduced greenhouse gas emissions, all of the activities that lead to those enhancements and mitigation of greenhouse gases actually improve agricultural resilience. And so that is what we're trying to do.

I'm with the Ecosystem Service Market Consortium. We're a large public/private partnership working across the agricultural supply chain and value chain to build and test markets to bring ecosystem service outputs, if you will, to society and to meet the demand that's there. And the way we're doing it is we're working with the entire ag supply chain, the value chain. We're co-investing in markets with significant funding from the Foundation for Food and Ag Research and co-investing as part of our private sector members and other members. So we're building this entire market together.

And what we're trying to do is in fact recognize but also reward farmers not just for soil carbon but for other reduced greenhouse gas emissions and also for the co-benefits of improved water quality, as well as improved water use conservation. So we generate multiple credits, and we're providing the tools and the technologies to measure that, to verify that, and then to certify that, so that buyers and those who demand it are sure that they are buying something that is credible and that actually represents a change that the farmer and rancher undertakes on their own.

Barbara Thank you, Debbie. Sally, from a funder's perspective.

Sally Great, thank you. And I also want to add my congratulations to Dr. Rattan Lal, a good friend and of course, as he mentioned, a fellow OSU Buckeye. We're delighted at FFAR to be working with the Ecosystem Service Market Research Consortium that we're a major funder of. And as they work to establish carbon and water quality and water quantity markets. And of course agriculture is the most complex of all systems. I was the deputy at the MIH, and I think about the complexity of medicine, but we're talking about one animal there. Here we're talking about the sun, the sky, soil, people, plants, animals, economics, physics, chemistry, engineering, everything. It's truly mind-blowing to think how we're going to tease out all these complexities, these interconnections, to generate knowledge that's going to give us practical solutions to major issues, such as climate change.

And when I think about complex systems and I think about science that's necessary in order to go after these complex systems, we really must broaden our knowledge base – complex systems really require this. And we can start with data. We know that the application of computer science, that data analytics to agriculture is exploding right now. And this is an area where we can rhyme and reason to what we do. We can apply what's been learned across other scientific disciplines to agriculture, but in fact in agriculture we actually are leading the way in the applications. They need many of the data technologies, including artificial intelligence to these real world problems. Digital agriculture is allowing us to farm with precision and to understand what climate practices work best for different farming systems.

But just think about some areas where we really don't have a knowledge-base that would be so critical to addressing climate change. For example, what do we know about how water management directly impacts soil health and carbon sequestration? How does soil health impact human health? Imagine the science that must come together to do this – microbiology, soil physics, hydrology, human nutrition, plant biology, genetic agronomy, all those things.

And to generate this knowledge base and as two speakers before just said, we must work together. In agriculture we're trying to work on the most important issues. For example, we just did a recent landscape assessment that demonstrated that hundreds of researchers, that thousands of projects are going on just on carbon sequestration and greenhouse gas emission in agriculture. These projects would work, represent great work, but it's very fragmented. Imagine what kind of economies of scale we could get if we pooled our resources, shared our insights and data and produced systems that connect these efforts. The acceleration and progress that we see would be unprecedented and especially if we couple then scientists and farmers together, we would really travel to new heights.

And so you know at FFAR we build public/private partnerships, and they're becoming even more easy to form in the agricultural space; because we believe that we can do more together than any one organization can do alone. And we can share risk, and we can revel in our successes. These public/private partnerships are our future; and if we're willing to work together, complex issues become less convoluted because we really have many minds to see the path forward. Thank you.

Barbara Thank you, Sally. And we're going to talk quite a bit about public/private partnerships. We have a great representation, in some ways, right here. But let's see. Who would like to respond further to this question or reflect on something that you heard so far? We have just a couple minutes for some discussion. Anyone? Elwyn, I failed to introduce you formally. I apologize. We're going to go next to talking about some of the technology innovations from the CG perspective. Anything that you would reflect on just this complexity of relationships and all that's required in data management all the way through to working through so many different soils and so many different parts of the food system. Go ahead, Elwyn.

Elwyn Yeah, I took that as an invitation, Barbara, and, yeah, no. I think these were great points, and I think that's where most of our 20<sup>th</sup> century constructs to manage ourselves in this incredibly complex world tended to simplify things – and that simplification became the problem. We've put things into boxes called agriculture,

environment, and climate, and public and private sectors, and farmers and manufacturers. And actually what we're finding is, to fix this, we've got to put that all together again and work together. And that's just a mind-boggling complex challenge, and that's why we've got a lot of unusual partnerships forming now in food systems, food, land and water systems space. And it's very much part of the way CGIAR is reformulating itself under this notion of one CGIAR just to really remove any of these residual barriers to working together.

So I think colleagues made a great point. I think the challenge is just how to develop the kind of decision-making tools to take decisions in this complex environment, rather than sort of be stuck by the data and decision-making and the number of partners you need to include in those decisions. So I enjoyed this first part. Back to you, Barbara.

Barbara Thank you. Debbie, you had some thoughts?

Debbie Yeah, thank you. I just wanted to point out that farmers and ranchers are businessmen and businesswomen, and the business of combating climate change, of delivering ecosystem services has to work for them and has to actually improve their bottom line. So farmer and rancher economics in itself are complex – right? We have just two million farmers in the United States alone, and replicate that globally – right? And each of them are running their own business. But we have to - If we want to scale impacts and allow them to really be part of the solution set, we have to make it -, give them the tools to do this and remain economically viable and become more economically viable while they're food, meat and fiber, as well as other ecosystem services. So farmer economics has to work, and that has been something that is a challenge to layer on a new requirement that we're asking for them. So I just wanted to call that out.

Barbara Liam, I think you raised your hand. Then we'll go to you, Sally. Liam?

Liam Yes, thanks a lot, Barbara. And I just wanted to echo actually what was said earlier on and in a very inspirational session with Dr. Lal and Al Gore. And this intersection between human health, plant health and soil health and how that impacts overall planetary health. And I think if we could make that more known, that connectivity. And this could sound a little bit overwhelming at times, and people are very concerned about planetary health. But if you bring it back to the fact that this is intricately related to soil health, and everybody, and particularly farmers, can work on soil health, I think I think that's where we can get a lot of somehow enthusiasm and excitement around really making a difference. Because the planet is too big for individuals to make a difference as to what people feel, but if you bring it back to soil health, everybody can do something.

Barbara And that's our laureate's favorite, one of his favorite quotes – *one and indivisible*, et al, and the soil being the bedrock, of course, of everything. Sally?

Sally Yeah, actually Liam just took a few of my words out of my mouth. I was going to say this intersection between human health and agriculture is just such an exploding field, and it has so much to do with what we're going to value the farmers. So the science of it is complicated, as I mentioned in my talk, just even thinking about that

intersection, soil health and human health, much less the entire enterprise of agriculture, such as nutrition and all of those other things that go with it.

So we do see this as scientifically a gigantic area that really needs more resources to try to tease out that relationship between agriculture and human health.

Barbara Yes, Erik.

Erik Yeah, Barbara. I just wanted to jump on what Elwyn, Sally and Debbie talked about around collaboration, because I think it's unbelievable. When I think back five years ago, it was so rare that we collaborated across the ag food value chain, and today it's just so normal for Syngenta to get together with Bayer, to get together with Cargill, ADM, Nestlé, Unilever, the Nature Conservancy, Solidaridad, World Wildlife Fund, well, just these unbelievable groups coming together, including farmer groups, to try to tackle these very, very difficult challenges, but these challenges that require the whole food system to work together. And this never happened before. So not only are the challenges tremendously important for the world, but the ability to bring people together – and the World Food Prize is a big enabler of this – to bring people together to go after these things together, because it's so important to the world. It's just amazing and really energizing.

Barbara Well, I'd love to hear from some of you. What are some of the results? What comes out of these unprecedented collaborations that are emerging all over the world, particularly in this important field?

Lal Barbara may I add a couple of comments?

Barbara Please.

Lal Okay, thank you. First of all, I also want to acknowledge the work that Syngenta is doing. In fact, we are right now working with them in collaboration with IICA to come up with a program to look at soil health across Latin America and the Caribbean. It's a very important development coming up as we speak. And their contribution in that part is really great to acknowledge.

I want to go back to what Debbie said – climate is resilient. You hear all kinds of them that I want to support very strongly, what Debbie said. We are really trying to create agriculture which is climate-resilient. It can re-bounce back after the mitigation that can happen following a climate extreme event.

And then what Liam said, which is very important – planetary health is of course the big thing, but the human health, soil as a living entity. Humans are the mirror image made of the soil they live on. If the soil they live on is healthy, people living on it are healthy and vice-versa. And unfortunately, when people are suffering and desperate, they pass their suffering to the soil, and soil reciprocates. And this vicious cycle is one that we really need to break. And the entry point to break the vicious cycle, it is soil carbon, manage soil health.

I want to go one step further in addition to this entry point. Many of you know that every day death caused by hunger-related issues is 25,000 per day, which translates to 3.1 million people per year. That 25,000 per day translates to 17.3 people per minute. And if you want to fill in the jumbo jets with about 350 passengers on each,

that would be about 80 jumbo jets crashing every day after day after day, and yet sometimes it's not a newsworthy item. And this is where we have to say that soil health is a key to eliminate that hunger and so that all those deaths that are happening can be avoided. And that part, the entry point in food and soil health and the climate resilience is so often carbon connected.

So paying the farmer – and I would like to say it's not a subsidy. It's a payment for ecosystem services. It's not a handout. It's not a charity. It's not a donation. It's not something we are doing you a favor. It is something that they're demanding from them to do for society and for the planet, and societies have been willing to pay them the fair price.

Barbara Such a remarkable lineage you drew for us right there with 80 jumbo jets dying every day and then of course dramatic need to increase food production in order that the farmers themselves have got to be able to make their livelihoods. And we must be able to also continue a safe, affordable, sustainable food system. So really a fantastic picture there. Does anybody else want to comment on this track of conversation, or shall we move on to our next question? Yes, Erik.

Erik Yeah, one point, quick comment. I think it's amazing to see that there are so many examples happening all over the world of trying to address this soil health issue. Just one example: We're involved in a project in Brazil called REVERTE, and we're working with EMBRAPA, the Nature Conservancy, the banks down there and others with the goal of reclaiming a million hectares of degraded pastureland. So the soil has been depleted in these million hectares, and we're using cover crops, seeds that have been specially developed for these poor soils, to try to help rejuvenate the soils, crop rotations, to bring this soil back to life. And the benefit is healthy soil for that million hectares but also an alternative for deforestation. So a double benefit to help the world's climate. And I just use that as one example of a great collaboration across, figuring out, you know, what's the issue? The issue is soil health, but the issue is also deforestation. So let's go after both by reclaiming massive degraded pasturelands in Brazil instead of deforesting.

Barbara Thank you. We need to keep bringing in these examples, because there is so much work going on, on the ground. So thank you for that. We're going to keep going into a next set of questions, a different topic, and bring in Tamara and Gabriel for this conversation especially. But first, Elwyn, we're going to turn to you just to talk a little bit about the opportunities in agriculture for mitigating and adapting to climate change through technology. What are the innovations in terrestrial carbon capture that we really need to capitalize on?

Elwyn Thanks, Barbara. Let me say a few things, but first congratulations, Dr. Lal. I hope you'll see as a CGIAR alumni how much we are changing to reflecting your good work. And we get it. We're actually reorganizing ourselves very much around being able to have a much bigger impact on integrated management of landscapes to be able to lead to better soil health.

So I wanted to make four points. First just to pick up on something that was said earlier. You know, the cost of mitigating emissions in food systems and agriculture is so minimal compared to many of the sectors. It's the unexplored frontier. And in fact in most cases or many cases, it's win-win. We actually do something that's good for



productivity, and it happens to be also good for resilience and happens to be good for emissions. And it's that still sort of a bit of a hidden secret in agriculture that we're absolutely full of basic founding improvements. But if we can get them done and scaled out, it has great byproducts of reducing emissions. I mean you can give so many examples. Dr. Lal spent his career pursuing those. It's just basic good agronomic, basic good landscape management, things that retain soil health so that that soil is more nutritious, or it remains nutritious, it remains productive, happens to withstand drought, storms, floods better, because it's a more diverse landscape, often with trees on it, and keeps the carbon in the soil and absorbs carbon. It's good agronomics. Now, yes, there are some tradeoffs, but my point is, it's full of win-wins.

The second point is there's lots of barriers to the scale-up of the things that many of us have spent our careers trying to pursue. And many of you have mentioned that already. I mean there's loads of barriers around the way financial markets work, the fact that they're not pricing in the benefits, what we call the externalities of farmers for doing good for the planet. The way land rights is working, for many farmers doesn't give that incentive. The basic education systems in many countries are still not producing sufficient literacy levels and primary education, secondary education. Digital penetration is not what it should be. My point here is that, just good development gets us maybe two thirds of the way there. What will get us the third? Changing policies. I mean they are essentially disincentive right now in many cases to scaling up mitigation and soil health. Improving accessibility of inputs – we're going to need a whole new generation of inputs for smallholder farmers, including better seeds but not just limited to that. So there's loads we can do to remove the barriers to doing all this stuff.

And then what about carbon markets? Well, that will be a game changer, but we don't need to wait until those are here before doing all this other stuff; in fact, we can't, because it's going to take still some time to get this right. And, luckily, because most of these things we're proposing that are good for soil health and mitigation, are also good for farming. And we can actually start moving forward faster.

There's all kinds of technologies that are being put to the task of what's used, that term "MRV," your monitoring, your reporting, and you're verifying of soil carbon. And that's moving really quickly, but it's still fiendishly complicated to get this right, to be able to have enough credibility that you can actually trade these benefits internationally and with financial products behind it. But there's some great stuff happening on sort of digitization, online tools. We worked on new livestock data for the first time in, I understand, in global discussions on climate change. There's actual data on the livestock emissions from cattle in the developing world context, not just in wealthy country context; and that kind of data is valuable. Remote sensing, portable measurement devices – it's all flourishing as technology. So one hopes, if we can push this, we can get the political consensus behind developing these markets, we can have that game change.

My last point, Barbara, is even in the absence of that, there's some great stuff happening because there's a lot of win-win out there, and we are trying to remove those barriers. There's things like drought-tolerant maize for Africa where we work with CGIARs, with hundreds of private sector providers and private sector partners in 13 countries. And that's 40 million beneficiaries right there from better variety, input variety of farmers. There's climate information systems where we work with

lots of local radio stations in Senegal and meteorologists bring them together with extension services and private sector partners to get finally some warning systems out there for farmers. There's all kinds of things we can do, but it will move a lot faster if we remove the basic barriers, and it would move by lightning speed if we could get the carbon markets working as well, the smallholders. But let's do the stuff, the basics, as well as doing the advanced stuff around carbon markets, is our message.

Barbara Thank you, Elwyn. Liam, some thoughts from you?

Liam Yeah, thanks a lot, Barbara. And also from my side, warm, warm congratulations to Dr. Lal. It's fantastic that you got the award this year.

And I think looking at innovation from our point of view – and we tried to do it in a holistic manner possible – I think usually we research and development-based companies we focus primarily on the innovations that come out of our pipeline. And Erik mentioned a few typical examples. Also Elwyn mentioned some examples and things like that are seeds that are drought or even flood-resistance seeds and hugely important and also if you think about things like rice and being able to reduce methane emissions and these types of innovations I think are critically important.

And the second category of innovation, which we rather see as an enabler and is everything around digital transformation; because digital transformation allows us to work, and with data, to take decisions in a much more precise manner than was ever possible before. So in essence this really helps us to produce more using less, less natural resources, less land, less water, less synthetic inputs and getting a higher productivity in a sustainable manner.

But I think in getting to the core, the third point, the big step forward is now the combination together with new business models that will actually incentivize carbon sequestration on the farm. And this is a topic that we, together with others, have been working on for quite a few years, not nearly as Dr. Lal. But we've been inspired by his work. And as Sally mentioned, this is pretty complex stuff, and the key challenge really comes down to verification as well. And in the approach that we've developed together with partners is, and kind of four principles, is, one – this has got to be farmer-focused; it's got to work for farmers and from an agronomic point of view but also from an economic point of view. The incentivization has to be in place. And as Dr. Lal mentioned earlier, and when we're talking about this incentivization, it's not a subsidy, and it's actually pricing things according to their true societal value. And I would argue today that society is already paying way more today by taking this approach, and society would actually end up paying way less, and the planet and properties and human and soil health would be in better shape.

So that's the first principle. The second principle that's got to be, we believe, and the approach has to be science-based. And this is where we're working on soil carbon accounting methodologies, which are in essence based on the denitrification, decomposition models; because it's not physically possible today to get a really strong carbon verified approach on every single farm. So you need to work with models first; but of course you can augment that and enhance it with in-farm measurements, and this is something that we're working on.

A third principle is it's got to be transparent. And that's why the models that we're working with, we published them – they're in peer review journals and available for everyone to see to develop further, and because this is an area that needs to develop further. And this is something that needs to be co-created in the broadest alliance possible, but we really need those scientific models.

And the fourth point is then related to verification. It needs to be third party verified by a party that has a globally accepted method of getting to a carbon sequestration and credits. And the process that we've developed so far has gotten in the first step of certification, they get gold standard recognition, just the first time in agriculture that this has happened. But I think these examples show the complexity that's behind it.

And your overall thinking is – we can't wait for perfection, and it'll take us too long to get to perfection. And, but we've got to act now. We have imperfect models, but together with many other partners, we can develop further and make a real dent then both in climate and soil health and ultimately in human health. So that's the way we're thinking around this.

Barbara Thank you for that. Just if everyone can think a little bit – Do you agree with Liam? Are these four of our essential elements – it's got to work for farmers, has to include soil carbon accounting, based on models first, with transparency in third party verification? Is that what is needed, and how do you scale up? But before we go into more on that, I'm going to turn it over to Tamara. Tamara Marcus is coming to us from right here in Iowa. She is on the ground in Linn County, trying to develop a GHD accounting system for your own county, I believe is the very first sustainability officer for the county. What do you have for us this morning, Tamara?

Tamara Yeah, thanks, Barbara. So I'm Tamara Marcus. I'm the Linn County Sustainability Manager, and this is really incredible to be amongst all of these knowledgeable, well-versed panelists, so thank you so much for the invitation. And a warm congratulations to Dr. Lal. I've never had the opportunity to work with you yet, but I hope that changes here shortly. So it's great to be here.

And also I was actually one of the Borlaug Ruan interns, I think, ten years ago now, so this is extra special for me to join you guys. And so, as Barbara mentioned, I'm the new Linn County Sustainability Manager. And previously what I've focused on is really technical comment research. So I've worked in the Himalayas, in India and Swedish Arctic, as well as indigenous communities in Australia. And through that work, what I've observed and what I really have grown to believe is that this engagement piece is so critical in how we move forward with climate adaptation and mitigation efforts. And so really allowing those who are going to be most impacted by this innovation that's been spoken of, these proposed policies that support new innovation, new adaptation, all of that. I believe all of those efforts, it's critical that these communities or these individuals are at the forefront. So I've heard a lot through the speakers here of directly engaging farmers, and I think that's so important.

And then also even to Liam's point of, it needs to be science-based, and I agree with that, using models to determine adaptation efforts. I 100% agree with that. And I also think we have to push back on what we view as science – right? So working with a

lot of traditional knowledge-holders, I think that there is a lot of untapped knowledge that we just don't know about that has been working for generations. And so thinking about how we create systems and networks to integrate that knowledge, those individuals respectfully into our own systems, I think will be key.

And so, as Barbara mentioned, what I'm hoping to do with Linn County is our first greenhouse gas inventory to allow us to assess our current level of emissions. But then also this climate action and resiliency plan developed from that assessment to forge a sustainable path forward for our county. And key in this work will be this piece of equity. So again, who has access to these new innovative technologies? How do we simultaneously create networks and avenues to ensure that the most vulnerable climate communities will be able to access that information in a way that makes sense culturally?

And so I think when we think about adaptation, we really need to be ensuring that we're doing so in an equitable way. Right? And I think again a big part of that is ensuring that we're not just coming to farmers, mid development of these technologies, right, but we're starting with them from the beginning and listening to their insights, to their life experiences, to the world views to help shape what that looks like; because ultimately that will ensure the greatest buy-in for these communities.

Barbara Thank you, thank you for that perspective. We're going to open it up in a minute, but first, Gabriel, you're calling in on the ground from your farm in Uruguay.

Gabriel Well, first of all, thank you so much for this invitation. Congratulations to Dr. Rattan Lal also for the Prize.

And I would talk from a farmer's perspective – right? I'm a farmer in Uruguay. Uruguay is a small country between Argentina and Brazil, two giants in agriculture. We have 18 million hectares in the entire country and only 2.5 million hectares are suitable for agriculture, and those are marginally suitable agricultural hectares. So we have to work and think and act really clever to stay in focus. Right?

And I believe there are a lot of key opportunities in agriculture for mitigation and adapting to climate change. And I would put no-till in the first step. For me, no-till is the main tool for adapting or getting resilience from different events, right?, and for achieving some predictability. For me, getting to no-till, helped me a lot in predictability. I know that when I'm going to a farm, I can go and plant the crop and then harvest that crop without any problem in the middle, which was their regular situation when we made tillage in my country. Leaving residues for me is really, really important and building new residues, too, through cover crops. We discovered cover crops in 2005, and it was interesting.

We had a late frozen in our winter crops, which destroyed those crops, so we planted soybeans after, soybean, of course, after that frozen. And we got an excellent experience there. So the next year, 2006, we said, okay, let's go and plant a crop, not for harvesting, but for feeding the soil and covering the soil and having more organic value in the soil. So we did that, and we also brought really, really nice results. And since 2007 until now we are in the places in the fields where we are not planting winter crops, we are always 100% of the time planting cover crops. So we have 16,

15, 14 years of cover crop experience, and we know that that adds resilience to a system a lot.

There is precision agriculture. We started with precision agriculture back in 2011, 2012 – satellites, drones. All that helps. We know the specific needs in each place, and we go and accomplish those specific needs. And we also have new fertilizing, new techniques of adding fertilizer to the soil; that helps, too. And irrigation, that's also a big help in some dry areas.

Those are things from the farm, from the field, but we have also things from politics, and that's interesting. Here in Uruguay we have some mandatory soil usage plan. That plan asks us a lot of information, and it allows us or not to make some proposed rotation in each field. Right? So we have to go to an online form, and we have to complete a lot of information like previous crops, the size of the field, the slope of the field, a lot of information, and the rotation we want to do in the future. And the software that determines if that rotation is doable or not. At the beginning we were a little mad with this, because we thought, okay, where is my private property? Right? Somebody's messing with my private property. But then we realized that farmers who were doing good things, good farming practices, we have to change nothing. We kept doing the same. Right? But those farmers who were not doing good farm practices, who were not rotating crops, who were not leaving residues on top of the soil, they have to change a little bit. And that's in a country where 60% of agriculture is that in these farms. Right? Well, I believe that's really important. So I know, and I use a lot of those opportunities and keys to try to mitigate and adapt to climate change. And I believe there's a lot of room for working in my country, of course, and in other countries to achieve that state.

Barbara Well, thank you for sharing all of that experience. It's fascinating to hear and try to think about other contexts where mandatory soil usage systems could be installed and probably are being installed. Let's just... Maybe we have one minute. Does anybody want to respond with just one thing before we go to our next piece? Rattan?

Lal I want to congratulate Gabriel, he and his country, along with Argentina and Brazil and Chile are doing a really great job in adopting no-till agriculture, with cover crops. And that's the way. They are now - South American countries are now the leading adopter of system-based, no-till agriculture, including cover crops. As he said, every year it's done in winter, and row crop is taken, just a cover crop. I salute you for doing such a great job.

Barbara Great, and isn't it wonderful to hear how much good work is going on. There is so much advancement and progress, from the largest company to small farmers in Latin America, South America. It's excellent.

We want to offer you more discussion on the carbon markets area and in particular on the bill, the Growing Climate Solutions Act. And you might have heard it referred to in the very first discussion opening this morning. Debbie, I think you're going to introduce us a little bit to the bill and to a special visitor we have by video.

Debbie Yes, thank you, Barbara. I'm quite pleased to have the honor to not only introduce Senator Debbie Stabenow, who's been a true leader and an innovator for agriculture

in the United States Senate for many years. But first talk about S3894, the Growing Climate Collections Act.

So the bill was introduced June 4<sup>th</sup> by Senators Braun and Stabenow, the original authors and sponsors of the legislation, along with governors or Senators Graham and Whitehouse. The senators also had a legislative hearing in the Agriculture Committee on June 24<sup>th</sup>.

And to summarize the bill, there are basically two major provisions of the bill. It authorizes the Department of Agriculture to create a voluntary certification program to support farmers and ranchers to participate in private voluntary carbon offset markets. The program gives the Secretary authority to develop a certification program, and that certification program does two things. It creates a certified program for technical assistance that farmers and ranchers can look to, to enable them to participate in those markets; and it also creates certified third party verifiers who are also trained in agricultural systems and the requirements of carbon offset markets.

The second thing it does, it establishes this program and the certification requirements, and then it allows the Secretary to post online a list of all the certified technical assistance providers and the certified third party verifiers so that farmers and ranchers who want to participate can go online, look to see who's certified and who they could tap to enable them to participate. The Secretary also creates an advisory council of 21 members from across agricultural and forestry value chain, including scientists, carbon offset market experts, etc.

And then lastly the bill authorizes the Secretary to develop a report starting first in October of 2022 and then every four years after, to really assess how our private voluntary markets for agriculture and forestry are operating and how well are they serving the needs of farmers and ranchers, what is the global demand for carbon so that we can help plan for it, and then to consider how to reduce remaining barriers and challenges, if you will, that farmers and ranchers still face, and participating in that conversation.

It's a really important piece of legislation because it supports the leadership of the private sector in the actions that they're undertaking, but also again it enables farmers and ranchers to participate in the markets.

So with that I'd like to introduce Senator Debbie Stabenow of Michigan. She's the ranking member on the Senate Agriculture, Nutrition and Forestry Committee and the co-sponsor of S3894, the Growing Climate Solutions Act.

Debbie

Stabenow It's wonderful to have the opportunity to speak with you today, and I want to first say congratulations to this year's World Food Prize winner, Dr. Rattan Lal, and to Debbie Reed, the Executive Director of the Ecosystem Services Market Consortium and to Dr. Sally Rockey, Executive Director for the Foundation of Food and Agricultural Research (FFAR), which Senator Pat Roberts and I founded a few years ago in the Farm Bill.

It's an honor, really, to address this year's Borlaug Dialogue. Between the pandemic and existing economic uncertainties, agriculture is facing so many challenges in its quest to feed a hungry world, as we all know. On top of this, farmers and ranchers are also on the frontlines of the climate crisis, whether it's the derecho that flattened corn fields in Iowa, the tragic wildfires on the West Coast, or extreme temperature changes that have wiped out entire food crops in my state of Michigan. The climate crisis poses major threats to our global food security, as we all know.

While agriculture is uniquely affected by the climate crisis, it is also a key part of the solution, and for that I am very hopeful. Our goal in the 2018 Farm Bill was to help make farms more sustainable and resilient. After it passed by a record number of 87 votes out of a hundred – which you don't see a lot right now in the United States Senate – we, because of that, enacted the most ambitious and bipartisan climate-smart agricultural policies that we have had in our country to date. Now I'm working across the aisle to build on this and support meaningful policies that are voluntary, producer-led and bipartisan.

That's why I'm introducing or have introduced the Growing Climate Solutions Act with my friend, Senator Mike Braun from Indiana. This innovative bill will help farmers and ranchers scale up sustainable practices and tap into new economic opportunities through voluntary carbon markets. The bill has the support of over 50 farm and environmental organizations – I'm so excited about that – ranging from the Environmental Defense Fund to the American Farm Bureau and the National Farmers Union. And we are grateful to all of them and look forward to adding to that list. As companies look for ways to offset emissions through carbon markets, farmers have an opportunity, as we know, to be rewarded for the voluntary, sustainable steps they're taking through carbon credits.

In order to break down existing barriers, though, and help farmers get started with carbon markets, the Growing Climate Solutions Act establishes an important USDA certification for trusted experts that farmers need in order to feel they can have the information that is credible and work with the experts in order to generate and sell carbon markets.

We also created an online one-stop shop at the U.S. Department of Agriculture to serve as a comprehensive resource for producers interested in getting started. For producers it's really a win-win, because sustainability and profitability go hand in hand. They are improving their operations, building on new revenue streams while addressing the critical climate crisis, and feeding the world.

While we've made progress in climate policy, there is so much more to do and a great sense of urgency to do it. I know you feel it, and I certainly do. Now more than ever we need leaders of food and agriculture to come together to support policies that will scale up climate-smart agriculture practices and help address global hunger.

And that's where all of you come in. We need your leadership. We need your expertise. We need your voice. Thank you for what you do every day, and I'm honored to be your partner.

Barbara Thank you so much to Senator Stabenow. It was great to have her here, even just briefly. I know folks want to talk about this bill and other mechanisms, incentive mechanisms, really, to advance carbon markets. So, Sally, I think you have some opening comments. Gabriel, we'll go to you, but others as well for just a few minutes.

Sally Thank you, and thank you, Senator Stabenow, not only for creating our foundation but being such a powerful advocate for agriculture. And we thank you for introducing the Growing Climate Solutions Act, and we hope this important bill will pass and that we'll see carbon markets grow.

So I contend that agriculture is really the only sector that can become carbon negative, therefore producing these credits that are bought by other industries. This in and of itself improves the economic standing of farmers if we can set this up, as they currently only make about 7.8 cents of every consumer dollar. The Nature Conservancy in its report rethinks soil. It is estimated that the annual economic benefits translated is when you have an adaptive soil health system, translated to 226 million of societal value that include things like increased water capacity, reduced erosion. And in the best case scenarios, it could even address up to \$50 billion dollars annually in social and environmental impacts. This is absolutely amazing, so there is a great opportunity under our traditional cap and trade models to bring value to farmers and ranchers that will be a win-win. And under those caps, when there are caps, there will be those that will buy credits and will have an agricultural system that will sequester carbon and produce benefits.

Actually, the thinking has somewhat changed in the last number of years. Originally, we thought about and worried about whether or not there would be enough demand for carbon credits in agriculture. But now that has switched to worrying about whether or not we can meet this demand. But this can only work – and you heard a number of our speakers mention this before – if it's voluntary, it's science-based, and we can generate a fair price. So we need to work quickly, but we also must make these markets work for all farmers, all size farmers, not only here in the U.S. but around the world. So we really need to get this right. And that's where we have public/private partnerships that need to come in to work together.

So how do we move from carbon markets to the various ecosystems, the values that farmers and ranchers provide? If we think about it, we can categorize them into provisional services – that's our materials that we produce, the energy, the food, the forage, etc. – to regulatory services controlling climate or air or soil quality (our carbon fits into that category), flood erosion, disease control and pollination. Then our supporting services, which maintain things such as the habitat for plants and wildlife, the maintenance of genetic and biological diversity. And finally the cultural services such as the nonmaterial benefits such opportunities for recreation, tourism, artistic appreciation and spirituality.

So each of these types of services, they may not fit into a traditional cap and trade market, because they could be very complex to create. But there could be some sort of market for them. But we have to think about these creative financing models, and we've already talked about a few of them. We have to have these models that view agriculture more holistically as to its value to society and through many of the components that I mentioned above.



We can do this by, for example, we heard pricing, price for all sorts of ecosystems as a price point and using consumer preferences, really their preference and willingness to pay, and all sorts of a host of other ways.

I'll just end by saying that farmers are the world's largest group of land stewards, and they protect their land for their bottom line; but they also are moved by the future they leave for their families and their communities and the planet. I will contend that we don't need a system to incentivize farmers to do the right thing, but we need a system to assure that they're still able to do it.

Barbara Thank you, Sally. Thank you. Gabriel, do you want to add a bit to this, and then I want to open it up for just a couple of other comments? Gabriel, I mean just what's going on in Uruguay? Do you have a carbon market developing?

Gabriel No, no. I would like to highlight a little bit more about no-till before discussing carbon markets. We don't have a carbon market here in Uruguay. No-till was born like 35 years ago here in Uruguay, and it appeared under farmers' demands and search for an erosion control system that allows them to keep farming without destroying the soil – that was why no-till started here in Uruguay. And then some good quality, positive things occurred after that started. It took us like three to five years to stabilize the system, and it was really difficult because we had less yields. We didn't know about fertilizer behavior. We had not enough herbicides for no-till systems here in Uruguay and in the entire world 35 years ago. But we kept working. We kept fighting, because we knew that was the way of overpassing the situation.

And after those five years, the recession time came, and that was good, because we could start creating soil, not only not destroying soil but also creating soil, through leaving residue, through cover crops and stuff. For example, I have in my operation 1.7 crops per year. In Uruguay it doesn't snow, so I can double-crop, winter crop first and summer crop then. And that helps my economy and it helps the soil a lot.

Then after these practices we were doing, we saw that while increasing residue we were also increasing yield. So I always believed that a farming system has to be charming to keep farmers on the farms – right? New generations tend to go to the cities, and that's no good, so a farming system has to be charming and has to be profitable – that's really important.

But this is kind of a bit, too, cyclical better yields, more residues; more residues leads to better yields. And so that helps. And the best thing, the fabulous thing is – when we're doing that, we're also sequestering CO<sub>2</sub>, and I believe that's the key thing. Right? I always say that when I'm harvesting, I harvest three things – I harvest the crop, I harvest a lot of information, valuable information, and I also harvest CO<sub>2</sub> from the atmosphere. So this is a win-win-win situation, not a win-win.

We have long-term research here in Uruguay that estimates that between one and two tons of carbon element per hectare is being sequestered from the atmosphere. And that's quite a number, because this comes from a research made in INIA which is our National Agricultural Investigation Institute. And this experiment has already 57 years. So it's not an experiment from ten years ago; it's a long-term experiment. It's the oldest research in Latin America.

About the carbon market, I believe that it's really important. It's essential, but it's completely essential for small family farms, because they have to get something. It's like the cart in front to change, to shift from a regular tillage situation to a no-till situation that for me is the key for getting this state of stable yields, high yields and where profit is not about words.

Barbara Thank you so much. Any other final thoughts on these topics? There's so much to say about emerging carbon markets. Reflections on the bill from anyone? Erik?

Erik Well, first of all, I think we should all support this act. Syngenta and many other organizations already have. Let's support it so it gets passed. This is a great move. I think it should be shared globally. I would love to see more companies adopt a similar policy and approach. I think that we can all collaborate behind it to help get together and have a verification certification scheme that works and a carbon market that works. So let's get going.

And then the one other thing I would just add to it is – We also need food labeling, because if consumers know that the food that they're buying is grown in a climate-friendly atmosphere, what will they pay for that? You know, today they pay 20, 30, 40% sometimes for organic food that has the perception of benefits. What will they pay for food that has absolutely certified, verified, third-party verified benefits to the world that can help save the planet. I think this is a great approach – let's make it happen. And Gabriel is already providing that farmers can do it today, that the products, the practices, the technologies are there today. We just need to adopt them widely, and it's so much benefit.

Barbara Rattan, did you have more to say?

Rattan Yes.

Barbara Particularly about the price of carbon?

Rattan Yes, but a few things before the price of carbon. I want to support what no-till agriculture was said. The idea is to make agriculture growth a mission of agriculture. And no-till, not using diesel for plowing is one part of it. The other part is that we have nitrogen fertilizer, if we can improve the efficiencies of it. Each kilogram of nitrogen saved from volatilization on leaching a lot, is 2 kilogram of carbon is equivalent that will use to produce and package it. So that's a very important part.

Cover cropping also helps to reduce use of herbicides. And each kilogram of activated herbicide is sometimes six to eight kilogram of carbon to produce it. So the low emission agriculture eventually will lead to carbon negative technology, which we are trying to promote.

I would also like to bring in here the concept of zero net land degradation. We have a serious problem of land degradation, estimated at two billion hectare globally. If we can adopt this kind of agriculture, we will restore the degraded land. So eventually we will reach zero net land degradation goal, which I think is a very important part that we should think about.

I want to mention something about rice, because when you talk about no-till agriculture, rice is left out. We have a new concept called aerobic rice. It's a

- direct-seeded rice. We are eliminating puddling. We are not doing flooding anymore. We are growing rice just like a wheat. Now, it is true that it will reduce the production of it, maybe 10%, maybe 15%. But you save a lot of resources. You're saving water, you're saving methane, which are emitting. So we have to think about agriculture which may sustain production without causing serious emission problem. So our goal is to make agriculture emission neutral, if we can, through this kind of tillage and we are awarding farmers for that. This is what the Growing Climate Solutions has said, and I really think it is very timely, and I hope other nations will follow it.
- Barbara These are some of the technologies that we've been hearing about, and I know Jim Collins' ears are ringing, because he's going to be talking about that on our next panel. One or two other final comments before we go to our lightning Russian, just to give everybody a last word. Any last, short comment? Debbie.
- Debbie Yes. The one thing I think we haven't touched on a lot is the fact that, too, carbon markets will focus on systems-based approaches and outcomes as opposed to what we've done in the past, which is singular practices and singular outcomes. Really, so that we can actually appeal and work for farmers and ranchers everywhere, we have to be more agnostic about practices and really just look at what are the impacts of a systems approach that a farmer or rancher does that we can quantify and then monetize. So some practices will work for a lot of farmers but not farmers everywhere. So we really have to focus on systems and outcomes in order for this to be scalable.
- Barbara And systems at all different levels. You hear that, and there's so many different systems, food systems to really think about. It's not just one.
- Debbie That's right.
- Barbara Anything else before we stop?
- Rattan Debbie just said, in terms of a no-till, the system, it is not a matter of not plowing alone. You must also have residue left back. You must also include a cover crop in a rotation cycle, and you must have a complex rotation, and you adopt integrated nutrient and pest management. That makes it a system. That's a holistic approach. So when you adopt only one part, like eliminating plowing, it may not work. You adopt as a whole system – that's what makes it work.
- Erik One other thought, Barbara. It's really important that we stop burning crop residues, that we keep that carbon for the soil and not burn it and cause all this pollution and carbon into the atmosphere. Technologies are there to do that, and we need government support, we need NGO support. We need to make that happen.
- Barbara Huge step, huge step to make. You all wanted to all do a quick lightning Russian. This gives you one minute, 30 seconds to one minute apiece to make your final comments. Why don't we start with you, Elwyn?
- Elwyn Two things. Many smallholder farmers, 500 million, approximately, of them feed about two billion of the world's population, relatively small share of carbon emissions, although what it's hard to measure that, roughly 5%, which is still a fair

amount, but they are most hit by climate change. And that's where there is just a vast amount of unmet potential, or win-win-wins, quadruple, quintuple wins of better land management, more nutritious food, more productive food, lower emissions and more resilience – and the list goes on.

And second point is also don't forget the basic carbon market would be great, but there's other stuff we can be getting on with at the same time that we're not doing enough of. It's not as sexy, but it's things like basic education for farmers, it's farmer extension services, it's and some of it, a catchy catch very exciting on the technology front around digitization. If we can do digitization, get smart technology into the hands of a significant share of the world's smallholder farmers, we can do an awful with that, including on some of the work around carbon markets.

And on that note, there's a lot of other policy changes we can be doing right now, whether it's avoid the conversion of high carbon stock lands, like peat soils and wetlands – that's a third of the soil stock right there; or it's redirecting public subsidies from inputs to environmental standards; or it's land tenure, etc., etc. So if we can get on with all of that at the same time, we can make great progress with smallholder farmers as well. Thank you, Barbara.

Barbara Thank you. Let's go to Liam, and then we'll come to you, Tamara. One quick minute.

Liam Yeah, thanks, Barbara. So I think ultimately what we're talking about is changing the paradigm of farming, that we're not only rewarding farmers for the crops that they produce and for looking after food security, but we also reward them for their services to the ecosystem and looking after planetary health and through that soil health. And so this, I think, is ultimately where we're trying to get to. And as long as we take truly farmer-focused approach where the economics have got to work for the farmer and the agronomics have got to work for the farmer, a science-based approach and one based on collaboration, I'm pretty sure we can help make agriculture part of the solution to climate change.

Barbara Thank you. Tamara, and then we'll go to you, Sally.

Tamara Yeah, just to echo this equity and engagement piece. So how do we think about the historical policies that have certain farmers, certain communities out for success and others towards failure – right? And so thinking about how we use these new policies, these new technologies to really address some of those historical inequities and move forward to a more equitable, sustainable path.

Barbara Thank you. Sally.

Sally Well, thanks for this great discussion. My idea also is to concentrate on data and digitization across our industry. We really need to share our data, share those data and your ideas. We need to co-create with farmers. It has to be a joint effort. And our issues are great, but our future is amazing, and we need to collaborate to make agricultural solutions to climate change. All hands on deck, and I always end by saying – if not now, when? If not us, who?

Barbara Thank you, Sally. Gabriel, and then we'll go to you, Debbie.

Gabriel Okay, I believe the solution is below our feet. I believe that the soil is the answer, right? So reaching that state of stabilization, high yields, porous fertile, soil, healthy soil, resilience, all leads to an environmentally better world, to where we want to be. So I believe no-till is the best tool we have to accomplish that state. And some crazy farmers – between them and my father, he was one of the farmers who started the no-till movement here in Uruguay – they have no idea what they’re doing when they started. So today we have to learn about that experience, and I think we have to start in building a better place to eat. That’s my philosophy.

Barbara Thank you so much. Debbie and Rattan, you’ll have the last word.

Debbie Thank you. I want to get back to the issue that I think we’ve all been tapping into, which is shared action. And really the critical time and place that we’re at in which the private sector is leading and investing in looking at their own agricultural footprint in the supply chain, right, and really investing in programmatic opportunities, structural investment, to give farmers and ranchers the tools to actually help us mitigate climate change. And that means the private sector is investing in technologies to measure, to report, to verify, right, so that farmers and ranchers don't have to do that, and every individual company doesn't have to do that themselves. So this shared action where we’re all collaborating and investing in that programmatic infrastructure is incredibly important to making this scalable and harmonized and standardized and again allowing farmers and ranchers to participate in a way that meets their needs but also our needs for demand for ecosystem services.

Barbara Excellent. Erik, I didn’t mean to miss you.

Erik No problem. I just want to re-emphasize that, as we look around the world, the weather extremes are getting worse and worse. I mean Louisiana this week just had its fourth hurricane this year. The highest temperatures, droughts, flooding all over the place. We have to solve this. We have to solve this now. Agriculture, farmers, the food system – we can be a critical part, a big part of the solution to climate change. We have the practices, as you heard from Gabriel and others. We have the products, the technologies. We can do this. We can get the carbon into the soil, and we have to do it, and we have to move quickly, because the world's not waiting for us. We’ve gotta move now and we’ve gotta move together. We can solve this.

Barbara Thank you, and to you, Rattan, for the last word.

Rattan Thank you, Barbara. I want to go back to what Erik said don't burn the crop residue. This is a time of burning seed, and I want to make a personal plea. Farmers of South Asia, Pakistan, India, and Nepal, Bangladesh. Please do not burn the crop residue. Even in India, a hundred billion tons of residue are burned. We want to see the first snow in the Himalayas white, not black. At the same time we want to save the health of the people so they not breathe the air which is contaminated and polluted; and that they do not burn, left on the soil; it’s a nutrient reserve. It’s a food for the organism. It controls runoff and erosion. So we should really find alternatives to burning.

The second thing I want to mention, Barbara, is residue left on the ground also creates nutrition-sensitive agriculture. It improves the nutritional quality of the food

that Al Gore and I discussed so much, because that is where you are recycling the nutrients. So residue is an asset; it's a reservoir and got to be used properly and used in a very judicious way.

The last thing I want to mention is true soil health we really promote the world peace. When the soil is not healthy, we have something called "soil refugees," when the land does not support them. There are 69 million soil, land, internal displaced refugees in 2019. Imagine those people knocking on the door of Europe or jumping in the Mediterranean or coming to the southern border of the United States. The peace and stability of the world depends on soil's ability to support their living. That is as basic as it can get. So the health of soil through proper management, through judicious use, to empowering farmers and land managers to do the best thing they can brings peace, tranquility and harmony to the planet. Let's do it.

Barbara Thank you for that and of course reflecting what Norman E. Borlaug said throughout his career. Thank you all so much. What gems of wisdom from all of you. What experience you bring and bring to all of us. I know everyone appreciates it, so thank you again.

We are going to close this session and move on to our next discussion, which is going to build on this, talking about innovative finance and investment. What really is needed in a way of innovative mechanisms to build the kinds of systems that we're talking about? We're hopeful that you'll all get on your social media and record some of these phrases and wisdoms that you're hearing. Join us for the next roundtable session - it's right there on your Whova platform under the agenda and we will start promptly in about 6 minutes at 11:30 central time. Thank you so much.