**G1 - Interview Chief forester, Windhoek - 20-1-2023**

That happens in three years. Four or five years, something like. That so and then, I mean the answers are there, if you do a calculated filling calculated by the biomass quantification tool. And whatever that tool is calculating the amount of woody plants to be removed. That doesn't look very appealing to harvest this. Because they have got this picture in mind of 100 years ago it used to be open savannas. You can see far away. But we should also take bone in mind that vegetation is also changing along the lines. So whatever vegetation that we saw 100 years back, it's not what you're most likely going to see now. And that's what they are. That's what they'd like to see. And that's where I call where the overharvesting comes in. And that makes them run into more trouble than they were before.

I'm not sure if you have driven dokania from here, no?

**At least not yet. Yeah, just yeah.**

Just from 160 kilometers. So passing the road block on the right, you will see large areas that was clear.

Right in front of our noses, right close to the window wake, forest trees. And I don't know how that happened. I don't know.

**I love everything. And so just so curiosity question. Do you think this can be prevented even if it's there, is there is a good post after care management or even this is threat even if after care management is done then. New invasive species are harder encroach. Your species will still try to manage and then reclaim the land. Just to understand the root cause of it. Is it anyway? It's coming, or is it just because of the? Loss of total not following aftercare management.**

I mean, yeah, I, to be honest with you, I don't think farmers can afford after care because they were in this Bush encroachment problem for so long. And the biggest problem that I've seen in my research is that farmers actually did most of the Bush control. In the drought, when we had lower rain and what I could see from my data is that during that time they did not get a significant difference in class production from the cleared areas and they encouraged areas. So it didn't help them.

So they did something thinking that it's the problem of the Bush, but it wasn't the problem the Bush and in my data I can see that immediately when the rain started coming in 20. 1920s. Over there. And you can see this big jump in the clouds partners production, so whoever. Did it in those dry years didn't actually get any benefit there. And now, in these dry years, this progressively growing species pioneer species, which is the single version. So they actually managed to establish themselves, whereas the grass couldn't establish themselves. So it was such a lost. Yeah, it was such a loss. And now with that most like I said, it takes 100 years for the plants that we know used to be encroaches to encroach. It takes three to four years, so a farmer had struggled before with the encroachment, with the drought within that four years and that we, the farmer can afford to do after that time.

**What would you say would be a sustainable way of extracting or doing the Bush thing?**

That would be surely. No doubt, it would be, surely. To do a survey and they use the biomass qualification tool, which in any case tells you exactly how many three columns per hectare you should remove for a sustainable booster.

**And do you a lot of people don't use it or why do they not use it?**

I don't know. It's already launched in 2019 already. So and also the reason why I moved over to forestry is to be right at the center of where law enforcement is taking place. That's why I move from agriculture to forestry. So that things can get done. I'm still busy giving training to forestry officials to get to use the tool. Because the process to my mind the process is so simple is for a farmer store, a far more harvester. Whoever wants to do Bush harvesting is, and any car is going to come to the Forestry office to come and apply for forestry permit. So if the forestry official can just go out to the site together, obviously. To take place, go do the surveys. Come back, enter the data. The model calculates. What would be the sustainable offtake? 33 covalent removal with the biomass from those 3 equal covalent removal, and then see if it's too low. Tell the farmer low if you can't, it's too high. Yeah you can. But in practice.

**So the farmers, they first have to. Go to forestry for the. Permit, right and then forestry. Goes up to their floor.**

So in any case, they can go do. This survey. The Biomass qualification survey.

**So then would it be the responsibility of the farmer to do the survey or forest?**

It should be the responsibility of farmers. And that's why I'm busy giving them trainings now. And it started long ago and after trainings, it just didn't happen so I'm trying to get a director. OK, there's still a few more trainings coming up sponsored by BCU Gizz and after that, then it's up to the director to give the director to all the forest officials that have to do that. But yeah. Hopefully it will not be too late.

**OK. So you think if everyone trains the forestry people properly trained to do all the biomass quantification that in the future we will bush spinning, could you? In formed in a more sustainable way, yeah.**

I mean. Training is one I mean. Doing the survey, telling the farmer there is amount of buyer messages you can get with just a little. Other thing like that, that's one thing, but I don't think people know anymore what is sustainable hours to how it should look. And I mean the model size are 203 equivalents per hectare to be removed. That's not very practical in an actor is 2 soccer fields. So how does it look if 2. 103 folds are removed from you so that. You can know with the rest of the area. Yeah, should look similar to that. What I normally do is I take a smaller area, let's say a 50 by 50 meter. And then I do all the extrapolation calculations if someone needs to be removed per hectare. How many is to be removed in a 50 by 50? Then we mark it off. I'm normally there with the harvesters when we harvest together. That small piece. And then I just tell them this is how it should look. The rest of the area, so obviously and. I mean, those are the things that. I'm not out there yet.

**Can forestry go back to a farm and say you haven't? All this in a sustainable way and. Penalize them or they're not, they don't enforce. Yeah. How do. You enforce that they do it in a sustainable way.**

My goodness, it's supposed to be like that. I don't know how much of it is being done.

**OK. And yeah, what what would you say are the biggest challenges regarding this Bush encroachment?**

Is that not from forestry side? Or from from forestry side.

**Yes. Yeah.** **From your experience.**

The biggest challenge for Forest Hill is obviously the the vehicles. The equipment. OK, the vehicles, Internet, the offers, computers, printers, that stuff. You guys are laughing, but they don't have that stuff. They hardly have such stuff and it's easy for me to sit down here and say they should have been doing that. And that and that, but I mean you come to an office where there's only one person, so. Does he lock up the office now and go out, he comes back. As even though internet to check on Google Earth. OK. Yes, the phone. I'm going to do my service. The little bit of planning on how to do the most of them don't have them.

**OK.**

But still I mean. The computer issue shouldn't be the problem, it should be the major problem is vehicle and the, it should be do the monitoring.

**OK. Yeah.**

That's the thing. And then, of course, and then of course just to forestry. I must have given this training now three times. And we are going back again. It's now no longer called the training. It's no longer, it's not called the support to the support to training, that's how they call it now. So come on. I mean, at some point people must also take responsibility and try and struggle a bit.

It's getting dark. That's what I think.

I'm speaking from the director of Forest. Speaking like this. This is what I think. I mean, yeah, you get to know something about struggling a little bit.

**And how many like how many people work for the directory, forestry. Or do you have like different bases of the country?**

Yeah, they've got offices all over the country all over.

**OK.**

At least two or three offices per region at least, so they are quite well spread throughout the country.

So be ideal if everyone. Had a car that offers offices.

Of which stores is in Juper region. Or she caught, or she caught her. Those are the main hot topics for the hot spots, for these Bush hours. So they should actually get more preferences when it comes to resources. I think so, yeah. I guess so.

**And we also learned that it's at least there are different regulations for commercial farmers and people living in communal areas. For this bush, encroachments and harvesting is it also regulated by the Directorate?**

Yeah, I know commercial farms, that's open for hours, communal farms, communal land, currently not. But I also understand why. I also understand why, because if a community, if a community can't prove. That all of them will share these resources. Equally, and that everyone will benefit. I'm on the side of forestry 44 taking it slow.

Because one reaches well off person farming in the communal land, working for example. He's just kind of strap the resource and leaving the poor community members with nothing, the ones who can't afford. To make the buyer kill. To make charcoal transport and charcoal to the nearest base.

I agree with forest being that in that sense, if there is no proper business plan or no proof they will really, everyone will benefit them. And I've been might even be worse in communal land than in commercial land. If it's open for the communal land for four hours today. I know that, yeah. Because the media is for everyone, I must take before the other one takes.

**You're still work of FC and. To see if this.**

I don't know the people at Forest management will be able to answer you that question. And he had botanical research, so.

I hardly get involved with for law enforcement. Certain I am just on the scientific side of the research of what should be taken, what is for us and the nice equilibrium honored forest arrangements and a good equilibrium. Developing the model, that's what I developed those kind of stuff, yeah.

**Yeah, with the model, the same one. Did you do it in corporation with NV, OK.**

Yeah, yeah, it's that.

Water levels in soil? Well, let's say in those kind of aspects or is that a difference?

**No, no, just a question. So then how do you exactly determine? What's a sustainable harvest is?**

Good question, that's normally rainfall dependent and with research it has been shown that beat 3 equivalents. It should not exceed 10 times the normal the average long term rainfall. So if in area, let's say you want look the long term rainfall is 500 not 500 two 150. And three equivalents shouldn't exceed 503 equivalent. Then you are in so one it's twice for 3 equivalents should not exceed twice the long term average rainfall of an area. That simply means the higher the rain for an. Area the more woody plants the area can accommodate without negatively affecting the bases primers that farmers need for their cattle.

**OK.**

So it means by removing an extra plant will not give you extra grass. And that's the that's the general rule of thumb. And when it comes to evapotranspiration 3 equivalents which is etc, that's normally 10 times. So evenings long term average rainfall is 250 millimetres ET directors shouldn't be more than 2500 ET per acre that is seen as.

**OK.**

**So you'd like to show you the concept that we're working on. It's called the bio hub. And the idea is that there are multiple communities farmers can deliver biomass. So in this case it would be the enclosure Bush. To a central place where there is a biorefinery and we are investigating a technology that can produce different outputs. So first is a bio oil that's in our investigation. We're looking at that, the production of biofuels for the shipping sector. But you can also use that as a basis for other products. A biochar that can be used realized by the communities in in different ways depending on the needs, and then it also produces a. A wastewater stream and a gas stream which can be utilized in the in the facility, yeah. So yeah, we are here trying to understand how this concept would work in Namibia or in this context so.** Yeah, what benefits should it generate? What are the preferred products or the use and what should be the use of those products, but also what are challenges or what could maybe have what could maybe be negative impacts of this system.

So yeah, looking at this concept concept, what do you think the benefit could or should be here in this context?

But frequently. I have I have this extraction refinery but. Yeah, I just don't know what the. Issue would be. How many tonnes would you need for certain? Liter of bio oil.

Let's say for example, it will be around 30%. So for every ton of food you are. Digging out, it fell roughly 30 to 50%.

So 300 kilogram.

I thought it was going to. Be much less.

We also need water. For that, so that that changes things. OK.

And let me just check here. Soil went down and this generation. In this part, I'm quite familiar of that.

With the biochar.

Yeah, this in here.

OK.

What do you? Mean with the water treatment, that's that.

**So, you know, goes bio char can also. So basically, biochar is carbon, right? You can also activate it and use as activated carbon as a filters.**

OK, OK.

**So if you have like a wastewater or something, but you need purification, you can also still use those as big bed filters and then.**

OK, I see. I see. OK.

**Perfect. Whether we are still trying to understand to what context biochar can be so biochar can be used for. Look, yeah, we still have to look at the soil. What effect does enclosure which had on soil which it lacks nutrients? Then, if biochar had these nutrients, we can bring it back as a fertilizer or just as a soil lemon mint, right? Or we can use it for filters. If there is we have the local community bases, you know, undrinkable potable water. So that can be done. As well, or biochar is still a carbon or charcoal. You can still burn and to produce electricity as well, right? So if there are like, off grid systems, people, the community is off. Grid if you can have like a small biomass plant or something, you know people can benefit from that from the biochar. So that is something can be tailor made for the local. Issue these are tensions.**

I mean, what I know from fire charge, normally it holds water, but what the better in this also especially in this dark country? Yeah, but yeah, yeah. OK, this is the only. Part, which is new to me so.

**The biofuel. OK, yeah. OK.**

Yeah, it's the only one it's used to. I've got no objection with this.

**OK. Yeah, because from a worse 3. What do you think? Also maybe it could be challenges or maybe negative impacts?**

Of of a system like this. Because especially the shipping sector would need large quantities.

Yeah, yeah.

And that was my worry. Yeah, but it doesn't look like Namibia is going to solve this problem very quickly because I mean even. If you are was, let's say you have a sustainable. And they still regrowth from those slower the trees that you live, they grow bigger. And at some point in time, harvesting will have to take place. I mean, it's just that you get better quality or better quality, I mean, by better diameters from a sustainably harvested area and smaller diameters from a wrongly arrested area. But I mean the biomass for us it's, it's here to stay regardless if you have a sustainable or unsustainable.

Here to stay. As and just understand your statement you want. It to be. Here or you say it will be. Here it will be here.

**OK.**

And it has to be here, because I mean, in our savannas, these woody plants, they've evolved together off the grass, so. They are. The nutrient recyclers of the neutral system. In terms of and they play a major role in the ecosystem. Nitrogen fixing Burrows for browsers. Good for the community. A long list. Shelter for animals, blah blah blah. Beautiful landscapes. So yeah. It has to stay and it has to be just correctly managed. Where we went wrong is that we replaced mixed feeders with cattle that are just grass feeders. So the Bush wasn't utilized overtime and with many poor management was the more you overgraze you lend the more room you create for Bush because cattle doesn't eat the thorny foods they eat the grass and there's no space for Bush to, because animals only armor one. Component of the station so it should be just correctly managed and then its a resource opportunity like everyone else was telling provided its correctly managed. And not short term, I see charcoal as a short term. I've got nothing to hide. Them, but I see it as a short term financial gain creating long term problems for yourself because with charcoal production people tend to take the good the Bush with the hood diameters that is required for charter. Yeah, we'll buy a child. That's not the case. You can take the smallest bridge that actually should be taken first. And well, I mean if you. See charcoal areas. They are taking the nice trees. Leave all that Bush that even parts of the machinery over that Bush. That should have been actually taken first. And there will be times that there will be times that harvesting will have to take place. Removing only Bush, which can be used for charcoal. But to improve your grazing capacity so that you can have more capital for your long term income from your lifestyle. And that's why I. Don't like charcoal? Because it's destructive charging production. And I'm happy you guys. Are beginning to.

So not just by choice. So in our process, we. It means woody biomass. It doesn't really care about small twigs or big, big, big branches, because at the end of the day we need wood chips, but at least you can include the seller branches that.

Yeah, we are not selective of which size we have like smaller the size is better actually for us.

OK, that's wonderful. That's positive. OK, but also but also normally if the land has been destroyed over harvesting then there's a lot of Bush now, now that Bush is normal in most cases, roughly about the same size, uniform stands the same. Now, in order to fix that harvest this thing that occupied the land, they must clear it now and what we have seen that in in those areas is that you should actually take the because by you taking away every time the Bush because it's uniform stand which, but there are a few other species in between, and it's normally machinery that novels that stuff, and they normally get away because it is sickle boost. Aggressive in creature than they harvest larger areas. How are you going to fix that area. Because now for the farm mates like this it was a problem. Within four years he got into this into this, Shravan, Shravan in coached. But now the booze is just this high. So it will not be economical to others push with this design, so the farmer is losing out because he is now at a reduced grazing capacity, but the boost is just this high. It can also not be. So the farmer loses out the few years of livestock production until the boost comes in around this height. Then it cannot be used for wood chips. So my problem is when is the van going to be fixed now if you if you do this clean up, wait for the to be up there. It's just a farmer boozing out. All the time. In terms of livestock production? And the movie is. So big, I mean harvesters can go from farm to farm, they will always have to buy a mess, but have always individual farmer. They are losing out in the winter. I mean I. Have been on the farm that farms at half of the carrying capacity that they should be, they could farm. According to the national or the, if the farm, everything was in order, they could have kept 6 hour cattle, but they only keep 3. 100 cattle is to bush. And just because of this, when are you fixing this? And I know the answer is that after you've harvested and the plants are small. Is to target those pioneer species without chemicals, without machinery, a manual. And let everything else grow and remove those. Regrowing species by hand manually, but that's apparently not practical performance. So what seems to work is not practical.

So the Bush harvesting should be done very selectively. The same way, yeah.

Even even if you are busy with the legal. Should we still downselect? Yeah, unless. For families willing to miss out two years, every time, two years in every five years. Which is not ideal, which no farmer well, but I don't just don't have the yeah, so desperate. That they believe everyone that wants to help them. If I come with them. These methods, which is not practical, let's shoot it off and say. OK, you come with your machine. Does it make sense? Yeah, because they want thing to be done. Now, yeah.

**And do you? From the directory of forestry, do you also do trainings and things like that? On on these topics to farmers or is that?**

All our institutions.

You know normally for the rains and forum and the biomass symposium, these are normally events that are once a year and if a farmers organization invites me out, then I normally go for farmers organizations to invite me. That doesn't happen a lot. It's normally. The recent forum, which is once a year or the biomass symposium, that that's normal.

**Why don't they invite you? Because I don't, really.**

And they. And they don't know me.

**OK.**

They will get to know me along boards. And no, not really, I think. Farmers know me just. Now I think they know me. It's just. So I've been bringing few projects of the nau. Then I'm of the agriculture union. They know me. I've been working on a lot of commercial farms.

**Going back to the obtaining of permit is that quite a relatively easy process to do the size that you need to that the person needs to come out and do the quantification. Or is there a lot of legal stuff you have to do? As a farmer.**

It's it's very easy to get a phone. I mean it's. Can even get it the same day. So I just don't know what exactly. They I know you can get a bum at the same day. So yeah.

It shouldn't actually take the same day. It should be taking a few days so that the forest. Officially can go. Out and go do the service it is too easy to get up.

**OK.**

**And do you have any other policies? That or would affect farmers or?**

Have you guys? Visited the NNF and maybe a niche.

**It's on Monday.**

Yeah, they will tell you. About the voices.

Have you visited the Directors Office, director of forestry?

**Next week, I guess.**

I really want you to visit there as well without me.

You guys speaking. With you.

And I hope they don't call me to come. Just for you to get their perspective. Please make a note and make an appointment. With the directors.

Yeah, this is directly from the 2nd.

And with N&F. That's very yeah.

**So for for this one you said. So one of the challenges, let's say for example, which I foresee which she was acknowledged, is that the shipping industry needs large quantities, which means a lot of biomass is required, which means farmers will be tempted to really, you know. Perform a lot of unsustainable harvesting in those things. What measures or what can be done to make sure that, yeah, so it's just that not from our project we see that there is a lot of potential here, right? And whatever new value chains which they are having right now, char, it could be charcoal or Bush to feed or fire wood or making furniture so on and so forth. Those are really small scale, but then if you really want to utilize or do something with this inculture push reduction in terms of debugging or debug push thinning right you have you have to have a larger uptake. Right. Because it also has a very high growth rate because encroaching this could be a potential value change. If not this, there is going to be some other value change which is going to be set up based on this biomass, which means the question of not the question, the matter of sustainable harvesting has to be in place. Right. Whether irrespective of whether it's a communal farm or a commercial farm, so then.**

It has to be. It has. To be.

**Then do you have any kind of? Proposals or something you can think of where we can actually ensure that happens. You think, like let's say for example the getting the land certified by FSC, could that be a solution or is it a more a newer sense from the farmer or just certifying them as communal forestry. You know that certificate. You think that will be a way to go about it? What could be a way to go about if not like 100% monitoring, but just to make sure it.**

Or to be, to be honest of you, you're to be really honest of you, is that I don't think with the law you can fix this because the follow up on the law is and on monitoring is just not there. And we are working now on on a farm just South of the farms name is crummy. And there are a few model firms in in the area that does the thing correct. So I think that, uh. Seeing should be believing for for for farmer and the one farm that we are just going. To start now, yeah. The farm is also pushing through, which is Nice. So we can really show where the farm was and our process of fixing the farm the correct way. So it's actually not ideal one. And I'm actually looking very much forward to that to that. So I think I think having a few modern model forms where farm visits and look at the farm and see how they are. This is a farmer that has a similar problem with me. He dealt with it a bit differently. This is how his outcome is and that's the point of departure of learning and I mean in a workshop Congress, that's one thing. It's normally more for the scientists. Farmers believe in seeing what they see believe in. Taking up what we see on. The ground and then we've got another farm here. And even the sea with the any you, Mr. Life and his family on the east. Those farms are beautiful farms. And it's farms that the farm owners are not interested in making child gone. They are very selectively treating the bougie of our sites. And leave the skeleton there to rob them and I mean, there are so few, but they are actually making me proud, but just to answer your question, the law can be the lawyers got loopholes and get misused and places using the law. This is my personal opinion, I don't think. You can get anything the right thing.

**This model forms. Is it possible for us to visit?**

These the farms, yeah. Yeah, surely. Relief center. His farm is about far.

**And what was the first one so.**

The farms name is Agapia. The farm owners name is Hendrik. And then Ruby fenter. From the Namibia Agricultural Union. He is far missing the Far East and the Botswana border.

Close to the Botswana border.

**OK. And and justice to also to get a picture. Because we are yeah, we are also trying to understand what really happens once this Bush is being taken out or debugged or Bush thinning like so. There are some agricultural lands which are getting being affected and then there are some range lands which are getting affected as well as a range land. Yeah, scientists. How do you think we can selectively do that? Or does it naturally happen or that should there be a human intervention to promote range, land restoration?**

Yeah, I mean.

**So my in in simpler terms, my question is what happens if all, let's say in future all the Bush is gone, then what happens to those lines? Agricultural land or range land or for some other purpose. No buildings. I don't know.**

You mean if all the bush is gone?

**Sustainably gone.**

OK. Yeah. We sustainably gone, yeah.

All the bushes gone. They attend. That actually is very big. That's a serious question.

It is still, it is still although self maintaining. But it's still there is still going to be increasing biomass in Bush.

Even though you are harvesting sustainable, because sustainable harvesting. You are leaving a lot of bush, though, yeah. So I'm not sure if I get you quite clear.

**So no, I I yeah you are. You you got you got my question correctly and my my question is also then my question is so anyway, there is still an increase in push even if you sustainably harvest. That would lead to restoration of range, land or any other land. Will still be a problem**.

How about at the lower at at the lower effort and at the lower cost and without you going too far down the line of having to reduce livestock? I wish I had my computer and project, but I mean if if you have us both sustainably over time, there is a bit of back growth or lead growth or additional Bush coming? But not at the rate as if you would have cleared the land. So everyone is called non equal opportunity to. And if you do boost standing, then everyone doesn't have to equal opportunity to grow. So these bigger ones, they kind of suppress the smaller ones or not all seedlings seed germinated, it was, they had all plants, coppers from the stem base that you have cut because of the competition and the existing competition is there. So of course, yeah. There will be always bush growth.

Unless if you maintain it. For a very long time, every year, removing Bush until there is no until there, there is crowding Bush out of their reserves and there's no seat bank left for the plants. Yeah, until you get to that stage by. But then you should. Really, annually remove push for a very long time. And as grain bring in seed. So I'm not sure if you're going to win the battle. And then of course you get some opportunistic weed plants like petalidium and glanum and. Is the other one better? What's the name of?What's the name of that one? But with the currents and so on, there's opportunistic plans. They are they. In the area, while the area is busy recuperating, you will see if you drive to to to arcania. There is some area there where they have taken. Soil to build the road from vendor Toka India. A large area. In that area, of course, the seed and everything has been removed after plants and that area is starting afresh, so you'll see a lot of better Bush in.

That area then if you pass them.

So and as soon as the vegetation, the grass is well established in these better brush tends to gets outcompeted.

**And would it sometimes be better for a farmer not to have just cattle bullets have, like, goods that are not graze as roses? Would that be better for the? To stop the Bush encroaching again.**

But it's often not very practical for far. Because if you the moment. You have small stock, your management is very up because you. Have to protect them from predators and so on, which is not the case of capital. And that's why we generally know in the movie and the southern farms are the small stock farms. These farms are allowed stock farms. But of course, yes, they will just have to do a lot of infrastructure on their farms because they have got cattle fences now, which is strand of wire like this.

And codes they normally pass through there. So we'll have to take, they all have to mesh. Wire over there. It is a huge cost.

**And I have, yeah, a couple couple more questions because you are specifically focused on that. My one first question is. So is there any database or any reports or any studies have been done? Based on how much water or how much nutrients the the specific so one of the thing about our project is, we are focusing on Acacia mellifera, right. We are very specifically focusing on that because that that pretty much gives makes it easier for all of the downstream processing because we are handling with only one species. Which means less chemical composition, diversity and those things. Is it possible to understand like has there been any reports or studies where how much water is taken or how much nutrients is being consumed by the plant by one plant or by in a hectare or something?**

I don't mind. What I know is they add very to. The to the soil of. They have the leaves because they are deciduous bones dropping leaves every winter. Fixing nitrogen of some viruses, that's about. I know that they add nutritional value to this well, but when it comes to download and now I've got no idea.

**Would you say that the soil quality is better when the Niners? Encroach because you have more. Plants fixing nitrogen? Or is it? Not like that.**

Yeah, they are not the only ones fixing nitrogen. They're not the only ones giving organic metal use or so and in actual fact, where the outstanding wherever you see where it's pushing through, especially in the place or areas, the soil is normally kept, there's a hard surface. That's so grass is the ideal. The more grass you have you don't have capsules. So yeah, they do contribute to soil. Quality, but they are not the only ones, and there are some other plants that can be better. If together enough.

And more diverse. OK.

**Just also from all your studies, is was focused all your research is focused on sustainable harvest, right? So that's pretty much the outcome of the two, the whole work you did was the outcome as the tool which pretty much the ending is using right now. So all other banks are also using. They estimate how much they can. Yeah, give out loans or something for the farmers, I guess. Am I correct or?**

Wrong. I don't know, OK.

**OK, yeah, this this better. It's your questions. And do you happen to know anybody from Nust or UNAM or any other organizations who's working on? Understanding the effects of this Bush on the soil or on the water table.**

I normally do contract lecturing at nust.

But sure, there's one there's there's one person I know he's professor Ben Strover. His wife. Yeah, Ben Stiller. Do you want these contacts? And then Doctor Evo Zimmerman, he retired from last. He is retired from nuance. That's the two people.

**Because we want to understand, like people say. Yeah, it deeply. The Bush depletes lot of water through water and so it's like we want to understand. OK. Then in that case, like you said, it's not the only Bush which fixes nitrogen or it absorbs carbon dioxide and those things. If we can replace those trees with some other grasses or flow shrubs or less invasive or less encroaching Bush or something like that. The same soil effects can be maintained with an added advantage of not depleting the groundwater at a much faster rate.**

And they are actually the they are actually the better plants. They actually the long ago they were seen as the culprits for Bush. Now, not anymore. We actually want them because if you remove them a lot, then you give space for sickle Bush and gruvia for diagnostic scenario and griva.

So what you just said now should be more applicable to biomass, Techician area and previous species. Of course, including the flow weights already tense.

OK.

But those other. Two species you mentioned.

Those are the.

Words or like the they should be.

Actually, not just them. It's a few more.

OK, OK.

It's a few.

**Because they grow faster, right?**

And an area you can just write sickle Bush, yeah. And yeah, they grow faster and they produce a lot of seed and. They are pioneers. They have got a short life screen and that short bio screen. They make sure they produce enough seed and they grow of the battle in that falls.

OK.

**So you've been all the best to take away.**

Yeah, that statement could pretty much destroyed. Yeah, yeah, yeah. But he also said that, you know, there there's already densely present that could be the option let's harvest. Teleflora make sure. Sickle, Bush and graveyard. And. They are not coming back. That could be it. Yeah, yeah, interesting solution. I will say. Or yeah, because we are not removing, we are just push thinning them, which means mellifera is still there. So that's a good sign. We just, we have to make sure that it's not completely removed. So the yeah others can grow, but just from your understanding or to your study, sustainable harvesting should prevent? Others from invading because there's already one.

Even without the aftercare.

OK.

Because, I mean, I've seen it with sustainable harvesting, least product from cut plants are the highest is 35% of his parents, that's. Not a problem.

OK.

I'm going tomorrow to an estate South or and they don't do any farming, but there's frequent fires coming through them and normally that come hunters come for others. It's scam for Bush that the one loves fire. So it looks as if the claim for Bush wants to replace the other ones. So fire kills that one fire doesn't kill the campfire Bush. And they can't stop from visiting. So that's another one coming.

OK.

That's not in the in the commas island. So every vegetation type have got more or less their own dynamics in terms of if you look at the commas island where we are now, I mean sickle Bush is not the main problematic guy. It would be normally spinosum and darkmantles come for others and a bit of Crimea, and to a small extent, sickle which. And you move into the higher rainfall. Areas like the thornbush savanna. That's where the sickle Bush is. That's, and that's invaded and so on. We're together with trivia cataphractus. Alexandre should move even more the higher in for a tower area than it looks have a crazy attacks are cancer and so on, the other one. So the IT looks as if the. The change in composition happens over the different vegetation types. But just by different species and the degree of change in this lowering for areas is not as much as in the higher inflow areas. And towards the east, it looks like Terminalia sericea is the one that is taking over areas that you are so. The principle of normal remains the same way as each felt type is called a different dynamic.

**OK. So then my question would be one of the last questions. So you understood what we're going to do, right? Basically have a, and we don't want to have a lot of chemical, chemically diverse species or different species. So then which region do you think in the current status of the current status? Which location do you think would benefit? From having this kind of value chain. Is it more towards the low, low rainfall region, high rainfall region where there is many flora? Or should we look at possibly there is much more damaging and largely available. Because one of the reasons why we chose Acacia mainly for us is that two reasons actually not one reason, 2 reasons. One, there are some regions where it's highly densely, you know, present. So that gives us the logistics and harvesting much more easier in terms of economy. And second one is the quantity, it's largely available. As well, in certain regions of what you are among those regions, Acacia mellifera species is largely available than pretty much other species out there in the whole whole of them. Maybe so that's. One or two of the reasons why we chose that because these value chains need large quantities. So based on all these things which we discovered, like, yeah, probably removing akeshi might be promoting a lot of much more, you know, higher invasive stuff or the lower, you know, lower rainfall region will have lower diversity or new plants? It's not much of a threat than compared to harvesting from a higher rainfall region, where removing will immediately be used by other invasive competitive species, not invasive, encroaching competitive. So from your understanding, yeah, what you say what you think?**

Are you providers also have lower biomass of of? Just to keep that in mind. Adobe comments island. Thornbush savanna. Our region wise commerce. Region was in Georgia Zone Juper region. Kunene inoshikacho regions. And but of Erongo origin.

OK.

Basically, I'll still have to. I don't know how to spell those things, but I think I will read that interview again and then that's good.

**We have it on tape.**

I think this is kind of quite important. Because let's say if you if you have a value chain already set up if, because we assume the biomass is largely available and then we harvest literally even the same harvest, if we harvest in the big quantities in larger hectares and then if it's going to be just replaced by much stronger one. Yeah, probably. That's not the best way. To do it.

Rather, look for more hectares and do lighter thinning. With a lot of hectors.

That's that's one way to go about things.

Yeah, more hectares means more transport costs and the whole cost, whole logistics and everything will. Yeah, we'll rest again. So we have to optimize. But I think the key message I will. Is sustainable harvesting might avoid also the invasion of invasion of new species. So that's a that's a good thing. I think that that's the biggest message. And the rate at. Which it has to be done and if I mean one more thing just to also to understand. You said the sustainable harvest is based on two things. One is the rainfall which is present in that region, how much it gets. Right. Can you explain it to me one? More time like. Yeah, I'm. Super new to this one.

Yeah, I mean the the determining factor. Of of of sustainable harvesting, of living behind the correct. Is is rainfall is the main determinant OK and of resource is normally twice for three equivalents. OK should not exceed twice the long term average rainfall. 3 equivalents per hectare should not exceed twice the long term average rainfall.

When you look at.

ET It should not exceed 10 times. The long term average rainfall. So in the in the Vendue area, if the rainfall is 250 here, yeah, if you do it, the survey of the of the model. Input the data it gives you 3 equivalents. It will tell you that that is the amount of three equivalents. If you enter your rainfall, if it exceeds 10 times, and if it exceeds twice. OK yeah. 10 times for evapotranspiration, vehicle once, twice four. OK, so 250 millimeter range usually have more than 503 equivalents per hectare, 250 millimeter range. You should have more than 2005.

OK. 100 OK, OK. Yeah.

And that's basically just the concept of in higher infill areas, we need more woody plants. For recycling of nutrients and it will anyway not affect the grass, the beiges layer negatively because that's the point where it's at equilibrium in the movie, higher rainfall areas is normally the deep sandy areas, so a lot of nutrient leaching can take place in those areas and that's where the Bush is there too to recycle. Utterance in any case without affecting. The grass. So it means if you add equilibrium, removing 10 more woody plants is not cannot assure you 10 kilogram more grass please.

OK. Yeah, you understood.

If I go right in more rainy areas, you. Harvest less plots.

Right.

And he's still. Very equilibrium.

Yeah, that's also the region where biomass is present in larger quantities, yeah. That's going to be an interesting trade off. Region of higher biomass, but you have to harvest the minimum on that. Yeah, that's already have to do a lot of cultivations.

But also but also higher biomass far above that, you can have enough and still leave enough. Behind that, that's true.

Let's show because that's region already being having a lot, because it's been encroached. OK, that's great.

So encouragement in the South southern parts. Will maybe give you. Just an example 200 kilogram. Encouragement outside will give you maybe five times. So although you take little but there's so much that little is a.

Yeah, that makes sense. OK. Oh yeah, that's true. We are Speaking of tree equivalence. Yeah, if the tree. If the bigger the tree.

Yeah, difference. I mean, the tree cover is a 1.5 meters. So if if a plant is 6 meters high and there is. 4/3 equals.

**So is that also taken into consideration for the calculation, like how high the tree? Is or it's not.**

The model does.

**That model does that OK.**

But just for just for interest sake 3, cover is just simply. 1.5. Meter. So if the plant is 3 meters, there's 2-3 goblins in that plant.

**OK. OK.**

Evapotranspiration, three equivalent that takes place of the canopy, spread. As well because. Plant two plants can be designed, but the canopy spread of that one is will be that much. And for this one, this much SO3 cover is not the best. So that's why we moved to evapotranspiration three goals. So that takes canopy. Volume into account, so it's normally 1.5 meter plant with a canopy volume of 500 cubic centimetres. Then that's one evapotranspiration to the equivalent. OK, perfect. But the model does all of that.

First of all, that's true, but we I won't understand what the model does. Yeah, because as a as a chemical engineer, I know that you should know what the model has because one of my professors usually used to say that.

Surely, surely.

If you have a model. Or a tool it's garbage in is garbage out. You really don't know what you are really pulling in. And how it's going to do, yeah. Is equal to garbage out.

I wear that garbage in garbage.

Yeah, yeah, yeah. It's the same thing.

Even if you do states garbage in garbage.

So I want to really understand this, yeah.

Well, that's how it works, yeah.

OK. OK, that's that's.

Andreas mentioned that you're not supposed to harvest the tree over 18 centimetres in diameter.

Yeah, that's the that's the big plans, yeah.

**Just out of curiosity, are there also any other people who are working at who's looking at the new tree? And cycling of this Bush. Because you said it plays a crucial part in more, yeah, that's but pretty much that's true for all the big trees. They impart nitrogen fixation or carbon sequestration. Yeah, those kind of things. But just to understand what role. Possibly you know, beneficial role if mellifera has fixing nutrients or something like phosphorus cycle or potassium cycle nitrogen cycling and so.**

Yeah, I'm not good at that. I mean, when I did my masters in, I basically took the soil samples on the three canopies close to the STEM base under the canopy between canopies, and there was higher carbon and soil organic carbon, and I can't remember what else. It it just showed better than in terms of the specific parameters that. Are to the lab could do. For me it showed it showed positive under 3 canopy as opposed to between and that's the most I can tell you about.

That's this one.

**Well, thank you very much for all this. It's very yeah. It's very good for us to understand this bit more how this all works.**

**And we would appreciate if you have like contact.**