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>> ROBERT OPP: Ready to get started? All right.  
Afternoon, everybody. Thank you for coming back from lunch promptly. I'm Jimmy Crawford from global insight. We'll have the session on deforestation. We'll have a small group here, so we're hoping for a lot of audience participation and we'll each do a short talk, I'll talk about technology, how it is applicable, remote AI, sensing, how it is applicable for deforestation is our forest expert. We're lucky to have him. Up until the middle of the weekend he was in the Congo based in the reign forest. If you have interesting questions you can ask him about flying back from the middle of the Congo, flying over hours at a time with only forest and then coming into Geneva. Dominic will kick us off and then we'll talk about the problem with deforestation and we'll talk about satellites.  
>> Can you switch to the other deck? We'll stay sitting down here.  
All right.  
>> Thank you for the intro. Thank you for having me. It is a bit of a change from the Congo basin here.

A few words about the forest trust, not sure how many people are familiar with it we're a small non-profit based next to Geneva and we work with businesses on questions of deforestation and also social impact. We were founded in 1999 and we're attached to the field work and having offices on the ground. We have offices in 13 countries, a lot of social, environmental experts and our ambition is to work with businesses to help solve these issues of social exploitation, labor problems, deforestation, other environmental issues that are linked to supply chains. We have worked with a range of companies, we started off in timber addressing the tropical deforestation issues, often starting with people working in forestry and quickly finding it is not only linked to forests but timber harvesting and a lot to agriculture commodities, we work on a range of products from the producers all the way through to the traders, transformers, the people that transform the products, the brands, distributors. We work as well with the people in the middle of the Congo basin. Just a few words to say, we have set up in partnership with Airbus, defense and space and others in monitoring the impact on forests starting, this is to help them understand impacts on the supply chains. When talking about deforestation we're really talking about destruction of forest. I think we often don't ask is how do we actually define a forest. It is simple in our minds but when you get on the field, it is often a lot more complicated than it can seem. This is a photo I took in Liberia, I find it illustrates the question quite well. You have a range of land uses, you have agricultural areas that have been cut down recently, some areas that are in natural regrowth after that agriculture use, switching cultivation. You have patches of natural rain forest that are there, some patches of old regrowth that are getting back to that natural rain forest. That's really a key question when talking about deforestation, what do we call the forest.

There's quite a few definitions that the most well-known ones, the FAO one, it is one of the most well-known ones, it basically says any area that is more than 0.5 hectares and 10% tree canopy, it is a forest. By that definition, my garden with its two fruit trees would actually be a forest because it would cover more than 10%. It is kind of vague and not very practical to implement on the field in different cases.

There is another forest cover definition from the University of Maryland which is well-known through the

platform global forest watch, I'm not sure how many are familiar with that, it is a Matt Hanson dataset called global forest cover and they classify all types of vegetation higher than 5-millimeters in height as forest. When I say all vegetation, it really means all and any vegetation. It could be an orchard, it could be a Palm oil plantation that's higher than 5 meters, it could be a rubber plantation, it could be natural forest, dense forest, primary forests and it is getting a lot of different things in that definition. High conservation value forest, that's another definition that was created via originally a forest scheme, and today it is wider use mostly for certifying commodity production. Another one which is a bit younger, it is high carbon stock forest, it is meant to be a pragmatic way of identifying where the important forests are on the field, tropical areas, looking at the Biomass aspect. You can see here kind of a vegetation gradient on the right-hand side, low open land basically, and regrowth all the way through to primary forests on the left and with the carbon stock being a proxy, it is to determine where we would say this is an important forest to be conserved or a degraded area and potentially if it is cleared, it is not that important.

So here this is just to illustrate the different definitions of forests. The FR, a, the FAO definition of forest classifies natural forest, clear-cut harvest, if it is click on harvest, that's planned and will be replanted, there will be natural regrowth that will happen, that still stays forest, rubber plantations are considered forests. Agri forestry and and Palm oil are not. The global set, it considers natural forests rubber plantations, Palm plantations, rubber trees, all to be forests, however, anything that's been cut down or that is open land is not considered to be forest.

This is a -- we have to choose one definition. I took the FAA map of change from the FRA to illustrate where the forest change is happening in the world today. As we can see here, the main countries, the two biggest countries where deforestation is happening is in Brazil and Indonesia and the other is the tropical regions and it is a trend increasing. From the year of 2000 to 2015 there's been more and more deforestation, it is happening more and more rapidly, it depends on what country and region, for example in Brazil, it has gone down a bit. Now it is picking up again in the last couple of years. But as a general trend, it is going faster.

This is I find an interesting map from WWF, it shows

where the projected deforestation fronts will be in the next 10, 20 years. As you see, the Amazon, of course, it will be kept on -- to be attacked on different sides. This is a forest we hardly ever talk about, South of the Amazon where soy development is going on, it is also under threat. A few fronts in the Congo basin, Papua New Guinea and the island there, it is covered in primary rain forest. Again, the deforestation fronts are very much in the tropical regions. Why is tropical deforestation important today? Why an issue? The first thing that comes to mind in my case is biodiversity. They only represent 10, 12% of the land mass, land area on earth and they're home to between 50 and 90% of all the land base species in the world.

This being any type of species, vegetation, insects, amphibians, plant species, they are Havens of biodiversity. The loss of tropical forests, habitat in those areas, it is direct loss of habitat for those species and these extensions of the species. Climate regulation also, that's an important one for -- it is a heat and water pump former ELs forest and they create rainfall, clouds, a lot of rainfall and they're massive carbon reserves, approximately 25% of the world's carbon is stored in the tropical forests. If tropical forest are cut down, soil erosion becomes an issue. Soil erosion is an issue because -- here in our climates, in winter, the leaves fall down and all of the tree, the reserves in the trees, they go to the roots. So they have very developed root systems to survive the winter. In the tropics, there is not winter. They don't need the development of the root system so the root system is superficial and the reserves are in the trunks of the trees. It when a tree is cut down, the roots don't hold the ground anymore that well, and there's a lot of rainfall in the tropics, a lot of rainfall, so erosion and so it happens at rhythms that are very, very rapid. It's a reserve of our natural pharmacy. A lot of our medicine comes from plants and a lot comes from plants in the tropical rain forest. A quarter of all Western medicine and chemicals come from the rain forest and they estimate we have tested 1 to 2% of the plants in the tropical rain forest at the moment. There is a massive amount to be discovered in those areas.

Now what are the major drivers of deforestation? The major driver of deforestation when people think about it normally, they would think logging, they would think people cutting down trees with chainsaws. Actually the main driver of deforestation overwhelmingly is commercial agriculture, deforestation for commercial agriculture and

in a lot of cases, it is the legal conversion and in 24% of the cases here according to the forest trends, it is commercial, agriculture tested to be exported. Often to Europe or to China. That's why TFT, we work with agro businesses, because they're very much linked to deforestation, tropical deforestation.

A study showed also that deforestation, if we're looking at trends in deforestation and where it happens, it mostly happens around roads and major rivers. There was a study in the Brazilian amazon finding 95% of the deforestation in the Brazilian Amazon happened within 5 kilometers of a road or a major river. This is to illustrate that drivers of deforestation are quite specific to each tropical basin, each tropical rain forest in the different continents. Whereas in Asia, many people have heard of Palm oil being a major driver of deforestation, in Asia Palm oil is, there is also pulp and paper plantations there that are very much driving deforestation and rubber plantations.

In Africa, West Africa, we mostly have Cote d'Ivoire, Ghana, Ivory coast, two major producers of Cocoa, they have lost a lot of forests due to the plantations. Latin America, we have major deforestation in the amazon, in the Brazilian amazon today mostly to pastures, to cattle grazing, and in other countries in South America, it is an expansion for soy. A very, very little amount for example for Palm oil in Latin America and very little in Asia for soy. It is very specific, the basins have specific drivers.

This is just to illustrate a bit according to the dishes basins and which countries, as I was saying, you can see Brazil, mostly soy and beef and a lot of the soy is exported. It goes mostly to China, to Europe, Indonesia, mostly pulp and paper and Palm oil and again, mostly exploited. It ends up on the commodity market, the products.

Going into the remote sensing aspect and how to automate these things, there are various types of deforestation, this is a photo we took in Liberia, once again, it is a Palm oil plantation that's being developed and it clearly is up to scale deforestation and these guys have armies of bulldozers, it is thousands of hectares a year that are basically put on the ground and transformed into Palm oil. That's clear-cut deforestation, it is easy to see from a remote sensing point of view. We have a forest and next week, next months you have straight lines, no longer a forest, things that are planted. Easy to pick up. Industrial scales, even easier, it is large areas and

mostly structured. They have roads being constructed, Geometric Rickal features. The small holder scale, more complicated to look. Smaller areas are going down and we'll have a bit less organized, more roads, more organic when you look at satellite imagery in the way that they develop. A bit tougher to identify. This is an example -- this is a platform that I have talked about at the beginning s I just took the raw imagery off to give you an example. We're in Malaysia here and peninsula Malaysia, 2015 and this is 2016. We have lost about 200hactacres thereof the dense rain forest and this is clearly industrial agriculture and it happened in less than a year and we see there are a lot of roads and we have seen this being -- it is very gee metric, the way it has been opened, clearly there are bulldozers behind that work.

That's easy to see. There are different types of deforestation, when there is deforestation for logging, for Coco, for creation of roads, for example, there is -- they are harder to identify in sensing, there is slight disruptions in the canopy, slight openings in the canopy with medium resolution you wouldn't see much. You really have to have high resolution to pick up that kind of detail.

It is important if some cases to pick up the detail because it can lead to -- it can be a preliminary science that will be predictive of future deforestation. For example, these photos from Ivory coast, in the forest reserve in the Ivory coast, on the top left happened side you may look like a nice forest there is. There's actually been cutting of the under story. All of the smaller trees have been cut down and the larger trees have been left because they were too tough to cut down. The same thing on the top right photo there, and basically that's where it will be the kindergarten of the Coco seedlings and the Coco will grow under canopy in this kind of conditions for a couple of years, maybe one, two trees will die, and then slowly over the years the farmers will burn down the trees that are remaining like you can see on the photo to the left there. In the end, you will have that tree standing in the open Coco field and the transition from a closed canty forest to an open Coco field could be 4, 5 years. It is really like progressive degradation and very hard to pick up via remote sensing.

Here is another example of deforestation in Indonesia but caused by small holder farming. In 2016, I'm not sure if any of you are familiar with this, this ecosystem is called by some as the last place on earth to have rhino,

Tigers, elephants and orangatang in the same system. So a lot of people are looking in this space, there is not much industrial expansion there, it is mostly small farmers. Here is the image from 2016 and we can see next to the road, 2017, a year after, a lot of little patches being cut away. Not necessarily -- we don't exactly know the cause here, we can see the deforestation. Not 100% sure it will be for Palm oil or for some other crop, probably for agriculture. Just a few key tools to keep in mind when thinking about the projects that can be developed here around deforestation, we can use optical imagery, that's for clear-cutting, it is easy to see. So you can use medium res, high resolution. If you want to really look at the fine degradation, you need to go into very high res. Optical imagery, there are some limits in the tropical areas. It is tropical areas, it is very humid, a lot of rain, clouds. Lots of clouds, difficulty to get regular optical images. Sometimes it is difficult to determine if we're looking at a natural forest or looking at an old growth of a planted forest. For example, we have had issues identifying rubber plantations, 30, 40 year old rubber plantations seen from satellites even with high resolution imagery, it is difficult to tell if it is actually a forest or a plantation. Radar, radar imagery is also -- imagery, it is useful and used in the styling service we have developed. Very useful. It goes through cloud cover. Certain bands of radar can go through cloud cover, however, there can be some issues, especially with slopes, radar has a lot of trouble with slopes and sometimes with accuracy, picking up all of the deforestation, it is not always easy, the radar. Other vegetation indexes that we have been using, that can be tested in terms of the project, it could be NDFI, DVI also, but it is actually indexed, canopy shape factor and others. These are examples of the work we were doing in the Ivory coast. We used -- this is specifically to detect the under canopy degradation, we used the NDFI and the canopy shape factor and we got some good results mixed with high resolution radar and we were able to get quite some precise information of where there was canopy under -- Coco under canopy.

Yeah, just a general reflection I had about looking at automation and issues that need to be resolved when we want to automate something. Satellite imagery is taken with different angles. When you want to automate something with the same algorithms, you have to make sure that that is compensated for. If something is taken from a straight 0

angle, 10% angle, it is not going to reflect in the same way. Especially if it is not the same time of day, you have the shadows.

Coulding in, you have the slope, the angle, the shadows, they can be very different and the photo, the satellite image can be very different as a result.

Cloud shadows can play a role in changing what can appear. Seasonality, even in the tropics, there are dry and wet seasons and trees do lose leaves. That's also something that needs to be accounted for and atmosphere factors such as haze and fog. Those are the issues we have been dealing with. Thanks a lot.

Thank you very much. I'll do a short talk, just to try to frame where we are currently in terms of using satellite imagery and AI to attract the course and the intent of this is to lead into discussion we'll have at the end of the day about the challenges we would like to pose back to the larger community about next steps and automation in AI. Just to motivate that, I want to follow-up on a few of the points of why we should care. You know, I think the main issue is really around Climate Change, that's a part that's the easiest to multiply because of the tremendous affect. This is the second largest cause of planet change after fossil fuels and in certain cases like in the case of Brazil, it is responsible for 70% of the greenhouse gas emissions coming from Brazil because of the deforestation of fossil fuels, if you want to reduce carbon emissions, it is cheaper to doing it by reducing deforestation rather than reducing fossil fuels, it is as relatively cheap way say by pain, there are bits and efforts underway to try to pay tropical nations to preserve rain forests as a global good. Finally, that the forests are vital to the University and to human kind and the planet, that's a good Example of that. The other part of the motivation, the report, you see the pictures. It is not obvious where it is happening, the problem is many are remote areas, we're talking about a 5-hour plane flight to reach the borders of the region where the deforestation is occurring, the amazon rain forest is about the size of the continental U.S. You won't see with your own eye enough of the forested areas of the world to get an accurate idea of how fast this is occurring and where it is occurring and whether you're doing good at a global level to actually slow it down.

You can't control or improve something you can't measure. I think the most important contribution we can make as a community, it is on the AI side and remote



sensing side, it is as an ability to create objective measurable metrics letting us measure if the deforestation prevention efforts are working and what regions they're working in and whether we're making an impact.

Secondarily, but also importantly, if you're actual going to take money from someone, if you're going to have a programme to pay tropical nations to not cut down rain forests, there has to be fair and objective measurements to actually control the payments. That's another major role in AI to measure accurately to scale the affects of deforestation. You have to differentiate between the different forests, not even if it is the reign forest you're trying to preserve. You have to understand the land use change that's driving the deforestation, cutting down trees, it is a lot of work, there are macro trends that are causing the deforestation to occur and by looking at what the forest became, as you were describing on the smaller farms, industrial farms, you can back out what's causing the deforestation. Thirdly, finding the endangered forest so we understand where we need to focus our efforts and finally, tracking degradation and deforestation, we'll come back to some of these at the end as we work towards projects that we can put in front of the AI community. In terms of where we are, one of the major advances we have really in the last 5, 10 years, it is proliferation of what I call medium resolution, we should standardize the terminology and obviously within this community, when I see medium resolution, I mean the planet imagery which I know some people, some people regard planet as high res and I regard high res anything below a meter, at 50, it is high, and the planet -- I know that's not standard. It is an action item for the who he will community to figure out how to use the same language. Super low res, things like that. You no he.

When I say this, when I say medium resolution in this context, what I mean is the planet level resolution, the 3 to 20. If you go back a few years, two years, 2016, we looked at all of the planet imagery over Bornio and the black regions in that left hand picture are places where even though we had doves that were in theory capable of measuring every few days, we got no imagery for the entire season because there were so many clouds. In 2017 that problem is almost gone but for the very middle of the country. We have had a huge increase in our ability to actually take imagery in the 3 the to 5-meter range and it exceeds is up meter range and there is a lot we can do with it that you can't do with the lens centers and low

resolution.

In particular, we have the 3 to 5 imagery, we actually separate out Virgin rain forests from planted rain forest. Here what we have done, it is a 3-year land use map of the light green here being the planted forest and the dark green being the natural forest and this region of the country, it is very little natural forest and then the urban areas. If you back out, you look at a larger area like Malaysia here, you see the light green, the natural forest, the dark green, the planted forest, hue other, the planted forest, much of the country is now a mixture of natural forest and planted forest and then we actually have separated out some other areas just to see as we said earlier how land use is happening over time to the grassland and you have that in yellow and then other areas like cities and other colors. This technology overall gives us a way to not only see in detail what's going on in the countries but to see the drivers of optic forestization and what this is really becoming.

A particular area that's difficult as was mentioned before, rubber plantations, these are not the 30-year-old rubber plantations, these are newer ones, we were able to separate here in 3 to 5 year imagery planted forests shown in lighter circle on the left with the plantations on the right. We have been working with global forest watch across a lot of these countries to take their data on planted versus natural forest. We use the same methods described earlier for poverty where we split the data and test and train and we use part of that data, see the differences between the forests and use other parts of the data to test and see how good we are at identifying planted forests versus natural forests and then going further down to identify roads, to identify cultural land, to identify buildings and you have the whole area of land use change and what our forests are becoming, ultimately down to the roads and buildings.

Popping out then to what -- this is a bridge into the larger discussion and then the discussion at the end of the day on how the AI can remote -- how the community can help in concrete ways. There are four main areas that we see right now, one is we now have shown that we can actually use AI to separate the Virgin forest from the planted forest and that's not done systematically but we have done it as tests on certain regions. So there is a worldwide measure of deforestation and as mentioned in the beginning, the measure of deforestation includes any trees being cut down anywhere, even if it is a plantation that

was intended for harvest. We now have the tools and we have the AI and remote sensing to be able to do a version of that that really measures the loss of Virgin forests. Doing that systematically overall areas of the tropics is a huge benefit for all of us.

Second, ideally we would like to know what areas are at risk. This is one of the things we're thinking about as possible project areas going forward. You know, there's a lot of evidence as was mentioned before that deforestation tends to occur around roads, tends to occur around major rivers so being able to look at the land use change that predicts deforestation in an area so really critical because that then allows international aid agencies to focus on those regions and perhaps to start the deforestation before it occurs.

Thirdly, looking at degradation, many areas that are deforested are first degraded, they're moving in, taking out some of the trees, building a Coco foundation and if you're just using low res imagery or medium res, you're not careful, you miss the degradation. Getting an accurate remote sensing base measurement of deforestation, it is critical. Finally, and relatedly, forests grow back slowly but they do grow back. Having the wherewithal to actually measure the rate of reforestation in areas that are recovering is important to see that we're making progress in that area and also for any sort of payout mechanisms that would incent the tropics to undertake these campaigns.

With that, I'll pause and leave about 20 minutes to have some audience questions. Anyone want to raise hands? I'll try to pull up --

>> There were thoughts on predictive modeling, the first talk had interesting areas of where this occurs, human pressure, the regional, economic factors, you know, based on observations of what's going on now, what do we expect to happen which is useful for benchmarking policy interventions compared to the reality of the expectations.

>> A quick answer and then we'll pass over.

As far as I know, there hasn't been a ton of work on predictive modeling. There has been some discussion of it and the basic focus of the discussion has been around things like road building as an early indicator of the deforestation and I think it is a fascinating area. If you predict the deforestation and you look at those efforts on a small part of the world rather than equally focusing on the whole world.

>> I would agree with that.

We're building. Definitely. Good indicator. Also

could be interesting, there was transparency around governmental concessions being given out to agro and industrial companies that also for example we know in papau new Guinea and Indonesia, there are concessions going out so we expect deforestation to be going on there.

>> I was wondering about the proliferation of the platforms around the AI, satellite imagery, there are lots of people out there doing interesting things. Do you see trends towards 3, 4 major providers of different types of uses, say governments, commercial, do you think we'll get down to a natural monopoly with the satellite infrastructure that's currently put up in terms of where it is.

>> That's relevant to all sessions here. It is a good question. You know, as we sit right now we're in this interesting transition where up until very recently the satellites were all government. Originally the government satellites, they're lower res, freely available to anyone, the original high res satellites were all put up for this spy satellite. Then overtime, some have been made for commercial purposes although the digital globe satellites were originally funded by the government and they attempt to partially Monday advertise them on the commercial size -- side. When you look at true commercial satellites, really sky sat, the original sky box, the planet, other folks like earth cast, black sky, those are all new companies that have started in the last five years and there is a new model, that's VC funded from the beginning. If they're taking government contracts, it is a small part of the income stream. I think it is very unknown whether or not that will turn into something. Right now speaking from this point of view S we have business with a dozen different satellite companies around the world and there is a lot of breadth today. It could centralize but may not because the other thing, we short of got two factors working against each other. To some extent, the satellite companies are buying each other, on the other hand F the price of launch vehicles continues to fall and the price of the components needed to create satellites continues to fall so new startups are being tried to build new technology and satellites, it is not clear which of the factors ultimately prevails.

>> Just going back to this morning, the slide, somebody from ISA, the number of satellites being launched every year, I just think it is going to create an amount of data that's going to be massive and a lot of different potential uses. My gut feeling is that there will be more

and more platforms out there doing different things and especially more specialized.

>> The regrowth question, trying to track the regrowth, it is what is the issue, the natural regrowth spread of trees, the people interacting with that, what, both? What parts are unknown, what is the challenge that AI could solve a problem that could be useful?

>> What I meant when I said that, it is just that in you're going to actually fund forestry regrowth as say an aid agency, you're paying some tropical nation to regrow forests, you need to have some objective way to sort of grade the effort. Obviously will there are more and less success in any right. I wasn't looking for a particular barrier but an objective, fair, impartial worldwide way to grade successor failure or relative success of those kinds of efforts.

Thanks. Those are great insights, everything, how do governments such as Ghana lay shape factor, Ivory coast use the insights -- governments such as Malaysia, Ivory coast use the insights?

>> That's a good question. It is variable across countries I would say. Ivory coast, it is a significant tri of the -- how do they call it, a tropical forest aligns, something like that, they have signed up to conserve, stop deforestation and conserve the forests. However, it is difficult for them to actually control what's going on. In Ivory coast, the Cocco situation I showed you earlier, it was a small holder farmer going into the forests and starting their own farms undetected and massively. It is very difficult for them to do anything about that. Indonesia, Indonesia is a lot more tricky I would say. For them, Palm oil is a huge part of the economy. Halting the development of Palm oil and protecting forests has huge economic impacts for them. They have historically been a lot more complex to deal with. So our team, we work with the agro industry and the private sector, we're not that good at working with governments to get action at that level.

For me, it is not the number of satellites, it is the number of organizations and people who are involved, it is good stuff, maybe it should be AI plus satellite imagery plus making the knowledge of the information freely available to those. Just coming back, taking specific examples for Palm oil and supply chain and worked for a company that was commercial one in the agriculture space, and part of theirs is to sustain in the feed the world in responsible, ethical way. Part of that, the Palm oil, it

is impacted in Indonesia, they actually invested in this at a roundtable of sustainable Palm oil and part of the efforts is that they met virtually, everything that they could in certain time scale and for the people that then come to them and say hey, there is Palm oil that I have to sell to you, oh, where are you, they go we're here, they'll look at the actual satellite map and say actually 6 months ago that was forests. Sorry, we're not going to buy that and part of the international government and the massive -- how can you say -- regulations from different countries, et cetera, it is this idea of supply chain of traceability or what they call from farm to fork, where did this come from. How did it travel? How did it get here? What is the common footprint? What is all of this? Trying to figure out some of this in connecting is one of the messages that I get, to collaborate. There is so many people and at times I have seen people doing things in parallel and the AI, it is how can we -- maybe it is part of tomorrow, the other things, it is to allow access to that data in a more freeway.

>> That's a good intervention. I won't go much into the RSPO, but traceability, it is a key factor in looking at commodities, commodity supply chains, understanding where the product comes from, that's your starting point. It is not as simple as it seems. Often Palm oil people have traceability to mills and the mills then buy from a range of plantations, they ouch often have areas linked to the mills and they buy from third-party suppliers and then another thing about going back in time, you said 6 months, well, six months, it takes three years for Palm oil plantation to go from planted to producing. All of the Palm oil you get on the market, it was destroyed at least three years ago if has been deforested, it was three years ago, probably more. That's also a very tricky question. There are a lot of people doing different things in parallel and so in the supply chain responsibility, duration ability world, -- duration ability world, I would say it remains a small world though and people know each other and know what they're doing and often they're willingly doing things in parallel because they don't necessarily have the same ambition or the same vision.

>> To add one more thing to show the strengths and weaknesses of what can and what can't be done with the remote sensing, on one hand, we have looked a bit at this problem of Palm oil traceability, we have found the same issue, the mills may buy from plantations that are not necessarily close. It is hard to see the original source.

Satellite imagery, including in images, it is the trucks, the trucks are in the open, they're leaving a Palm oil plantation, driving to a mill. On the other hand, if we were only getting imagery, you know, at best once a day, more likely at the resolution we need to see trucks, more like once a month, right, that's not a useful image to understand where the trucks are coming from that are feeding the plantation. What do you need for that? You need some sort of Internet of Things data which may not happen in near term on where has that truck been. Where is it going.

Eventually, the data will be there as we get big data and Internet of Things, it is realer and realer. What we have now, it is only part of the solution for that level of traceability.

It is a good question.

There's a question over here somewhere? My question is how once we have a good idea of the State of forest plan on the planetary basis, who has the capacity to affect change on the global basis or on a more local basis. How do you pull the policy makers to move from deforestation towards reforestation? What is the ideal there? This is a question of if we have identified a forest area being at risk, who will actually throw their body across the tracks to keep it from happening or --

>> I'm hoping it no longer needs to be such a bodily sacrifice as there are people that do take it from that State of activism. They have the economic approaches that have not been developed that once we have, you know, full state of the system, that we can start building incentives and deploying policy tools that were not possible.

>> The million dollar question. There is really no simple answer to this question. One thing, so when deforestation happens, it is happening for a lot of different reasons. The main one I would say is because of the world population growing. Because the people in the planet, they're consuming more and more primary materials. There's more and more need for consumer goods and therefore, that's just driving the market, asking for more products. A lot of deforestation happening today, it is no longer being happening on an industrial level as it used to be on a concession level basis. A lot of it is rule of thumb. For example, Palm oil, talking a lot about Palm but we'll continue, Palm oil, 50% of the world's Palm oil is produced by small holders, people with less than 20, 50 hectares and those guys planting the Palm oil in Indonesia, Malaysia, they just want to send their kids to

school, University, be able to pay hospital. For them, it is really a way to make a better living. It is -- yeah. It is never a black or white situation, I found that by being on the floor, it a dilemma between local development, the local communities and then protecting the important forest. There is never a clear, easy answer, it is very gray I would say.

Who would actually have the power to implement that. We work a lot with the private sector, and the private sector, so we push the private sector to commit to no deforestation and we're helping them get towards that. It is taking longer, the implementation, it is taking longer and it is more challenging than we would like it to be.

However, governments also need to play a role. In the end, I don't think private sector and companies can be the guardians of the world's tropical forests. Governments have to step in at one point and play a role in protecting the areas.

>> Thank you. We have one more question. Do you know what happened with the Government of Belize and the offer to the U.K. government to rent their rain forest? As far as I'm aware, you know, you have actually got the seemingly benign well informed government that recognizes the holding of public good, but was actually on board with renting rain forests. As far as I'm aware, nothing happened about that.

Also, I'm not entirely sure about the data because obviously the U.S. forestry service just pointed out that U.S. cities have lost 36 million trees a year and the amount of infill going on in urban areas due to population growth and secondary homes, I'm not entirely sure the North-South nature of this conversation, I think there is room for a fair degree of inspection on the part of the industrialized north because I live in a very small constrained valley. You get -- constrained valley and you get a micro chasm that's happening there and the amount of construction happening there, not even the construction but the amount of tree loss of people deciding they want their view so that tree has to go because it impedes the view of the snowy mountain tops, I mean, it is literally horrific in the last ten years I would estimate that at least 50% of the trees in my local area have been cut down and you can see the collapse in the bird population, it is dramatic.

If you get these weather areas, you see what's happening on the local scale and people understand what's going on, I made my husband go out to the trees and I grumbled and people talk about AI saving the planet, improving the carbon footprint, I think it is worst, the



data, it is scary. Honestly if you want to have a sustainable future, we have to plant trees as if our lives depend on it. That would be -- I think this is just sort of lecturing the Developing Countries about which of the sustainable industries, I think it is an intelligent point you just made about a these are all livelihood for people and I think there is a fair bit that can be done in the industrialized north and I'll probably dispute the map with the green area.

Thank you.

>> I understand where you're coming from. Definitely I agree with you that there is some things that need to be done in the north for sure. The trend though, in Europe, especially France are that there is less and less farmers. When they abandon the farms and they turn to forest. The forest area in Europe, particularly in France, it is growing for the past 200 years due to actually farmers leaving the country side. So, yeah, for sure the city is expanding, urban areas are expanding, they're impeding on forest lands and agricultural lands, that definitely is a case. I think that is counter balanced by all of the farmers abandoning farms. For Belize, no, I had never heard of it, the renting of the forest case. .

Anybody else in the audience knows the story about this and the U.K. thing?

>> I know the story about Ecuador, which I think is probably different in this case, but when they had the oil discovery there, they tried to get paid to not actually do oil exploration. I don't think they quite met the expectation of income for it so they went ahead with exploration.

>> Any other last questions? We're targeting about an hour, we're right on. Anyone else? Great. Okay. Is there one? I couldn't see in the light. Go ahead.

>> My question is just bouncing back on the previous questions. So with this data, is the main action traceability or machining or using in discussion the private companies or trying to attract more governments in the future. I think it is both. As I said in the beginning, I think the the two main contributions here, you really can't improve something, you can't measure, it is just wishful thinking if you can't measure. Once you have a measurement, you at least have the hope of improving the thing you have a metric in. The other thing, if you're going to have think mechanisms where you'll have money exchange hands, you better have an objective sort of measure that nobody can play with. I think satellite

imagery plus automated AI or otherwise based analysis system is a good candidate that can't be manipulated that's a fair method for paying off any sort of a fund transfer.

It is both.

If you're talking about being able to make something into a metric, that can be used for incenting cooperations and incenting governments in the terms of effectivity of government operations.

I totally agree with you.

I can't figure out what I was going to say!

(Laughter).

Yeah. You can't yet -- it is flying blind basically. If you don't know what's going on it is like flying blind. We have a case we used to use global forest watch as a base and they don't differentiate between Palm oil and it natural forest. When you look at it, it is a range of data and you don't know if that's actually deforestation going on or if it is actually Palm oil being cut down, replanted. You need to have a precise -- you need to -- you need to have precision to the data you have got if you want to take action especially business linked action, if you want to take blind decisions, if you want to engage -- take supplier engagement actions, say I'm an industrial brand and I want to -- I have seen that there is deforestation happening and I want to engage the supplier I'm buying from, I have to make sure when I challenge them on the practices that it is actually happening. When I go to him, you guys have been deforesting and actually it is them cutting down a few Palms and planted them again, that's a waste of time and energy.

>> I was wondering, it seems like AI could be used in the positive case too of identifying areas like where they were -- where there were farms that you were talking about how in France the forests, they have retain over, and maybe it is possible to at least tell countries, okay, if there is deforestation going on here, we have identified these areas where you may seed and replace forest, just to create the balance.

>> Sorry. I didn't quite understand.

>> It makes sense. If you identify areas that are good candidates, either because they were deep rain forest in the past, or because they're no longer being used actively for farmland, a candidate for where you're going to reforest.

>> Should we wrap? Thank you, everyone. Great questions. Happy to talk further during the breaks.