Thank you all. It’s quite an honor to be here today.

I was asked to talk about the agriculture–forest nexus. Agriculture in black, forest in white. Agriculture is often the bad guy. But I’m here to let us try to talk differently about agriculture.

I’ve been straddling the forest–agriculture divide for over 30 years. Starting out in the forests of Kalimantan in Indonesia, watching birds and monkeys, but every day hearing chainsaws cutting the forest. And I thought, what’s going to happen? What do we do? So I thought, I think we really need to be working outside of the forest to figure out what to do with agriculture, to allow the forest to remain.

I still think it is a challenge. I think there are great successes, but we need more. And I think that requires a debate, an open debate. It’s often too contentious. People stick in the forest, they stick in agriculture, they don’t talk together. We need to change that. That’s my first challenge to everybody. What is an open platform to be able to discuss this in a scientifically reasonable way, so we can move forward rather than digging into our corners?

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I’m afraid the current draft SDGs have sustainable agriculture (I believe that’s goal number two) and then conservation and recuperation of terrestrial ecosystems (that’s down like goal number 15) as totally separate. They’re not connected. They will not allow the dialogue we need, because agriculture is linked to forests, and the development of agriculture will determine the fate of the forests. We have to have that debate. It’s got to be an open debate, and a way to look forward.

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What does this image tell you? This is a picture from Indonesia. What do you see there? You see agriculture. Do you see a forest? Yes, no? Well, actually, this is an agricultural landscape. Here’s the first challenge – think more broadly about agriculture. That thing that looks like a forest is an agro-forest. Most of the trees in there have been planted by people for timber, for resins, for fruits.

All agricultural systems are not the same, and their links with forests are quite different. Open up your minds about what agriculture is. At the same time, open up your minds of what forests are. All forests are not humid, tropical forests – as lovely as they are, and I’d like to spend much of my time there. Forests are different. You have Miombo woodlands in sub-Saharan Africa that are currently the largest changing ecosystem right now. Let’s open the debate and think how to do things differently.

“Open up your minds about what agriculture is. Open up your minds about what forests are.

The clearing of the Cerrado for agronomists, agriculturalists, was one of the greatest successes for producing more food. We have to produce more food. We need forests, we have to produce more food – how do we do it? Ecologists say, “But look at all the biodiversity that was lost. And even though it was less carbon lost than if it was the Amazon, it’s still a lot because the area is large.” So I challenge you, how could the Cerrado have been done differently? Should it have been done differently? And produce still enough food? We have to produce at least 100 percent, even 150 percent more food to feed 9+ billion people. How do we do that? How do we do it differently? Can we? So challenge yourselves. Especially as Africa and the African green revolution are taking off, the woodlands – the Miombo woodlands, the Guinea Savannah – are being threatened more than the Congo rainforest right now.

But how do we do this? That’s a challenge for all of us.

A lot of the debate these days is taking two forms. One is agricultural intensification, also called land sparing. You increase your yields of the land you’re already using, so you have to use less land. This could be, if that were a forest, land sparing. All the agriculture is being intensively cultivated in the landscape where it should be, and the forest is right there, looking okay. The other one is called land sharing. It’s also called wildlife friendly. It’s the integration of agriculture and forests and trees within the landscape. Or landscape mosaics – this is also a landscape mosaic. I like this picture; I can tell all sorts of stories about it.
Let's first look at agricultural intensification. That's increasing yields on your current agricultural lands, so you spare more land from being converted to agriculture. Some people even think, “Oh, and then we'll even have land that we can allow to recuperate and grow back into forests.” There have been several studies, analyses, meta-analyses done. And, at a global level, the answer to that is yes. Agricultural intensification does spare forests from being cut, and grasslands and other natural ecosystems. They say as much as 12–17 million hectares were saved from the Asian and Latin American green revolution, with less than two million hectares of forest being cut as a result of that.

That sounds good, but when you get to the local level – and again, I want us to think local, think specifically about the types of forests, the conditions where you are. Because the conditions of agricultural intensification can lead to more deforestation, but it depends on many factors. Demographics – what's the population pressure in the area? Do people really need to move into that forest? Roads – roads are a big culprit for leading people, more farmers, more agricultural expansion. Market integration or lack of integration will really change that dynamic about agricultural intensification and if it leads to more forest clearing or not. The types of crops – the types grown, whether they're labor intensive or not – will also determine the outcome of agricultural intensification.

As many of my colleagues in the front row know far better than me, it's actually the policies that have to play along with agricultural intensification. And when you have the right policies in place – we'll hear more about them today; we already heard some from Carlos [Nobre] – that is the effective way to produce food and also protect the forests and other natural ecosystems that we need for many ecosystem services. Carbon being one, but biodiversity and the others. And biodiversity, as Carlos said, is probably becoming more and more important than the carbon story.

“Biodiversity is becoming more important than the carbon story. And there are other ecosystem services that are important to agriculture.”

Agricultural intensification, I will submit, is the right way to go if you're talking about biodiversity and carbon stocks. But there are other ecosystem services that are equally important to agriculture, such as pollination, pest control, water, water quality, the flow of water and floods, controlling floods, and things like that. So land sparing is perhaps not the solution to that, and that's where I think these landscape mosaics become incredibly important.

Just to give a couple of rather gross examples. The one I really like is the law, I believe it was a law in Brazil, that Brazil nut trees could not be cut. You could cut the forest, but you had to leave the Brazil nut trees. Well, I traveled around the Amazon a lot and I went, wow, this is great. Look at all those Brazil nut trees. Well, years went by and people discovered, wait a minute. There are no Brazil nuts coming out of these trees. What was going on? Well, it turns out the bat that pollinated these trees was far away in the forest, so the forest wasn't close enough. We didn't know enough about the ecosystem service of pollination to allow that ecosystem service to happen.

Pest control is another one. There's a bit more information on some of these types of things. There's great pollination work going on now, too, and I'm just trying to highlight some of them. But pest control, if you have strips of native vegetation within agricultural fields, there's much better biological pest control. We know that. But we don't know how much of that vegetation we need, we don't know where it should be on the landscape, or what its composition should be.
“We’re remiss in looking at all these other ecosystem services that come from forests and other natural ecosystems, and how they’re important to agriculture.

I think we’re quite remiss in looking at all these other ecosystem services that come from forests and other natural ecosystems, and how they’re important to agriculture. I’d like us to again reopen our thoughts, and I think there’s a lot of fruitful work that could come out of that.

The other one I bring up is water, and that’s the one really directly related to climate. Again, there are people beginning to look at this, and look at it in a proper way. But, very often, people don’t study the connection between the rainfall that goes into the forest, the rivers that come out of the forest, the groundwater, and how that feeds into agriculture. More and more people are looking at that. The best example of water and forest ecosystem services, the New York City water supply that comes from a very nicely protected forest area.

“People don’t study the connection between the rainfall that goes into the forest, the rivers that come out of the forest, the groundwater, and how that feeds into agriculture

I work a lot in Africa, and there have been several rice schemes that have failed three years after putting them in because the water dried up. There was not enough water for irrigation. So they’re replanning their national parks to include wetlands and forest, to make sure that there’s sufficient water for these rice schemes. So I think, more and more, we actually need scientists involved in these types of planning and decision tools so that agriculture can benefit from forests and we can intensify and keep the forest there.

“We need scientists involved in planning and decision tools, so that agriculture can benefit from forests, and we can keep the forest there.

Again, I would like to say not all forests are the same. Let’s think about ecosystem services and what they are, so that we can at least start some dialogue and some systematic approach for knowing about what areas we need, what are the populations we need within those areas and those landscapes, and the configurations of these landscape mosaics to provide those ecosystem services. It will differ according to the forest type, the kind of agriculture, and the interactions between them. There are some good models being developed now by Ramankutty and DeLuca and others, that look at the value of different ecosystem services in the agriculture part or the non-agricultural parts of those landscapes. I think they’re very useful. They’ve been used again mostly for carbon and biodiversity. I think we really need to expand them to those other ecosystem services. And they need to become spatial. Currently, they’re not spatial. There are a few that are, but I think we really need a group of students and a whole new cadre, a network of people, to really start delving into these ecosystem services and landscape mosaics.
“Let’s think about ecosystem services and what they are, so we can start some dialogue and some systematic approach for knowing about the configurations of these landscape mosaics to provide those ecosystem services.

The other thing is that there’s very little field data, even in the United States, for a lot of these types of situations, let alone in the developing world. We need to put together a strategic plan for where those data need to be collected. It can be collected everywhere, but how can we do it strategically so that we can use models to help look at trade-offs and synergies with different agriculture-forest combinations and configurations? I’d like to talk about – people talk about trade-offs all the time between agriculture and forestry. I would like to talk about synergies.

“People talk all the time about trade-offs between agriculture and forestry. I would like to talk about synergies.

My last major issue is recuperation of degraded lands. People talk about it all the time. I think there’s great confusion about even what a degraded land is. It’s often confused with marginal lands, but I think a degraded land is where primary productivity has dropped for whatever reason. Marginal lands never had much primary productivity and might not. So I’d like to think about degraded lands where the potential for increasing primary productivity is here, and how we go about it. Again, we need a systematic approach, including a definition, but also the identification of where they are. The maps out there are done by people sitting in a room just saying, hey, is this degraded or not? Yeah, I think it is. And we now have global maps about degradation. So let’s look at that as a possibility.

It’s also so we can answer: What degraded lands can we rehabilitate? What is it about that land that we could rehabilitate? And rehabilitate it for what? For crops? That could be it. Or for forests, or for trees, or a combination? And I don’t think we know that, and I really think it’s a real fruitful research area to think about.

Let me give some examples. Many people can say it doesn’t work. I was recently at a meeting in Ethiopia where people were talking about planting trees. Planting trees in landscapes and agricultural systems. And a colleague of mine, an African colleague, got up at the end of the meeting. He said, by the way, I can count more publications that are made about planting trees than actually trees that were planted. So what’s wrong? Why aren’t trees being planted when we think they should be planted? We need to look at it more.

In South Africa, there was a huge campaign to plant Eucalyptus and pine trees for fuelwood, for timber. Shortly after that, the streams and the rivers started drying up. And now there’s a campaign called Work for Water. So people are actually now taking those trees down so that the water will once again flow through these streams. Those trees were put in the wrong landscape where there was not enough rainfall, never was, for trees. So we have to be careful how we think about recuperation of degraded lands. There are very good examples also, and I think Ethiopia is one of those. And they have a merit project. This is food for work or cash for work. People are actually transforming landscapes by planting trees, setting aside areas. Forests are growing back. And they’re finally measuring things, and they found sediment loads in rivers are down by 50 percent, carbon stocks are up, biodiversity stocks are up. And water is appearing in streams that dried up 50 years ago.
“People are transforming landscapes by planting trees. Forests are growing back. Sediment loads in rivers are down, carbon stocks are up, biodiversity stocks are up. And water is appearing in streams that dried up 50 years ago.

There are ways at a large scale that we can recuperate – recuperate through planting trees and transforming landscapes. The other big example that’s underway is China, and it’s happening at an enormous scale, as you can imagine. Some of these command-and-control projects can work to a certain extent, but not all of them have worked in China. People don’t know why in some areas it’s worked and some areas it hasn’t.

I’d like to see us put a concerted effort together to find out what’s worked and what hasn’t, and to include the biophysical, the social, and the institutional factors. I think we can move a large way toward using the land already cleared much more efficiently and effectively.

Thank you.”
Dr. Cheryl Palm is a Senior Research Scientist and Director of Research in the AgCenter.

A tropical ecologist and biogeochemist, Dr. Palm’s research focuses on land-use change, degradation and rehabilitation, and ecosystem processes in tropical agricultural landscapes. She led a major effort quantifying carbon stocks, losses and net greenhouse gas emissions following slash and burn and alternative land use systems in the humid tropics in the Brazilian and Peruvian Amazon, Indonesia and the Congo Basin. She has spent much of the past 15 years investigating soil nutrient dynamics in farming systems of Africa, including options for soil and land rehabilitation. Her most recent work investigates the trade-offs and synergies among agricultural intensification strategies, the environment, and rural livelihoods.

She is Deputy Director of Vital Signs Africa, a new project developing and implementing integrated monitoring systems in agricultural landscapes. Dr. Palm received her Ph.D. in soil science from North Carolina State University after completing her Bachelor’s and Master’s degrees in zoology at the University of California, Davis. She served as Principal Research Scientist of the Tropical Soil Biology and Fertility Program in Nairobi, Kenya, from 1991 to 2001.

She has served on the faculties of North Carolina State University, Colorado State University and spent a year as visiting scientist at the University of California, Berkeley. She a Fellow of the American Society of Agronomists and served as chair of the International Nitrogen Initiative (INI) from 2008 to 2011.

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Carlos Nobre
National Secretary for R&D Policies, MCTI, Brazil, on climate variability

Eduardo Brondízio
Professor of Anthropology at Indiana University Bloomington, on governance

Pushpam Kumar
Chief of UNEP’s Ecosystem Services Economics Unit, on green economy

John Holdren
US President Obama’s science advisor, on energy

Daniel Nepstad
Executive Director of the Earth Innovation Institute, on land use

Carlos Nobre
National Secretary for R&D Policies, MCTI, Brazil, on climate variability

Transcripts and videos are also available for the other speakers at the Colloquium on Forests and Climate: