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Forests under threat

GENOME EDITING

Africa can speak for itself

CERTIFICATION

Testing the Food Security
Standard

INDIA

Andaman Island farmers
battle climate change

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Dear Readers,

Having been praised for its exemplary policy on forests for many years, Brazil is now witnessing a rapid acceleration of rainforest destruction in the Amazon region. According to the country's National Institute for Space Research (Inpe), deforestation increased by 93 per cent in the first nine months of 2019 compared to the same period in the previous year. Between January and September 2019, around 7,800 square kilometres were deforested, whereas Inpe had recorded around 4,000 in 2018. Not at all pleased with this being made public, Brazil's President Jair Messias Bolsonaro simply fired Inpe's Director-General Ricardo Galvão.

Shortly after taking office early in 2019, Bolsonaro drastically slackened the country's environmental constraints. Now, Brazilian farmers are allowed to burn down not just five but 20 hectares of forest to make room for crops and livestock, while the powers of the authorities responsible for carrying out checks have been drastically reduced. However, the President maintains that it is not his policies but "eco-terrorists" who are to blame for the situation. He is probably referring to people such as shaman Davi Kopenawa, who is courageously campaigning for forest and biodiversity conservation in Amazonia with his organisation Hutukara Associação Yanomami, which recently earned him the Right Livelihood Award.

Forest fires and deforestation are also reaching frightening proportions in other regions across the world, as the latest reports from Indonesia and also from Australia show. Even though considerable progress has been made world-wide in reforestation, such as with the large-scale afforestation measures in China, this cannot obscure the simple fact that, at least in terms of tropical forests and primary forests, the net balance is negative. Or, to put it in our interview partner Wanjira Mathai's words, when it comes to our forests, we should really switch to emergency mode.

Of course our journal seeks to draw attention to these worrying developments. But it is far more important for us to highlight the other side of the coin, which is how deforestation and forest degradation can be avoided, and how previously intact forest stocks can be restored. How can people in rural areas benefit from the environmental services of trees without a conflict arising between using and protecting the forest?

This may be a generalism, but political determination is right at the top of the list of prerequisites, and so is knowledge of the complex socio-ecological system in which intact forests and climate change, food security and poverty alleviation, culture and human well-being interrelate. These are precisely the topics that this edition addresses, in addition to incentives and community-based solutions, empowerment and character building, and – yes, love as well.



Unlike in other editions, we have also fully devoted our "Scientific World" to the Focus topic, albeit bearing in mind that we can of course only cover a fraction of the latest exciting research on this field.

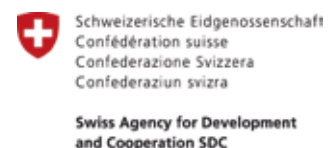
Given these complex contexts, nobody can expect simple solutions. Although holistic approaches are needed, the devil is in the details, as is so often the case. And these details can't simply be customised to cater for fast reading. But our latest readers' survey – thanks by the way to everyone who took part – has shown us that it is the depth with which our journal treats subjects that you appreciate in particular. And perhaps this is the season that will allow you a little more time than usual to delve into its contents. We are convinced that our precious resource forest deserves such attention.

Wishing you and your dear ones a peaceful festive season and a Happy New Year.

On behalf of the Editorial Team,

Silvia Richter

Partner institutions of Rural 21



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Advisory council:

Dr Reinhard Grandke, DLG

Petra Jacobi, GIZ

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Karl-Martin Lüth, DLG

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Dr Detlef Virchow, Plan International

Editor in chief / Berlin office:

Silvia Richter, s.richter@dlg.org

Editorial staff / Frankfurt office:

Daniela Böhm

Olive Bexten, o.bexten@dlg.org

Ines Lechner, i.lechner@dlg.org

Angelika Wilcke, a.wilcke@dlg.org

Editorial assistance:

Mike Gardner

Translated by:

Christopher Hay, Tazir International Services

Cover photo:

João Luiz Bulcão/Polaris/laif

Design & Layout:

Andrea Trapani, DLG-Verlag

Editorial office, distribution, advertising:

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Give forests the attention they deserve

Ecosystems and humans are integrated parts of complex social-ecological systems. In these systems, forests and trees play a crucial role. Managed well, they offer a unique opportunity to contribute to all of the 17 Sustainable Development Goals. A call to shift from the current development scenario to one that ensures the sustainable use of our most important terrestrial natural capital.

By Robert Nasi

The world is covered by approximately four billion hectares of forests, of which 93 per cent are natural forest and seven per cent plantations. Among the former, 33 per cent can be considered as intact (“primary”) forests and 60 per cent are naturally regenerated forests, i.e. forests under some form of management. Primary forests are of tremendous value for biodiversity, harbouring more than 80 per cent of the terrestrial biodiversity and ecosystem services. Losing them would have unimaginable consequences.



Tropical forest products play a vital role in the livelihoods of hundreds of millions of households.

Photo: Mokhamad Edtiadi/CIFOR

An estimated 1.6 billion people depend on forests and trees outside forest

resources for their livelihoods. More than 800 million people (30 per cent of the global rural population) live on 9.5 million square kilometres of agricultural lands (45 per cent of the total terrestrial area) with more than 10 per cent tree cover, 180 million on the 3.5 million square kilometres of agricultural lands with more than 30 per cent tree cover, and about 350 million within or near 40 million square kilometres of dense forests. The estimated value of ecosystem services stemming from forests, trees and savannahs represents more than 76 trillion US dollars (USD).

A wide range of products and services

According to World Bank figures, the international timber trade generates up to 150 billion USD a year, and the real value of local and national timber trade – sawnwood, panels, roundwood, fuelwood – is likely as large. In-

come derived from the sale of non-timber forest and farm products, such as bamboo, nuts, fruits, honey and bushmeat, adds another 50 billion USD.

Perennial tree crops and tropical forest products play a vital role in the livelihoods of hundreds of millions of households; they are also a primary source of export earnings and foreign exchange, representing hundreds of billions of USD for many countries, with vital spillovers for local development. Tree crop value chains produce important globally traded commodities including cocoa, coffee, coconut, rubber and oil palm that form the basis of smallholder livelihoods. Cocoa and coffee alone cover 20 million hectares and are the mainstay of over 30 million smallholder households. Recent global assessments suggest that up to 28 per cent of household income is derived from forest resources for smallholders living at the forest margins. More than 80 per cent of rural

people in the developing world still depend on fuelwood for cooking as well as warmth.

For the first time in history, more than 50 per cent of the world’s population now live in towns and cities. By 2050, this number is expected to increase to 66 per cent. The rapid expansion of cities has highly damaging effects on forests and “green” areas: increased pollution, decreased availability of food and resources, as well as increased poverty and frequency of extreme climatic events. Urban forests and trees play an important role in increasing urban biodiversity, providing plants and animals with a favourable habitat, food and protection. Strategic placement of trees in cities can help to cool the air between two and eight degrees Celsius. Trees around buildings can reduce the need for air conditioning by 30 per cent and considerably reduce heating bills. Trees are excellently suited to absorb pollutants and filter fine particulates out of the air.

Forests and cultures are intricately linked. The recreational value of forests as places of and sources for spiritual comfort is now widely recognised. Growing numbers of people visit forests each year, so much so that some suffer from severe overuse. Living in close proximity of urban green spaces and having access to them can improve physical and mental health, for example by lowering high blood pressure and reducing stress. This, in turn, contributes to the well-being of urban communities. The Japanese even invented a word for using forests for such purposes: “shinrin-yoku” (“forest bathing”).

A green infrastructure for sustainable development

We have made remarkable progress in terms of wealth and health, but there are still 900 million people going hungry, and most of our development has been at the expense of natural resources. Forests and trees have been particularly hit, destroyed for agriculture or degraded by suboptimal management. Around 12 million hectares of land are lost each year to degradation, harming the well-being of at least 3.2 billion people and costing more than 10 per cent (6.3 trillion USD) of annual global GDP in lost ecosystem services!

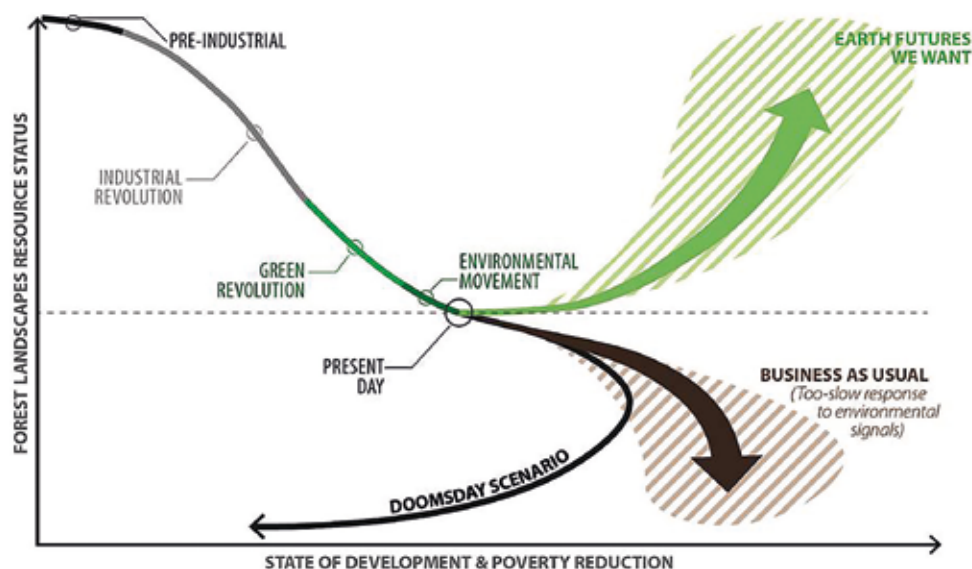
Continuing this trend threatens the future of agriculture, and humanity itself. Beyond the myriad of goods produced, forests and trees are also fundamental to sustaining food systems, ecosystem services and mitigating or adapting to climate change. Progress towards achieving the SDGs and the recently reached Paris agreement on climate change requires the world to shift its historical development trajectory away from a ‘doomsday scenario’ or business as usual environmental degradation where development continues at the expense of the environment (also see Figure).

Managed well, forests and trees offer a unique opportunity to contribute to all the 17 SDGs because of their spatial extent, the range of goods or services they produce or maintain, and the number of people they provide such goods and services to.

The significance of landscape approaches

“Landscape approaches” are now used by many major organisations and agencies specialised in food production and poverty alleviation thanks to the recognition that ecosystems and

Potential future development pathways



Source: CGIAR Research Program on Forests, Trees and Agroforestry; November 2017.

humans are integrated parts of complex social-ecological systems. These approaches are inherently complex and dynamic, as opposed to approaches with clearly-bounded spatial entities. People, in various forms of social organisations, shape the landscape and its natural resource base while their options are essentially bound by both the potential of the land and these resources as well as the prevailing natural resource governance system. Changing the trajectory of a landscape implies a change in the behaviour of the key actors within that landscape and thus requires the identification of successful leverage points and negotiated approaches.

Our ideal approach for forests could be summarised in three points:

Conservation: we must conserve the remnant “primary” forests and critical ecosystems (peatlands, mangroves, tropical mountain cloud forests ...); such land should not be newly allocated for industrial uses or conversion to agriculture.

Sustainable use: we must sustainably use the large area of “naturally managed forests” for the provision of goods, jobs and services to humankind; preferably we should foster community-based management and make sure that local communities reap real benefits from their forests beyond those gained by the global community. We must increase the area of plantations, making sure they are established based on best agro-ecological and social practices, as they constitute the most parsimonious use of

land to produce the required wood and wood-based material to shift towards a bioeconomy.

Restoration: We must restore the huge areas of degraded forest lands but pursue this as an economic enterprise that creates jobs and wealth while restoring ecosystem services and diversity.

Forests are our most important terrestrial natural capital and are excessively under-valued and under-appreciated. It is vital to establish a science-based understanding on the state of the world’s forests, including threats and the opportunities they offer to transition from a fossil economy towards a circular bioeconomy. Forests require a long-term and holistic approach which integrates climate change mitigation and adaptation, biodiversity and their role in decarbonising our economy. This approach requires us to overcome the past short-sighted and polarised debate between conservation and production. Biodiversity and the bioeconomy are the two sides of the same coin: sustainable development.

Robert Nasi is Director-General of the Center for International Forestry Research (CIFOR) and Managing-Director of CIFOR-ICRAF, formed when the Center for International Forestry Research (CIFOR) and World Agroforestry (ICRAF) merged last January.

Contact: R.Nasi@cgiar.org

References: www.rural21.com



Forestry protection and conservation are very much about what you love



It's quite simple really. You want to protect the things you love. And just what you love is often determined in very early childhood. Wanjira Mathai talked to Silvia Richter about imparting values, the importance of role models and the potency of empowerment.

Ms Mathai, for years you have been engaged in showing people the significance of intact forests. Why is this topic so important to you?

One aspect is that to me, food security and forest integrity are inextricably linked. Because, especially in countries like ours on the African continent, food production is largely

reliant on rainfed agriculture. We are dependent on the climate – a climate which was very well understood and predictable in the past. We knew that the rain would come in March, so there were certain things you had to do on the land by March. In March, April, and May, you had rains. But that is very closely related to the integrity of forest systems. Forests are part of the climatic cycle. Without them, you are unable to create the conditions that bring rain, which is also needed to feed the rivers. A lot of agriculture depends on the water that is flowing in the rivers. So food production and intact forests are very closely linked.

But agriculture is often also a cause of forest loss ...

Food production for sustenance is very rarely a cause for forest degradation. It is only recently that people have been encroaching into forests to grow their food. With good agricultural practices, you could grow your food on the farm. And in fact, it is sometimes quite a distance to the forest. But the soils there a lot more fertile, so it might be easier to produce food there. However, the forest has a different role. It is a conservation platform. And if you don't have the forest, you will very quickly begin to see that your food production is affected.

So you don't really see a conflict here?

I don't see a conflict with small-scale agriculture. I think the conflict has come where enforcement has broken down, and with the advent of commercial agriculture. Where people have

been allowed to go into the forest and begin to graze their animals or to grow food instead of practising agriculture the way it should be. We should be focusing on how we can engage in more efficient agriculture, on how we can increase agroforestry practices on our farm, so that we have fodder and food as well as an environment within our farms that is facilitating our growing of food.

There was a time when we knew about crop rotation, when we knew that you needed to plant beans so that you could return the nitrogen into the soil. I think we have lost that knowledge. Many countries in Africa have lost their agricultural extension services, which used to be instrumental in ensuring that farmers got the information they needed to farm correctly – not to farm too close to the river, not to grow the same thing all the time, to intercrop and apply all the other practices. But instead, people have abandoned what they were farming and sometimes moved to the most sensitive areas – not necessarily because they had to. Often, this happens because we are not optimising agriculture where we live and where we should be. Technology has improved, and knowledge has improved. I would rather invest in extension services and in ensuring that farmers are well informed and are able to grow their food. And let the forests play the role they need to play.

Let's talk about the Green Belt Movement. Women's empowerment has always played a big role in it. Why?

Women are on the frontline of food production, energy security and water security – the three things that you absolutely must have. And the founding of the GBM in 1977 was an acknowledgement that these three elements of the survival toolkit were threatened. Women were saying that they had to walk further and further away to get water, they didn't have fuel and they certainly didn't have nutritious food for their children. And all of this creates a really dangerous situation. But it is the women who were feeling the pinch. So women became the very first responders to this call. Men subsequently joined the Movement as well. But women were always the ones who

Wanjira Mathai is

Senior Advisor on Forest Restoration for the World Resources Institute (WRI).

For close to six years, she led the board of the Green Belt Movement (GBM), an environmental grassroots organisation that was founded by her mother, 2004 Nobel Peace Prize Laureate Wangari Maathai, in 1977 under the auspices of the National Council of Women of Kenya. The Green Belt Movement still empowers communities, particularly women, to conserve the environment and improve livelihoods. Today, Wanjira Mathai chairs the Board of the Wangari Maathai Foundation which was started by the Maathai Family and the Green Belt Movement, to nurture a culture of purpose and integrity in youth and children.





With its activities, the Wangari Maathai Foundation above all seeks to reach out to young people – the leaders of tomorrow.

Photo: WMF

were saying: “Wait a minute, there is something wrong with what I see.” And especially women who were older would say: “It was not always this way.” I remember my mother always telling me how she used to run down the hill to fetch fresh water from the river. As a child, she would spend hours playing with tadpoles and frogspawn in the river. Now we know that some of these are what we call indicator species for fresh water. They don’t live in filthy water. That source of water was very close by, which meant that my mother was able to fetch water quickly. So to hear women talking about having to walk further for water was really surprising to my mother.

I think that it has a lot to do with the fact that women feel the pressures of this degradation much more than the men do. And so they are the ones who respond, and also the ones that we target. They are most responsive. They absolutely took on the Movement like a wildfire. In many ways, it has become a source of social, emotional connection with other women because they work in groups and they share stories and much more. One plus one is three – it is so much more they gain!

Why do you think has the Movement been so successful?

The GBM really believes that change will only come when people understand the underlying root causes of things. It has always seen empowerment as understanding what the problems we are facing are and how they link to the degradation of the land. And once you have made that connection, you never forget. To this day, I have been to places where women say: “Forests attract clouds. Without these forests, we would lose these clouds, and without these clouds, we have no rain.” It’s that connection that they begin to make. And that’s empowerment. Because long after you’re gone, they are still at it. Nobody will come and tell them something different. And that investment in empowerment is very much

a signature piece of the Green Belt Movement’s success.

Do you think that the role of women in communities has changed over the last few years – and with the work of the GBM?

Well, we have seen some changes in the governance system in Kenya, which has opened new opportunities for women. But what we have also found is that women who have been empowered – like the women of the GBM – have changed their behaviour. When an opportunity comes for them to be in leadership they put themselves forward. And this a big thing for women, who often censor themselves and don’t even put themselves in the running. Often, they are not going to be considered, but not because they are not good enough, but because they decide there is someone stronger than them out there. Self-censorship. But now they are showing up, they are putting themselves forward. They say: “Why not, I can do this.” And they assume local leadership, whether in chairing their GBM group or chairing their women’s church group. Kenya’s new 2011 constitution created new opportunities for women and women’s representation. There are many women in the GBM who are prepared and who are putting themselves forward now. These women were inspired by what they had seen with the leadership of the Green Belt Movement and Wangari Maathai herself.

I think empowerment is when you can see your own potential and then say: “I’m going to stand for this seat, I’m going to put my hand up to be the chair of this group, I want to be the treasurer, I want to be one of the officials.” It was uncommon for women to do so. If you have a group of ten and three of them are men, then one will be the chair, the other one will be the treasurer, and the third one will be the secretary. No, wait ... the secretary might be a woman ... But we see the changes with the kind of empowerment that the movement has

brought about, not even deliberately, almost like a side effect.

The legacy of your mother is also maintained by the Wangari Maathai Foundation. How does it differ from the GBM?

Africa has an increasingly young population. According to the East African Youth Survey, 80 per cent of Kenya’s population is under the age of 35. These young people will be in charge – if they are not already. They are innovating, they are just thinking differently. We at the Foundation believe that the opportunity here is to begin to influence what their value systems are. I love the quote by Senegalese environmentalist Baba Dioum who said: “In the end, we will conserve only what we love. We love what we understand, and we will understand only what we are taught.” So how do you educate children to understand what they might love, what they might conserve? For if you do that, you don’t have to bang your head against the wall, because the minister for the environment already loves the forest! You won’t have to convince him or her.

So we use Wangari Maathai’s life and work as a metaphor. Who was she? Why was she the way she was? Those who knew my mother knew that she was definitely crazy about forests. She loved them and understood profoundly the role they played in the ecosystem and for humans. So the Foundation’s work is very much linked to what the Green Belt Movement is doing, except that it approaches it from a different angle – youth and children AND the underlying values and character traits that guide us.

What exactly does the Foundation do?

Essentially, the Foundation is working to build character and personal leadership in children and youth. And we do this in two different ways. We divide the work into two main age groups: children from ten to seventeen years of age and then people from eighteen to thirty-five.

In the 10 to 17 age group we have the Wanakesho Program. In Swahili, this means “the children of tomorrow”. These are our future generations. For them, we have a school-based initiative that works on life skills training to build traits that we have mapped out from Wangari Maathai’s life. We have created our own curriculum that focuses on character and personal leadership and have infused it with emotional intelligence content from our partners Six Seconds. We’ve identified eight character traits of Wangari Maathai: courage and

confidence, honesty and integrity, resilience, creativity and resourcefulness, gratitude, commitment to excellence, service to others, and responsible stewardship. And then we create programming around these values. And since these young people have identified Wangari Maathai as a role model, we unpack who she was. So while the GBM is about what Wangari Maathai did, the Foundation is about who she was. She was an environmentalist working with women to advance the cause for forests and landscapes. But why did she do this? What values drove her? Who was she really? Where could all this have come from? And can we actually code this and share it with children as we invest in the future?

We are piloting this work with teachers of four schools in Kenya. We coach and mentor them because they are the custodians of learning. The curriculum is currently in its pilot phase. Our hope is to get the teachers to create opportunities for the kids to develop certain character attributes that we believe in, for instance when it comes to courage and standing up for what they believe.

And the older people?

For those between 18 and 35 years of age, we are developing a gap year programme for young women and men before they go to university. We envision putting them through a wilderness experience, a character development and leadership course, and an entrepreneurship and self-awareness programme. This gap year programme will be called “The Savannah Stars”. The programme is still in development, inspired by “Desert Stars” in Israel. Very exciting! It is about the premise that I mentioned in that earlier quote by Baba Dioum – that we can actually influence how young people will “show up” when they are in leadership.

What are the current leaders doing wrong?

The reason why we can’t get compliance with some of our ambitious forestry targets is because there is no political will, there is no interest. And this has a lot to do with the character of the leadership. If they don’t understand why this is an important topic, how would the rest of the population understand?

Gus Speth, an American environmentalist who is the founder of the World Resources Institute, said: “I thought the greatest environmental challenges were climate change, ecosystem collapse and biodiversity loss. But I was wrong. The biggest environmental challenges are greed, selfishness and apathy.” Isn’t that the

truth? The reason we are fighting in Kenya to protect forests and urban green spaces is because of the greed and selfishness of a few who have decided private gain is the priority. That’s greed. So I really like this idea that character could be an opportunity for us to begin to think about leadership across the board.

How do you assess the situation in Kenya?

I think Kenya is doing a much better job than many, but we have still lost quite a bit of forest, and our urban green spaces are also constantly under attack. There is not a very clear understanding why this should be non-negotiable in some cases. And of course there are sensitivities, where you have local communities living or just having been settled in forest land. And as difficult as it is, we have to deal with it. It cannot be ignored.

I haven’t always been working in environment. I spent quite some time working in disease eradication. When there is a disease epidemic, everything stops, people go into emergency mode, and that is what we need now with regard to forests. People need to go into emergency mode. We cannot say: “This is an option, maybe ...” No! If it is true that this forest being logged is a critical piece in the survival equation, that our survival depends on the survival of this forest, that the impacts of climate change will be so catastrophic as to destroy life as we know it, then we have to sit up and take notice. We have to organise how people will be moved or resettled. Of course we cannot be inhumane about how we conduct our forestry. In areas where communities are vulnerable and they have been living in the forest, we have to decide that maybe they must stay there. But then we have to recover that forest piece from somewhere else. How can we make sure that there is something like a land-swap to compensate for land that is impossible to recover? I believe in land swaps. We need the forest in its integrity. It may be costly, but it needs to be done. Because if it was an epidemic, we would not be discussing things, we would be taking immediate action.

Are the forest restoration initiatives initiated by the international community doing justice to the urgency of the situation?

In 2011 the German Environment Ministry was instrumental in launching the Bonn Challenge. This literally triggered the subsequent setting up in 2014, during the UN Climate Summit, of the UN Forest Declaration. So with the Bonn Challenge, Germany had already stepped forward with a commitment to

restore 150 million hectares by 2020, and now we have 350 million hectares by 2030. More recently, the AFR100 initiative was launched, with the German Development Ministry and the WRI providing initial funding. The African Union endorsed the initiative, and now we have 28 countries and over a 100 million hectares in commitment. We have surpassed what we expected. Now the big task that I and many others have is to see those commitments translated into interventions on the ground.

So you are satisfied with the work of the international community?

I am grateful to the international community for helping us all set ambitious targets. There is a lot they have done. And there is still a lot more that they can do, especially in financing, in making finance a little bit more accessible. Public financing, private financing. We haven’t been able to really see the impact of REDD+ financing for example because it is so difficult to obtain.

But another role the international community plays is in terms of consumers. There is a huge opportunity for us as consumers to demand certain products. One of the things which I am really enjoying being in Europe now and which is also growing in Kenya is precisely the demand that consumers are putting on what they will (or will not) eat, the decision on where they will put their money. Because ultimately the private sector – whether it be coffee, tea, palm oil or soya – they are responding to the demands of their customers. And we are the customers. It is a lot more prolific here in Europe, where you see people saying: “Label everything so I know which one has sustainable soya because this is the one I will buy.” There is still a long way to go, but I think that is the beginning of a revolution which will create the necessary pressure to bring about change. We are forcing producers to clean up their value chains. And that is satisfying.

We have a lot more power than we think we have. That needs to happen in the West, but it also needs to happen at home. Because the very same suppliers cannot be given a cut at home. We also have to say “No”. We cannot give money to counties that are deforesting. If that county is deforesting, don’t send my money there. So we need to begin to use our voices as consumers to demand responsibility. Because then – as we have seen it with soya in many cases – the suppliers will begin to cave in and reform.

Reaching zero deforestation in supply chains – why we need a jurisdictional approach

Many global companies have committed to eliminate deforestation from their supply chains by 2020. But as increasing global deforestation rates indicate, most of them are not on track to meet that goal. One reason could be that approaches are too narrowly defined. Taking the example of Indonesia, our authors demonstrate how an overarching approach could help implement these corporate zero-deforestation commitments and supply chain initiatives together with all involved stakeholders in a manner beneficial to forests, the overall environment and human beings – and at scale.

By Franziska Rau und Gerhard Langenberger

The world's forests are under pressure. Despite the considerable efforts of the global community, the tropics lost 15 million hectares of tree cover on average in the last three years according to Global Forest Watch, including almost 5 million hectares of primary forest. The expansion of agriculture – both for commodity production and by smallholder agriculture – is responsible for up to 80 per cent of tropical deforestation. Notably soy, palm oil, cattle, pulp and paper but also natural rubber, cocoa, coffee and other agricultural commodities drive deforestation. Demand for agricultural land is projected to increase at the expense of forests – indirectly partly driven by the growing global population and related production and consumption patterns world-wide.

A major share of commodities produced on recently deforested lands is exported. The European Union (EU) alone accounts for 36 per cent of deforestation related to international commodity trade of crop and livestock products. Between 1990 and 2008, this corresponded to nine million hectares and about seven per cent of overall commodity-driven deforestation. Thus, the European market is also responsible for a significant share of biodiversity loss and greenhouse gas emissions. According to a recent publication in the journal *Global*

Environmental Change, up to nearly 40 per cent of emissions from deforestation across the tropics is induced by international trade.

International commitments – well-meant, but insufficient

The private sector recognised its responsibility for deforestation in its supply chains in 2010, when the Consumer Goods Forum (CGF), an association of the world's largest consumer goods manufacturers and retailers, committed to eliminate deforestation from their soy, palm oil, beef and pulp and paper supply chains by 2020. In 2012, the Tropical Forest Alliance (TFA) 2020, convening governments, companies and civil society, was founded to implement the zero-deforestation goal defined by the CGF. The endorsement of the New York Declaration on Forests in September 2014 was another landmark signal. Governments, companies, civil society and indigenous people's organisations jointly committed to halve deforestation by 2020, to end it by 2030 and to support the private sector goals on zero deforestation. Since then, companies all along global supply chains have published more than 1,200 commitments to sustainable commodities, mostly for palm oil.

The zero-deforestation goals set by individual company pledges and collective aspirations such as the TFA 2020 are carried out through various supply chain instruments, ranging from codes of conduct to sustainability standard systems and moratoria. Most companies implement their commitments through the sourcing of products certified by sustainability standards. Relevant sustainability standards such as The Roundtable on Sustainable Palm Oil (RSPO) or the Roundtable on Responsible Soy (RTRS) have continuously strengthened their forest protection criteria. Following the adoption of the latest RSPO standard in November 2018, the RSPO now requires no deforestation by additionally integrating the High Carbon Stock (HCS) approach in the High Conservation Value (HCV) concept (see lower Box on page 11). The Soy Moratorium in the Amazon, a commitment by major soy traders not to source soy from lands in the Amazon deforested after 2006, is the first voluntary zero-deforestation agreement implemented at regional level. Over the last years, several transparency initiatives supporting supply chain instruments have been developed, such as TRASE, mapping links between production sites and consuming countries via trading companies, or Global Forest Watch, monitoring deforestation and restoration rates.



Halimah Deny Sofian from Mentebah is one of the rubber farmers participating in the pilot project in Kapuas Hulu in West-Kalimantan/Indonesia. Photo: GIZ/ Canopy Indonesia

To end commodity-driven deforestation by 2020, companies would have to eliminate five million hectares of conversion from supply chains each year. However, they will fall short of this target. The impact assessment of the New York Declaration on Forests reveals that the rate of both annual global tree cover loss and tropical primary forest loss has increased rather than decreased since its endorsement. One reason why companies are not on track to implement their zero-deforestation goals might be a lack of ambition, for many company commitments cover only parts of their supply chains and lack time-bound, measurable targets. Besides, most focus on their production site and neglect the surrounding area, thereby potentially leading to leakage effects.

Why holistic approaches are needed

The pressure for zero deforestation from global supply chains has to be implemented at scale if forests are to be preserved. This is why a landscape approach is needed. With its support, sustainability and, notably, deforestation risks are addressed at landscape scale instead at farm level only – across commodities and together with stakeholders from governments, companies, civil society and, notably, smallholders. This is different to the certification of individual concessions, creating i.e. a sustainable palm oil plantation, however, lacking the impact on the surrounding landscape.

Depending on the definition of the project region, one refers to a “landscape” or a “jurisdictional” approach: “landscape approach” in the

case of a project area defined by geographical characteristics and “jurisdictional approach” in the case of political or administrative boundaries. In both cases, the basis is formed by a multi-stakeholder platform, with ownership of all stakeholders being a crucial aspect of forest protection.

The jurisdictional approach put to the test in Indonesia

Kapuas Hulu is a district the size of Belgium located in the mountainous part of West-Kalimantan/Indonesia, bordering Malaysia. It hosts two national parks and, with the lake and peat region around Lake Sentarum, the upper course of Kapuas River, Borneo’s largest river system. Seasonal outflows of Kapuas River into the surrounding lakes and peatlands prevent massive floodings at the lower stream around Pontianak, the provincial capital. More



Landscape [or jurisdictional] approaches seek to provide tools and concepts for allocating and managing land to achieve social, economic, and environmental objectives in areas where agriculture, mining, and other productive land uses compete with environmental and biodiversity goals.

[Sayer et al., 2013]

than 70 per cent of Kapuas Hulu is classified as forest, providing habitat for numerous species, among them Orang-Utans. This unique ecosystem must be preserved.

Subsistence agriculture and rubber production were the most common use of arable land in the region until oil palms arrived in the 2000s. In order to support sustainable development while protecting ecosystems in Kapuas Hulu, in 2016, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), on behalf of the German Development Ministry (BMZ), initiated a jurisdictional approach in order to build up deforestation-free supply chains of various commodities from Kapuas Hulu to Germany. Here, instruments are to be piloted that could also be suitable for other project regions. Since the project is being implemented in the administrative entity of the district, its approach is referred to as jurisdictional.



Landscape and jurisdictional approaches encompass a variety of mechanisms but, at their core, they bring regional stakeholders together to agree on and implement a shared approach to a more sustainable use of natural resources and land use management.

[ISEAL 2019]

In 2017, the partnership started with the local government of Kapuas Hulu and GIZ signing a Memorandum of Understanding to jointly work for balancing agriculture and forest protection. As a next step, a local multi-stakeholder platform has been convened to identify local sustainability risks and to jointly develop strategies that take into consideration both ecosystem protection, agricultural production and economic development of the district. International sustainability goals are thereby translated into locally adapted and, most importantly, accepted sustainability goals. It is of crucial importance that every member has its value proposition for being in the platform, be it a smallholder, the private sector or the local government. To adequately represent the often diverging interests of all stakeholders is a major task. The conflict resolution desk provides support with land tenure issues. In order to ensure that people and forests will co-exist in the long-term, incentives have to be created, in order to win over the support of the local

inhabitants in protecting the forest. Therefore, the platform supports sustainable agricultural intensification to increase the income of local smallholders.

A preferred sourcing region for companies and a biosphere reserve

The jurisdictional approach is an important step on the road to a preferred sourcing region for companies with zero-deforestation targets. In the long run, local producers enjoy preferred market access to buying companies committed to forest protection and sustainable, certified products. Companies trading in verifiable sustainable products may enjoy better access to critical markets as well as preferential credit lines from banks supporting enterprises which intend to de-risk their supply chains. Moreover, their supply with raw material might also be better secured in the long run, as it is coming from a sustainably managed region.

To reduce the costs of certification, the sustainability requirements of internationally recognised standard systems are integrated into land-use planning. The High Conservation Value Resource Network – a coalition of organisations based on an initiative by the Forest Stewardship Council (FSC) – developed a new guidance to identify high conservation value (HCV) areas on a jurisdictional scale, and not only on the individual farm. The concept (see lower Box) is piloted in Kapuas Hulu. Biodiversity benefits from this as well: Zooming out to the jurisdictional scale, biodiversity corridors connecting habitats can be identified as HCVs that were neglected in previous assessments at farm level.

The next step is guidance on identifying both HCV and High Carbon Stock (HCS) areas on a jurisdictional scale at the same time. Together with partners, monitoring and transparency instruments that observe deforestation frontiers and ensure the traceability of products from Kapuas Hulu to Germany are developed. In a public-private partnership with a global German tyre manufacturer, GIZ supports local farmers with the sustainable production of natural rubber. The first shipment of sustainable and traceable rubber from Kapuas Hulu arrived in Germany in 2019, proving that the concept is implementable.

All these processes have inspired the district government to revive its goal as a conservation district as proclaimed in 2003. The appointment of Kapuas Hulu as a UNESCO biosphere reserve called Danau Sentarum/Be-

DEFINITIONS: WHAT IS A FOREST? WHAT IS DEFORESTATION?

The identification of **deforestation** requires a clear understanding and definition of the term 'forest'. There is common understanding that a forest is composed of trees, ecologically characterised by a microclimate of its own and specific nutrient flows, providing a variety of habitats and ecological niches and thus being home to a respective forest flora and fauna. The UN Food and Agriculture Organization (FAO) gives a globally accepted definition which is applied in its Global Forest Resources Assessments.

Forest definition by FAO (2018)

- Extent (surface area): > 0.5 ha
- Size (vegetation height): trees > 5 m tall
- Canopy cover (horizontal projection of tree canopy): > 10 %
- Management: exclusion of agricultural or urban land use as agroforestry, palm oil plantations or olive orchards

These figures refer to 'potentials'. Hence, an area recently logged but intended to be reforested formally is considered as forest.

Source: FAO, 2018: Global Forest Resources Assessment 2020

The **High Conservation Value (HCV)** concept is an internationally accepted instrument to identify ecosystems deserving protection by six natural and social values:

- HCV 1: Species diversity significant at global, regional or national levels
- HCV 2: Landscape-level ecosystems, ecosystem mosaics and intact forest landscapes (IFL) significant at global, regional or national levels
- HCV 3: Rare, threatened or endangered ecosystems and habitats
- HCV 4: Ecosystem services in critical situations
- HCV 5: Community needs satisfied by sites and resources, identified through engagement with the community
- HCV 6: Cultural values of importance for the traditional cultures of local communities or indigenous people

Source: <https://hcvnetwork.org>; <http://highcarbonstock.org>

tung Kerihun in 2018 confirmed the vision for the district as outlined in the jurisdictional approach: a sustainable agricultural development protecting forests and beneficial for people.

References: www.rural21.com

Deforestation is the act of converting forest permanently to another land-use or to reduce the canopy cover permanently below a given minimum value. Since agricultural usage generally disqualifies the classification of tree stands as forests, even if they dominate the landscape as in home gardens or other agroforestry systems, their clearance would not be deforestation according to FAO terminology.

FAO defines a **forest area net change** as the difference in forest area between two Forest Resource Assessments. The net change can be either positive (gain), negative (loss) or zero (no change).

Zero net deforestation means that the total forest cover within a given landscape did not change over a certain period. This does not preclude local (legal) deforestation as long as it is compensated by reforestation elsewhere in the respective landscape. Thus, theoretically, natural forest can be compensated for by a pulp and paper or rubber plantation.

Zero gross deforestation, on the other hand, refers to the loss of forest area over a given period, without considering any reforestation or afforestation.

The concept is applied by governments, companies and civil society and is integrated in several sustainability standards.

The **High Carbon Stock (HCS)** approach is a methodology to distinguish landscapes of high protective value thanks to their considerable carbon stocks from degraded landscapes with low carbon stocks and few biodiversity values which might be converted. The methodology was developed with the aim to ensure a practical, transparent, robust, and scientifically credible approach that is widely accepted to implement commitments to halt deforestation in the tropics while ensuring that the rights and livelihoods of local peoples are respected. The HCS approach stratifies the vegetation into six classes by using satellite data and ground survey measures.

Franziska Rau and **Gerhard Langenberger** are both advisors on deforestation-free supply chains at the Programme Sustainable Agricultural Supply Chains and Standards by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Bonn, Germany.

Contact: franziska.rau@giz.de



The main drivers of deforestation are well-known. Yet the complexity of underlying factors is hard to tackle.

Photo: Jörg Böhling

Benefits beyond carbon – fifteen years of REDD+

In times of large forest fires in the Amazon, Indonesia and Central Africa, continuously high deforestation rates in the tropics, and climate change becoming ever more evident, it seems like REDD+ – the mechanism for payments for reducing emissions from deforestation and forest degradation under UNFCCC – is not delivering on its promise. REDD+ has indeed not met the high hopes it raised of reducing deforestation and increasing reforestation in terms of speed and effectiveness. Yet, almost 15 years since REDD+ was initially introduced, it is time for a more differentiated appraisal.

By Ute Sonntag and Jürgen Blaser

At the beginning, the REDD+ concept (see Box) was seen as a simple and captivating novel approach for forest-rich developing countries to receive results-based payments for avoided deforestation while at the same time demonstrating an active contribution to climate change mitigation. Looking back, the mechanism was at the heart of applying the principle of common but differentiated responsibilities of developing and developed countries for climate change mitigation, which today is codified in the Paris Agreement in its Article 5.

In its initial phase, REDD+ was mainly driven by project developers in the so-called voluntary markets. Often in cooperation with NGOs, they invested in the protection of particular specific forest areas with the intention of selling emission reduction certificates. Financing mainly came from private sector companies that anticipated a compliance market where large polluters would need to offset their emissions at the source beyond the internal obligations. The high expectations on

REDD+ is an instrument created by the United Nations Framework Convention on Climate Change (UNFCCC) in 2005. It is defined as “Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries”.

REDD+ led to a variety of projects, generally at sub-national or local level. But after a while, it became obvious that without clear national strategies and a functioning framework in place, project-level interventions have very limited influence on underlying drivers of deforestation and a high risk of just displacing destructive practices to other forest areas.

As the anticipated compliance market has not materialised to date, Official Development Assistance (ODA) financing has been the only sizeable source of funding for REDD+, and

has shaped the large-scale national or jurisdictional REDD+ approach.

The first step. How to become “REDD+-ready”

But before becoming eligible for results-based payments (RBP) for avoided deforestation, a country needs to meet several conditions. Not “only” does it need to effectively counteract deforestation drivers, but it must follow a rigid methodology as well. Being “REDD+ ready” includes inter alia a thorough analysis of the current forest situation, the elaboration of a National REDD+ Strategy that is widely recognised in the country by all relevant stakeholders, a National Forest Monitoring System, a Forest Reference Emissions Level (a benchmark to measure emission reductions from deforestation, calculated as average emissions from deforestation during a historical reference period), and a functioning Social and Environmental Safeguards Information System.

Specific programmes (see Box on the right), such as the Forest Investment Programme (FIP) of the World Bank or the UN-REDD Programme supported, in addition, pilot investment and policy actions to further improve the countries' capacities to implement the defined REDD+ strategy. Complementarily, ODA funds for results-based payments like the Amazon Fund in Brazil, the Carbon Fund of the Forest Carbon Partnership Facility (FCPF) or the German REDD for Early Movers Programme, were set up as bridge funding and large pilots for a global REDD+ financing mechanism. In 2018, under the Green Climate Fund (GCF), a pilot programme for results-based payments was set up which could transition into the most important REDD Fund based on ODA.

However, while there was significant progress in readiness – about 40 countries have submitted their national Forest Reference Emissions Level to the UNFCCC to date – effectively reducing deforestation proved much more challenging than anticipated.

Too many obstacles, ...

REDD+ has not proven to be a sufficient financial and political incentive to steer forest and land use towards more sustainability and hence lower emissions. Naturally, a price of five US dollars (USD) per ton of CO₂e (carbon dioxide equivalent – a measurement for a certain amount of greenhouse gas that describes the amount of CO₂ that would have the same global warming potential when measured over a specific timescale) has limited weight in economic decisions. Such a price is currently offered in the multilateral RBP funds and corresponds, as an example, to about 2,000 USD for not deforesting one hectare of tropical forest. Yet, even a higher price cannot substitute a clear political will that prefers long-term visions over short-term gains. Sadly, in most REDD+ countries, powerful political and economic – often vested – interests still favour deforestation and forest degradation, combined with continuously weak law enforcement for forest protection and persecution of environmental crimes.

The main drivers of deforestation – palm oil in Southeast Asia, cattle and soy in the Amazon basin, basic needs of an expanding population and mining in the Congo Basin – were identified with ease. Yet, the complexity of underlying factors such as land speculation dynamics, contested land tenure, internal power struggles, insufficiently transparent or non-existent governance is hard to tackle. Expectations of

PROGRAMMES AND INITIATIVES

The **BioCarbon Fund Initiative for Sustainable Forest Landscapes** of the World Bank has been operational since 2013 and provides funding of 350 million USD for activities to reduce deforestation as well as for results-based finance.

The **Cancún REDD+ Safeguards** were adopted by the signatories of the UNFCCC in 2012. They provide a set of seven political, social and environmental principles for REDD+ preparation, implementation and monitoring. They are meant to protect people and the environment from potential harm and enhance positive benefits of REDD+. Each REDD+ country is obliged to report to UNFCCC how these Safeguards are being addressed and respected.

The **Carbon Fund** – currently operational until 2025 – provides results-based financing of Emission Reduction Programmes (ERP). As of today, 18 countries are accepted to the portfolio with an ERP to reduce deforestation or to increase their forest carbon stocks, RBP (results-based payments) reaching an average of up to 50 million USD. The development of these ERP has shown to be more complex than initially anticipated.

The **Forest Carbon Partnership Facility (FCPF)** of the World Bank is a multilateral financing facility for piloting REDD+. Its total financial volume amounts to 1.3 billion USD in 2019. Through its Readiness Fund, FCPF supports 45 countries in creating a framework for implementing REDD+ in a participatory process.

The **Forest Investment Programme (FIP)** of the World Bank runs from 2009 to 2028, with a total volume of 753.9 million USD, to support 23 countries in their REDD+ implementation activities.

The **Green Climate Fund (GCF)** is the central climate funding instrument of the UN Convention on Combatting Climate Change

(UNFCCC). It provides finance for projects and programmes in developing countries that contribute to mitigation of or adaptation to climate change. Signatory states have committed to mobilise 100 billion USD per year for these purposes, from 2020 onwards. The pilot programme for results-based REDD+ finance of the GCF was introduced in 2017 and currently holds 500 million USD. So far, Brazil and Ecuador have been accepted with their proposals to GCF. In the long run, it is foreseen that GCF replace interim programmes such as the FCPF or the REDD for Early Movers programme.

The **REDD for Early Movers (REM) Programme** funded by Germany, Norway and the UK rewards forest and climate protection pioneers by compensating for emission reductions from deforestation. The programme is jointly implemented by Germany's KfW (financial cooperation) and GIZ (technical cooperation). REM currently operates four country components in the Brazilian states of Acre and Mato Grosso, in Colombia and in Ecuador. Apart from rewarding emission reductions, REM promotes sustainable development. Indigenous peoples and other forest dwellers are explicit target groups of the REM programme – at least 60 per cent of the payments goes directly to small farmers, women and indigenous and local forest-dependent communities. The benefit-sharing programmes were designed with the local stakeholders and comprise grievance mechanisms and management systems for social and environmental risks. By June 2019, KfW had paid 127 million euros of results-based finance to Brazil, Ecuador and Colombia.

The **United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD Programme)** was launched in 2008 by three UN Organisations (FAO, UNDP and UNEP). It supports national REDD+ readiness processes with a total volume of 320 million USD in 65 countries.

receiving “REDD+ benefits” were overrun by the financial and institutional investments to be made for achieving results and corresponding payments. Along with contradicting political agendas and insufficient land governance in terms of planning, regulation and titling, this situation has so far impeded the urgently needed transformational shift. Successful developments and promising steps are still fragile and

can be threatened anytime by short-sighted political decisions, as recent developments in Brazil illustrate, putting in question the permanence of achieved REDD+ results.

Reforming national policies and laws that conflict with the social and environmental goals of REDD+ would be central to its effective implementation. National REDD+ strategies in

REDD+ has helped, albeit in a modest way, to make conservation and sustainable use of tropical forests financially more attractive for communities and forest users.

Photo: GIZ/ Raphael Linzatti



many countries involve forest, environmental and sometimes agriculture institutions at national level. Yet, this is not enough. REDD+ implementation must coordinate and streamline commitments from a wider range of government sectors such as ministries of finance, infrastructure, mining, transport, water and education, to name just a few. Decentralisation is equally important, but has been neglected so far. As forest destruction and conservation ultimately take place on the ground, REDD+ implementation needs political buy-in at regional and local level. Bottom-up action plans have to fill each REDD+ strategy with life. Fiscal incentives for municipalities and communities, sound regulatory frameworks rewarding climate-smart agriculture and transparent monitoring systems are promising means.

... but driver of many positive developments

Yet in spite of all challenges and much criticism from various stakeholders, REDD+ efforts have not been in vain. A holistic view on what has been achieved can actually leave us quite optimistic. For one thing, a different and more emancipatory approach to ODA funding – from input- to results-based payments – has been found and piloted, inspiring donors to earmark considerably more funds than ever raised for the forest sector before: since 2009, yet with different starting dates and until today, 1.3 billion USD in the FCPF, 753.9 million USD in the FIP, 350 million USD in the BioCarbon Fund, 320 million USD in UN-REDD, 312.5 million euros in REDD for Early Movers (REM) and 500 million USD for an initial REDD+ Fund in the GCF in 2018. Even if this has not been enough to reduce deforestation and degradation or plant new forests, it has made path for eye-level negotiations on ODA funding incentivising the aspiration of common goals.

Furthermore, REDD+ has advanced and improved transparency on the state of forests and in the land use sector in the form of forest mapping, forest inventories and independent monitoring, conducted in many tropical countries for the first time. Further, REDD+ put a foot into the door of intersectoral cooperation at national levels, also involving broad participation from civil society for identifying a common vision through the elaboration of a national REDD+ strategy. In many countries, it was a first for environment and agriculture ministries, joined in some countries by transport, mining, water and other ministries, and civil society, to start a dialogue with the aim to



Thanks to REDD+, indigenous peoples and local communities have influenced high-level UN negotiations.

Photo: UNFCCC

harmonise planning and activities along a common low-deforestation goal. Many of the national climate change strategies (the so-called NDCs – nationally determined contributions under the Paris Agreement) refer strongly to the role of forests and the implementation of the national REDD+ strategies. The concept of safeguards experienced a breakthrough by applying it in the REDD+ readiness process and has – despite or even because of numerous errors and lengthy processes – sensitised a broad range of stakeholders to the importance of taking care that well-intended activities and investments actually do no harm and deliver co-benefits. Through the process, an often backward-looking forest sector was taken out of its lethargy and confronted with new types of decision-making with regard to forestry and land use planning.

From a rights perspective, REDD+ has contributed significantly to advancing the social inclusion agenda at international scale as well as in many tropical countries.

With the visibility REDD+ has given to them as crucial stakeholders and rights holders, indigenous peoples and local communities (IPLC) have been able to elevate themselves and their concerns to the national and international climate agenda in an unprecedented way. Their traditional role as forest stewards has finally found recognition and is valued. Indigenous representatives have participated and influenced high-level UN negotiations ever

REDD+ BENEFIT SHARING DESIGNED WITH AND FOR INDIGENOUS PEOPLES



Photo: GIZ/Raphael Linzatti

Data records from around the world demonstrate significantly low deforestation rates on recognised Indigenous Lands, even compared with protected areas. Thus, strengthening land and use rights and subsequently of territorial management could be a valuable investment into effective forest conservation.

The REDD for Early Movers (REM) programme sets its focus on benefit sharing through self-constructed and self-governed indigenous programmes. In Colombia (see Photo) and Mato Grosso, Brazil, large consultation processes were organised in order to shape indigenous benefit-sharing schemes: Through existing platforms of representation such as the National Organisation of Indigenous Peoples of the Colombian Amazon (OPIAC) and the Mato Grosso Federation of Indigenous Peoples and Organizations (FEPOIMT), over 900 respectively 1,500 local representatives participated in the decision whether and under which conditions they take part in REM. They drafted investment priorities and selection criteria for project proposals as well as legitimate decision-making arrangements. While the indigenous component in Mato Grosso is still in its preparation phase, in Colombia, the first ten projects have already promoted about 10,000 indigenous families in the first year of benefit sharing.

since, fuelling debates on climate justice and alternative pathways of human-nature co-existence and inspiring social movements all over the world. The value of traditional knowledge has become indispensable to the discourse on sustainable natural resource management.

At national scales, REDD+ processes guided by the UNFCCC-Cancún Safeguards as well as additional requirements and guidance of development partners such as the World Bank/Forest Carbon Partnership Facility (see Box on page 13), UNDP and the German Federal Ministry for Economic Cooperation and Development (BMZ) have opened up new and strengthened existing spaces of participation and representation. Multi-stakeholder platforms, networks and inclusive governance or advisory bodies have enabled a more direct dialogue of IPLC's and women's organisations with Governments, created opportunities to raise voices, stand for their rights and influence policy processes. Indigenous and women's delegates sit at national and subnational political tables as fully recognised stakeholders.

The massive investment of REDD+ countries, civil society organisations and development partners in capacity building has catalysed the ability of IPLC to make use of the arising opportunities. Apart from understanding REDD+, local organisations and representatives have improved their mobilising, and self-organising and negotiating skills. In some countries, indigenous leaders even highlight that, through encounter and continuous practice of collaboration, mutual recognition of different perspectives and trust have increased

between governmental officers and indigenous representatives.

So through a back door, REDD+ has reopened a dialogue on the rights agenda of historically marginalised peoples and communities, reaching from rights to social inclusion, over safeguarding potentially harmful activities, towards specific issues as their long-neglected tenure rights demands. Vice versa, IPLC's and women's perspectives have condensed in REDD+ policy and programming design and implementation in many cases. The concrete – and in some cases already well-heard – proposal by some of the most critical stakeholders of the effective conservation of the world's forests is a broader vision of REDD+ beyond carbon benefits, as a promising way of addressing poverty and social exclusion.

Future challenges and ambitions

In sum, REDD+ has evolved through practice and broad inclusion, and by setting ground rules for more equitable action in the forest sector. It has helped, albeit in a modest way, to make conservation and sustainable use of tropical forests financially more attractive for communities and forest users. Well beyond forests, REDD+ has turned out to be a catalyst for empowerment and rights of marginalised groups. Fully applied, it has the potential to contribute significantly to many Sustainable Development Goals. Nevertheless, the ultimate challenge remains, as the empowered stakeholders depend on standing forests. In 2014, the New York Declaration on Forests

set clear goals: halving deforestation by 2020 and reducing it to zero by 2030. It is a sad reality that we are not on track to reach these targets. Translating plans and intentions into concrete policy action and reaching commitments at all levels, including deforestation-free supply chains, are overdue.

REDD+ is not the silver bullet to save the Earth's forests, nor can it guarantee to keep global warming in check. Yet it is potentially one important element towards such an end. REDD+ has incentivised countries and helped to recognise the role of forests in its climate change and wider sustainable forest development agenda. Way beyond, REDD+ has set important grounds – comprehensive country-based strategies, rules and processes – for concrete and multi-layered actions. It is understood that complementary measures and investments in sustainable land use are required. REDD+ accompanied by additional economic incentives, broader discourses, new actors and unprecedented policy coalitions may be able to move domestic policies away from the business as usual trajectory and help to reach the pathway towards a sustainable future of humankind.

Ute Sonntag is Advisor in the REDD for Early Movers (REM) Programme at Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Bonn, Germany.

Jürgen Blaser is Professor of International Forestry and Climate Change at the School of Agricultural, Forest and Food Sciences HAFI at Bern University of Applied Sciences in Switzerland. Contact: ute.sonntag@giz.de

How to preserve the multifunctionality of forested landscapes

The problems related to forests and their management are still tackled with rather conservative and sectoral approaches today – both in the global North and South. However, such isolated strategies cannot accommodate the competing interests of different stakeholders. The multiple functions and management practices of the different production systems and landscape elements are too intricately interlinked. Hence our authors call for a holistic approach and take various projects to show what counts in implementing such a landscape-based strategy.

By Zora Lea Urech, Kaspar Schmidt and Francisco Medina

Forested landscapes must satisfy different needs of different stakeholders in parallel, such as biodiversity conservation, timber production, water quality and quantity, protection from natural hazards, food security and economic development (e.g. tourism, mining, infrastructure). While in industrial countries, homogenous landscapes focusing on one function (e.g. on food production) dominate, in developing countries, smallholder farming systems often shape a small, scattered and still multifunctional landscape. The multifunctionality of such mosaic landscapes depends highly on the interlinkages between different resources and land uses that constitute the landscape, each with a different value to different stakeholders. The current efforts of development cooperation try to preserve and promote this multifunctionality of landscapes in developing countries in order to improve the resilience of local people's livelihoods, supporting ecosystems and inclusive socio-political systems.

The increase and decrease of forested areas are directly linked to other land uses in a landscape. Globally speaking, forests are under increasing pressure because other land uses – particularly agricultural and pastoral land uses – are expanding into forested areas. Direct monetary benefits from agriculturally managed areas are in most cases much higher than the benefits resulting from an intact forest – at least on the short term. But forests and the environmental services they provide are directly linked to other production systems and landscape elements and thus have to be considered as an integrated element of a multifunctional landscape. Research results from India, for instance, show that the richness and density of native trees in a landscape (they should be neither too abundant nor too scarce) influence the pollination of coffee plants by bees and, ultimately, coffee production.

The great challenge to conserve or even strengthen the multifunctionality of forested

landscapes is to integrate competing interests of different stakeholders within one landscape. In the end, local populations often suffer most from the conflicts resulting from these different competing interests: those communities who directly or indirectly depend on forest services and products, but also have to secure their food and income. It is therefore essential that the use and management of forests is integrated into an overarching strategy and vision at the level of a landscape or a jurisdiction – referring to the related jurisdictional approach that puts more emphasis on the organisation of governance in space – and that this strategy and vision is framed by applying essential good governance principles such as equity, transparency and participatory decision-making. The following examples illustrate how this can be done successfully.

Participatory management of forested landscapes in the Bhutanese Himalayas

Pitched on the Eastern Himalayas, Bhutan has a high forest cover and is home to a great diversity of different forest types from lowland subtropical forests, through broadleaved and pine forests to mixed conifer and subalpine fir forests. The landscape of most of the country's valleys is dominated by forests intermixed with pastures, agricultural land and mostly scattered settlements. Given the steep terrain, forests assure essential ecosystem services such as soil conservation and provision of water both for adjacent as well as for downstream communities. They are also an important source of construction material, fuel and a broad range of non-timber forest products for local communities and the national economy. Moreover, they are key to the conservation of biodiversity as a global common good.

Bhutan takes pride in its efforts and success in nature protection. Over the past decades, sus-

A forested landscape in a high-altitude valley in Western Bhutan.

Photo: Sabine Nebel



tainable forest management including the use and marketing of forest products and services has become more important in the context of the modernisation and economic development which aims at contributing to Bhutan's development vision of gross national happiness. The country has pledged to remain carbon neutral and is developing its hydropower capacities. Forests are highly relevant for these policies as a carbon storage option with the potential for further carbon sequestration and for the provision of essential ecosystem services – such as water – for hydropower production.

Given these assets and various groups of beneficiaries of forest products and services with partly competing interests, Bhutan has applied diverse approaches to forest governance and management. Until the 1980s, the forestry sector was highly centralised. The central government was the dominant agent in the sector. However, the central forest agency faced significant challenges ensuring effective forest protection and management alone across the country. The centralised model also led to conflicts with local communities who had been deprived of their forest use rights with the nationalisation of forests in 1969. Since the 1990s, Bhutan has moved significantly towards a decentralised organisation of forestry and more people-oriented forest policies while keeping forests under state ownership.

Since the mid-1990s, with the support of the Swiss Agency for Development and Cooperation (SDC), other donors and Helvetas, Bhutan has developed its own approach to community forestry. Today, hundreds of local communities are involved in forest management across the country. The decentralisation of agriculture and forestry, the build-up of an inter-disciplinary extension service for agriculture, livestock and forestry and the process of democratisation that gave local communities more say in decision-making processes on natural resources have greatly facilitated this change towards more people-oriented ways of managing forests. Applying key good governance principles such as subsidiarity, participation of key actors including local people and governments in decision-making and working across sectors helped to develop and establish new policies and systems like the National Community Forestry Strategy (2009) or the National Forest Policy of 2011 and corresponding enabling national laws and regulations. These allow the integration of local, national as well as global interests in the conservation and sustainable management of the valuable forest resources of Bhutan and provide important entry points for broader resource management at the landscape level.

The significance of forests: a question of perception

What comes to your mind first if thinking of forests? In Swiss society, timber production, protection from natural hazards, biodiversity and recreation are amongst the most frequently mentioned benefits of forests. At the global level however, the most important forest services might be carbon storage and sequestration and biodiversity conservation. But forests provide a much wider diversity of products and services from which societies indirectly or directly benefit. This diversity and society's perception about the significance of forest products and services vary from country to country. Also within a country, perceptions differ significantly between different interest groups, even among different communities living within a forest, near to or far from a forest.

A study in Eastern Madagascar, for instance, analysed how the perception about forests and forest resources changes according to the distance from the village to the next forest. Village communities living close to a forest give significantly more weight to the function of the forest as a land reserve for agriculture than to direct products and services even though they use a wide range of forest products to cover their daily needs (e.g. as food, medicine, for construction). Many households of these villages are not aware of the finiteness of the forest, as it has always been there close to their village.

Sustainable management of forests and landscapes in the Andes

Similar to forests in the Himalayas, mountain forests in the Andes provide a wide range of services and benefits to local communities and many other stakeholders. The Andean Forests Programme is a regional initiative to support Andean communities in adapting to climate change and to ensure the continuity of social, economic and environmental benefits provided by Andean forests in the long run. Established in 2014, the programme works closely with government agencies at different levels, communities, research, the private sector and other stakeholders in Colombia, Ecuador, Peru, Bolivia and Chile. It is funded by the Global Programme Climate Change and Environment of SDC and facilitated by a consortium comprising Helvetas and Condesan (the Consortium for Sustainable Development of the Andean Ecoregion).



Rice fields in a multifunctional cultural landscape in Eastern Madagascar. Photo: Silvia König

Their focus is much more on the establishment of their fields for crop cultivation to assure food security, and households can still easily access forest services and products. However, households in villages situated a few hours walking distance from some of the same forests which have been cleared during the last decades are already aware of the consequences of forest decline. Families in the latter communities mentioned that they had already experienced decreasing quality of water required for daily needs and above all the decreasing availability of forest products for house constructions, medicine or food during lean seasons. They are therefore aware of the importance of forests and trees as elements in their agriculture-dominated landscape. But forests have gone and land for reforestation has become too scarce.

The programme promotes collective learning amongst stakeholders in managing forested landscapes by applying new approaches and demonstrating their impact on so called "learning sites" across the Andes. One of these is located in the Department of Apurímac in Southern Peru. Since 2015, the stakeholders from Apurímac have identified the main problems and challenges in the Andean forest landscape in a participatory diagnosis, compiled relevant experience and developed best practices and recommendations for measures to improve landscape management together with the community of Kiuñalla. The measures promoted were the use of solar panels and improved stoves to reduce firewood consumption, the recovery of natural pastures, and the sustainable management and restoration of communal forests. In addition, the programme supported the elaboration of forest fire risk management plans, the protection and recovery of water sources for rural and adjacent ur-



Local people working on a "cocha", a local water reservoir, in Apurímac, Southern Peru.

Photo: Andean Forest Programme

ban areas and the drawing up of the Department of Apurímac Forest Development Plan.

At the national level, the programme has fostered government agency awareness of local initiatives in order to design more inclusive and pertinent forest management policies. In these ways, the Andean Forests Programme has been supporting the elaboration and implementation of new forest management approaches and public policies concerning Andean forests. The vision of a sustainable landscape management with its intersectoral articulation (environment, agriculture, water) at multiple levels (communal, sub-national and national) has been a key element to illustrate the implementation of national public policies at the local level and to show concrete examples of

effective improvements at the landscape level that are recommended for replication in other areas in the Andes.

Forests can no longer be seen as an isolated element in a landscape simply because they are not isolated, and the many services forests provide unfold through interactions with multiple management interventions in the broader landscape. To develop a strategy at a landscape level, however, complex processes are necessary. For the smooth facilitation of such processes, an in-depth analysis of often complicated situations and wicked problems is required in order to understand the different perspectives among different actors with differing interests, claims and influence and power. The identification of compromises and

solutions calls for their being addressed in a concerted way, thus based on participatory and multi-actor discussions that take into account the interests of local communities, the private sector, the public sector, civil society and governments. This requires time, resources, and high moderation skills – much to invest, but much to benefit, too.

Zora Lea Urech is Senior Advisor Forests & Biodiversity at Helvetas Swiss Intercooperation in Bern, Switzerland.

Kaspar Schmidt is Head Environment & Climate Change at Helvetas.

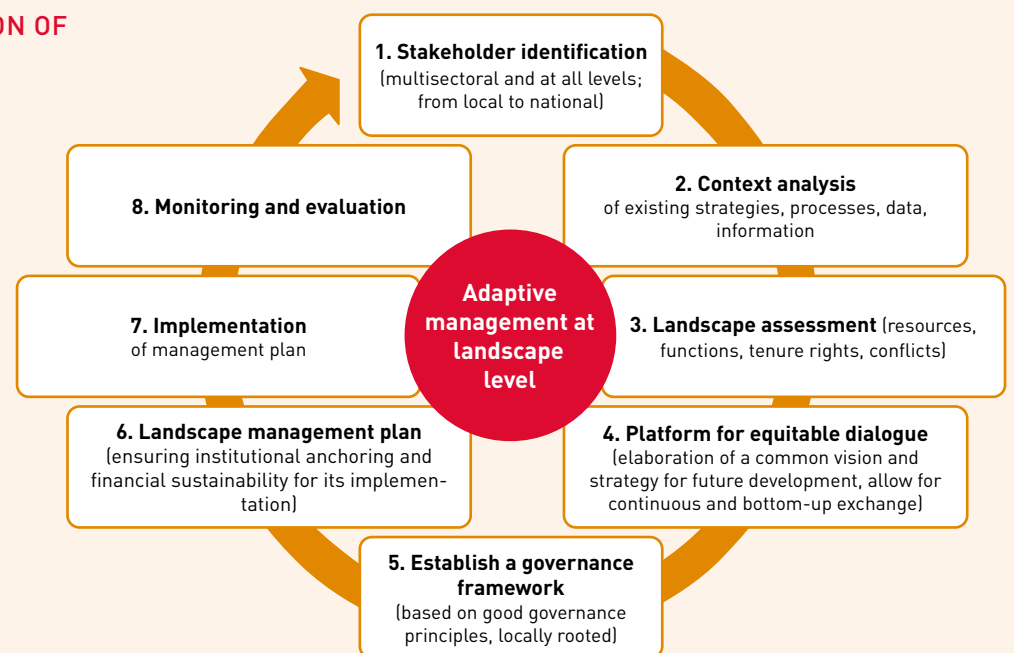
Francisco Medina is Regional Director of the Andean Forest Programme at Helvetas Peru. Contact: zora.urech@helvetas.org

EIGHT STEPS FOR THE IMPLEMENTATION OF A LANDSCAPE APPROACH: THE CASES OF MACEDONIA AND MADAGASCAR

The process of implementing a landscape approach in multifunctional forested landscapes always needs to be adapted according to the individual context, and the concrete objective, as the examples of two Helvetas projects show:

In **Macedonia**, the concrete aim is to establish a large-scale protected area (International Union for Conservation of Nature/IUCN category V: protected landscape) managed by the state forest services, which shall consider the interests of the logging industry, hydropower companies, mining companies, hunters, three different municipalities, conservation NGOs, tourist development, and civil society. In **Madagascar**, the entry point is sustainably sourced cacao, where the cocoa-sourcing companies have a particularly important role.

Based on long-term experiences in different countries, Helvetas generally follows the eight steps illustrated in the Figure, also in the concrete cases of Madagascar and Mace-



donia. In both cases it is essential to have a strong data base, context knowledge and understanding of different perspectives in order to develop different scenarios that are convincing to a diverse range of actors. In Macedonia – with its centralised governance mechanism – it is significant to find a com-

promise with authorities from the forestry and mining sector in order to avoid economic disadvantages. In comparison to this, in Madagascar it has remained an essential challenge for decades to find incentives for local farmers to reduce deforestation and establish locally rooted governance mechanisms.



Miriam Kipsang, a lead farmer in Kocholwo village, Elgeyo Marakwet county, Kenya. After trying FMNR on her own land, she reached out to 60 other women. She has sloping land and first rehabilitated one hectare. Finding that grass grew well under the trees, she locked out the animals and cut out weeds. The land had been bare, but now it is a recovering pasture mixed with trees.

First regreen mindscapes, then landscapes

For decades, our author has championed farmer managed natural regeneration, better known as FMNR. Working with communities in various countries, he came to an important realisation: without understanding and addressing reasons for deforestation, reforestation efforts risk sharing the same fate as the original forests.

By Tony Rinaudo

Farmer managed natural regeneration (FMNR) is a simple, low-cost restoration technique enabling farmers to dramatically improve food production and income. On one level, it involves the systematic regrowth and management of trees and shrubs from felled tree stumps, sprouting root systems or seeds. On another level, because FMNR involves behaviour change which can be adopted by whole communities, districts and countries, it is a landscape management practice. To manage emerging trees, certain practices – such as fire use, livestock management, collection of woody biomass and cultivation – must change. When such changes occur at landscape level, there is a shift from land degradation, biodiversity loss and disrupted water and energy cycles to restoration.

Making use of nature's capacity for self-healing

Seemingly treeless landscapes often contain a vast reserve of living tree stumps with the ca-

capacity to regenerate. This can be done at low cost, quickly and simply (with low technology), and at scale. In areas with no or few living tree stumps, there are usually tree seeds in the soil which can be reactivated.

In my work on combating the desertification that started in Niger 35 years ago, learning that many degraded landscapes contain an “underground” forest just waiting to be released led to the realisation that the main constraints to reforestation are not so much technical or financial but social, and are policy-related. While the FMNR pruning technique (see Box on page 20) was co-developed with farmers and honed to meet their needs, much effort also went into raising awareness and popularising the idea.

FMNR goes against the standard practice of clearing fields of all woody vegetation. Yet when farmers can understand that leaving at least some trees to regrow on their land is in their best interests, and that they and their children will have a better future, the rest fol-

lows relatively easily. Nature has an enormous capacity for self-healing, if humans take away the constraints and simply allow it to heal. Hence the need to “regreen” mindscapes first – a process akin to turning trees from enemies into friends!

Wide-ranging benefits

By restoring woody vegetation on deforested and often degraded land, FMNR addresses multiple problems simultaneously. These include land degradation and fertility loss, soil erosion, biodiversity loss, food insecurity, fuelwood and building timber shortage, fodder shortage and dysfunctional hydrological cycles (exacerbated flood and drought events, reduced groundwater recharge and the drying up of springs, wells and streams). When done at scale, FMNR contributes to increased groundwater recharge and increased soil moisture, especially when practised in combination with physical soil and water conservation measures.



A young FMNR training participant in Humbo, Ethiopia, showcasing her newly acquired knowledge.

Photos: World Vision Australia

Since FMNR helps to lift yields and income, it improves livelihoods, food security, resilience and risk reduction. There are documented reports of reduced impact of drought and reduced incidence of flooding. One example is the restoration projects in Humbo and Soddo in Ethiopia. Here, steep hills had been cleared of trees and so when it rained, there was serious flooding and mud/landslides. Restoration of the tree and grass vegetation has not only reduced flooding but reduced temperatures in drought years, increased organic matter (and hence soil moisture holding capacity) and attracted more rain than neighbouring districts. Besides, farmers practising FMNR are more likely to harvest an annual crop in a drought year than their non-practising neighbours. With trees on their farmlands, they also have other options to draw from, including harvesting and selling fuelwood, timber, wild fruits, traditional medicines and fodder. In Niger, for example, farmers rely on their FMNR trees as an emergency reserve which they draw on during food shortage periods – harvesting and selling wood in order to buy grain. In addition, the trees represent a standing fodder reserve, keeping livestock alive in drought.

As land and vegetation restoration is foundational to economic development, FMNR can contribute to diversification of agricultural enterprises, increased investment in agriculture and economic activities, poverty reduction and sustainable wealth creation. Typi-

PRACTISING FMNR

In many contexts, FMNR involves the following steps:



1. Select:

Select desired tree stumps, and for each stump choose several of the tallest and straightest stems to leave.

2. Prune and manage:

Remove the unwanted stems and side branches. Manage any threats to remaining branches from livestock, fire and competing vegetation (weeds).

3. Maintain:

Cull emerging new stems and prune side branches from time to time.

cally, once trees are restored in a landscape, farmers can increase their income from sale of fuelwood, poles and fodder, bee keeping and sale of wild fruits and traditional medicines. In the Humbo case, because of the large increase in availability of fodder, farmers are not only selling grass, some are fattening livestock. This was impossible in past years as there simply wasn't enough fodder available. The lives of women and children are also made easier as fuelwood is easier to gather and closer at hand. Women have more time to pursue economic and other activities important to them. Their status in the community is often lifted as they participate in group decision-making activities and, sometimes, leadership.



Change human thinking and behaviour, and the trees will grow.

Modelling conducted by Frank van Schoubroeck (2018) on the effect of integrating trees in farming systems in Baringo County, Kenya, found that FMNR lowers the risk of total crop failure, allows for more intensive cow herd management and consequent income generating activities, and reduces farm-level labour to collect fuelwood and stock fodder for animals. As women contribute significantly to these activities, FMNR is likely to reduce women's labour burden and reward them better for their work.

Since all resources and expertise needed can be found or developed within a community, FMNR does not create dependency. Adoption and spread often continues well beyond the life of any externally funded project. A Gha-

na study of the economic, social and environmental benefits of FMNR by Peter Western et al. (2013) found a social return on investment ratio of 6:1 by year three (end of the project). Ten years after project closure, the ratio has risen to 43:1 as tree size increases and as the practice continues to be spontaneously adopted.

Well-conceived FMNR projects facilitate good governance, greater collaboration and peace-building. Thanks to these wide-ranging benefits, practitioners often express a heightened sense of well-being and self-worth. They have greater agency in managing available resources. Confidence builds, and they have greater propensity to take calculated risks in investing in improvements to production systems. A common outcome of FMNR interventions is the restoration of hope.

Taking the concerns of farmers seriously

Despite FMNR's many benefits, resource-poor farmers living in high risk environments have every reason to be wary of adopting new innovations. Initial restrictions on FMNR uptake usually stem from false beliefs, negative attitudes and destructive practices around trees on agricultural and grazing land. Many farmers are convinced that trees grow slowly and therefore will not benefit them in the short or intermediate term. Often they believe that trees compete with crops and pasture and must be removed. It is important to acknowledge this mindset, but also to invite farmers and communities to come on a journey of discovery and learning, testing on a small scale and learning through observation, adaptation and collaboration. For especially when growing trees from mature stumps, they grow amazingly quickly – in Niger, even 1.5 to 2 metres in

the first year! So one of the big hurdles is to convince the farmers that they will not need to wait a decade to benefit from their work, and in fact measurable benefits, though small, are obtained in the first year – from the pruned branches for fuelwood, from the leaves enriching the soil, from habitat for pollinators and insect predators, from slightly reduced wind speed and temperatures, and, significantly, in dry countries from hydraulic lift, which increases moisture in surface soil layers.

Very often, well intentioned government policies to protect trees have the opposite effect. In many countries, the government owns all tree resources. If individuals are allowed to harvest trees at all, they must go to the centralised forestry department to purchase a permit. Fines and even imprisonment for cutting trees can actually be powerful incentives for farmers to surreptitiously remove all trees from their land. This not only avoids the possibility of punishment; it stops others from taking what farmers consider as rightfully theirs. Today, organisations such as The World Agroforestry Centre, The World Resources Institute and World Vision advocate governments to create enabling policies that empower and equip communities and individuals to responsibly manage the natural resource base – and to sustainably benefit from it.

Interestingly, perhaps because of the simplicity, low cost and “farmer managed” nature of FMNR, governments, donors, experts and implementing agencies may discount its value as a restoration practice. Even at this level, re-greening of mindscapes may be required.

A co-learning journey

Over the past years, World Vision has introduced the FMNR concept in 27 countries. In the course of our activities, we have learnt the following key lessons:

- It is important to work with farmers, communities and authorities, building on what they know already. FMNR implementation is a co-learning journey in which both promoter and adopter learn new skills and ways of applying restoration principles.
- Stakeholders need to understand the value of trees and how they will benefit. “Mindscape greening” sets the scene for behaviour change, leading to landscape greening.
- Mechanisms to adequately deal with constraints such as negative peer pressure, tree theft and fire or livestock damage must be in place.

- Enabling policies that give farmers ownership of, or at least user rights to, trees on their land provide powerful incentives for farmers to adopt agroforestry and FMNR. Farmers can implement FMNR with reasonable confidence that they will benefit from their work.
- Farmers must be able to benefit from their trees, not only directly through the goods and services they provide for domestic consumption, but financially through the sale of timber and non-timber tree products.
- Formation and capacity building of FMNR practitioner groups provides strength in numbers and mutual support.
- Co-creation by stakeholders of by-laws for tree and land management and a locally managed compliance mechanism give farmers greater security.

Tony Rinaudo is Principal Natural Resources Advisor at World Vision Australia. For his decades of work in combating desertification, he received the Rural Livelihood Award in 2018.

Contact: Tony.Rinaudo@worldvision.com.au

References: www.rural21.com

FMNR and related regeneration practices

| Approach | Definition | Relationship to FMNR |
|---|--|---|
| Natural regeneration or spontaneous natural regeneration | Natural regeneration is the process by which forests are regenerated from seeds that fall and germinate in situ, or vegetative means. There is minimal external input or management in natural regeneration, other than possibly fencing or excluding threats from the site to be regenerated.* | FMNR also works with trees that develop from seeds that germinate in situ, and also existing root stock. However, FMNR also includes various management practices such as pruning and management of threats, as well encouraging the sustainable use of the regenerated trees. |
| Assisted natural regeneration (ANR) | ANR is a method for enhancing the establishment of secondary forest from degraded grassland and shrub vegetation by protecting and nurturing the mother trees and their wildlings inherently present in the area. ANR aims to remove or reduce barriers to natural forest regeneration, such as soil degradation, competition with weedy species and recurring disturbances, which include fire, grazing and wood harvesting. In addition to protection efforts, enrichment planting ensures new trees are planted as needed or desired. | ANR is used to regenerate secondary forest and does not include the pruning of existing trees, only protection of mother trees and wildlings or seedlings. While FMNR uses similar protection methods, it also includes the pruning of trees and seedlings to encourage accelerated growth, and allows for the use of tree products and the establishment of agroforestry or silviculture systems, as well as forest restoration. |
| Farmer managed regeneration | Farmer managed regeneration refers to the regeneration of introduced species that remain unnaturalised in a specific landscape. The same practices of pruning and management are used as in FMNR, however farmers may select species for specific uses, such as the regeneration of eucalypts in Ethiopia and Timor-Leste for timber. | Farmer Managed Natural Regeneration prioritises the selection of native or naturalised species, which not only provide benefits for the land user, but also support the protection of local biodiversity and ecology. |
| Forest landscape restoration | Forest landscape restoration (FLR) is the ongoing process of regaining ecological functionality and enhancing human well-being across deforested or degraded forest landscapes. FLR is more than just planting trees – it requires restoring a whole landscape ‘forward’ to meet present and future needs and to offer multiple benefits and land uses over time. | FLR is a broader, landscape-scale practice that FMNR can contribute to. FLR includes a range of different practices, including tree planting, agroforestry, natural regeneration, assisted regeneration and FMNR. FMNR has enormous potential to contribute to FLR, particularly when practised at a landscape scale by many land users and on communal land, such as hill slopes, forest buffer zones or along riparian areas. |

* Natural regeneration is also called fallow vegetation, secondary or second-growth forest, succession, natural stocking, passive restoration, regrowth and scrub. Source: Farmer Managed Natural Regeneration (FMNR) Manual. World Vision, 2019.

Africa is taking ecosystems and landscape restoration in its own hands

Nearly two thirds of Africa's land is degraded. This is all the worse since the rural population, and here, above all, smallholder farmers and households, heavily depend on healthy soils and tree cover. Our authors show how the continent is responding to the challenge by implementing forest landscape restoration initiatives, one of the most recent ones being AFR100.

By Mamadou Moussa Diakhité, Teko Nhlapo, Petra Lahann, Diana Mawoko and Camilla Shiluva Holeni

Rural communities in Africa depend predominantly on forests for everyday upkeep and survival. Locals in rural African communities regularly go out into the forests searching for batches of firewood for their next meal, while others collect mushrooms, fruits, nuts, berries and herbs to sell locally in order to earn a living. Therefore, forests carry within them the well-being and livelihoods of the populations in the African continent. A further important function of forests in Africa is their job creation potential. The timber production sector employs tens of millions of people, and therefore households, through small-scale wood collection, charcoal production, transportation and retail.

The rural population receive around a quarter of their income from the collection and direct trade of plant seeds, shoots and roots, mushrooms, wildlife and insects. Non-timber forest products are also harvested and traded as medicine, decorations, essential oils and skin-care products. In Africa, we use a lot of palm oil in our products, which is derived from the palm tree forests. Some families make their living by picking fruits from these palm trees and using them to make and locally trade palm wine – an alcoholic drink that is popular in the West Africa region. However, the predicament that arises is that with this high demand of services from our forests, we are faced with an increased rate of deforestation and a rapid degradation of our forest landscapes.

A vicious circle of poverty and overexploitation of resources

Every year, nearly three million hectares of forests and land are lost on the continent, accompanied by an annual estimated three per cent drop in GDP owing to soil and nutrient depletion. The result of this process is that nearly two-thirds of Africa's land is degraded, with millions of people facing hunger, malnutrition and poverty, who in order to survive have to further deforest and often overexploit the continent's natural resources. These actions not only intensify the effects of climate change, but



An oasis in the Kanem Region of Lake Chad Basin. Women from the local village participating in the Great Green Wall programme.

Photos: Andrea Borgarello for TerraAfrica / World Bank

also severely hinder economic development and threaten the ecological functions vital to the economies of African countries.

Rural smallholder farmers and households suffer most from degraded land as their activities are largely dependent on stable weather patterns, healthy soils and tree cover, as well as water. Framework conditions such as governance of natural resources and policy coherence often do not favour restoration at scale, and numerous other barriers impede progress. These barriers include weak institutional coordination, inadequate mechanisms of devolution to local resource users and insufficient economic incentives for local and foreign investments in sustainable land management. These issues, which occur at global level, have led to increasing awareness regarding the potential for forest landscape restoration (FLR) to generate numerous benefits for people and support progress towards multiple national targets and the Sustainable Development Goals (SDGs), addressing issues such as food security,

poverty reduction, land rehabilitation, regeneration and restoration, biodiversity conservation and climate resilience. Various global and regional restoration initiatives have emerged from this (also see upper Box).

The African response

For African countries too, there are numerous opportunities to scale up forest landscape restoration by restoring both deforested forest lands and degraded agricultural as well as pastoral landscapes where the tree cover has been depleted. Africa is unique in that it has the largest restoration opportunity of any continent in the world, with more than 700 million hectares of degraded landscapes that can be restored. Experiences in numerous countries, including Malawi, Rwanda, Ethiopia and Niger, to name a few, have demonstrated that FLR delivers a wide range of benefits and can be achieved on millions of hectares. Successful experiences with proven restoration practices

such as Farmer Managed Natural Regeneration (FMNR; see article on page 19), Assisted Natural Regeneration (ANR), etc. improved management of small-holder woodlots, reforestation, evergreen agriculture with intercropped trees, and associated sustainable land and water management (SLWM) practices, such as water harvesting and erosion control, have been documented, along with practical steps that can be supported to catalyse their adoption at scale. One major effort that was already launched in 2007 is the Great Green Wall Initiative (see bottom Box).

The Africa Forests and Landscapes Restoration Initiative (AFR100) is a more recent measure. It was launched in December 2015 during the 2015 United Nations Climate Change Conference's Global Landscapes Forum. The fact that 28 African countries as of today have joined the initiative and have committed to restore a total of 113 million hectares of degraded forest lands by 2030 as well as the progress already made in the first four years is extremely promising. To date, 20 partner countries have completed their restoration assessment by using ROAM (Restoration Opportunities Assessment Methodology). This methodology was designed by the International Union for Conservation of Nature (IUCN) and the World Resources Institute (WRI) and supports countries in identifying and analysing areas that are primed for forest landscape restoration. Using this assessment countries have started developing national FLR strategies in consultations with all relevant national stakeholders which will guide and coordinate the implementation activities.

In terms of implementation, each country has its own strategy, depending on the presence of technical and financial partners and their needs as well as opportunities. Some governments, such as Malawi, have allocated funds for FLR implementation activities, while other countries work together with the private sector and governmental and financial partners like the World Bank, the German Development Ministry (BMZ), the German Environment Ministry (BMU) or the Global Environment Facility (GEF). FLR Implementation on the ground follows the FLR strategy and is guided by the countries. It is typically conducted by the government itself through tree planting campaigns, by the over 30 technical partners, such as the UN Food and Agriculture Organization (FAO), the World Wildlife Fund (WWF), WRI, IUCN etc., by private sector companies, or by local partners, such as grassroots organisations, communities, women associations or youth groups.

Bridging financial and capacity gaps

However, AFR100 does face challenges which need to be addressed in the upcoming years in order to be successful so that all countries can reach their goals in FLR implementation. It is noticeable that technical and financial partners are not equally present in partner countries. While some countries have the support of more than ten technical and financial partners, such as Kenya, Madagascar, Tanzania, other countries have either no partners to assist them or just one or two, like Benin, Ivory Coast and Mozambique. AFR100 will need to work on ways to improve technical and financial assistance for countries where technical assistance is absent or underrepresented. This also would allow to address the issue of lack of local and national capacities for FLR implementation and good practices in some of the partner countries.

AFR100 is working to bridge this gap by organising knowledge exchanges such as webinars that we have planned between our partner countries and financial partners in order to enhance access to funding opportunities. Another way AFR100 bridges the financing gap is through the annual Land Accelerator, an AFR100-partner-led endeavour to train entrepreneurs from African countries through business planning and incubation sessions. So far, the Land Accelerator, organised by WRI and Fledge (a global network of company accelerators and seed funds), has taken place twice in Nairobi, Kenya, in 2018 and 2019. Out of the 335 businesses that applied to the 2019 Land Accelerator, 14 entrepreneurs from eight African countries came to Nairobi to pitch their ideas to a room full of investors. Building up on this success, the development agency of the African Union – AUDA-NEPAD – aims to expand the Land Accelerator in the years to come.

In conclusion, we can agree that significant additional work is needed to take stock of the successful cases of forest landscape restoration, expand communication, advocacy and outreach, and support the implementation of comprehensive strategies and concrete plans to trigger the widespread adoption of FLR practices. The AFR100 Initiative will accelerate restoration to enhance food security, increase climate change resilience/adaptation and mitigation, support biodiversity conservation and combat drought, desertification and rural poverty.

Mamadou Moussa Diakhité, Petra Lahann, Diana Mawoko, Teko Nhlapo and Camilla Shiluva Holeni
all work with the AUDA-NEPAD/AFR100 Secretariat.
Contact: MamadouD@nepad.org

Global and regional restoration initiatives

Dozens of national governments have made commitments to restore deforested and degraded lands as part of global and regional restoration initiatives, including the **Bonn Challenge** which was launched in September 2011 and endorsed and extended by the **New York Declaration on Forests** of the 2014 UN Climate Summit. The Bonn Challenge targets the restoration of 150 million hectares by 2020 and 350 million hectares by 2030. It is supported by the **Initiative 20x20**, seeking to bring 20 million hectares into restoration in Latin America and the Caribbean by 2020. The **AFR100** Initiative also backs the Bonn Challenge.

The Great Green Wall Initiative

The Sahel is a region with very sensitive human and environmental dynamics. It is one of those extremely fragile ecosystems where the signals of climate change have been most apparent. The region has gone through major drought periods, and rain shortage is identified as an ongoing crisis for the Sahel. The region is stricken with multidimensional poverty and, at the same time, is faced with a steady population growth continuing into the next century. The Sahelian community is heavily dependent on natural resources for agriculture and/or livestock production as these are its main source of livelihood. However, most of the agriculture is rain-fed, which makes production challenging given the region's low rainfall patterns. The increasing demand for natural resources is resulting in a continuous pattern of land degradation in the Sahel.

In response to this plight, the African Union launched the Great Green Wall Initiative (GGWI) for the Sahel and the Sahara in 2007. The objective of this African-led initiative is to restore Africa's degraded landscapes by planting an 8,000 km-long line of trees and plants across the entire Sahel, from the Atlantic coast of Senegal to the east coast of Djibouti. The initiative aims to curb desertification and transform millions of lives in one of the world's poorest regions. So far, around 1,000 kilometres have been planted and provided food security, jobs and a reason to stay for the millions who live along this forest line.

Greening the desert

Action on climate change and dryland conservation, wastewater recovery and sustainable forestry, income generation and job creation. A joint research project by the universities of Cairo and Munich shows how multiple issues can be addressed simultaneously – if policy-makers focus on long-term benefits rather than quick profits.

By Klaus Sieg

Trees are a rarity in Egypt. Ninety-six per cent of the country is desert; most of the remainder is intensively farmed or built-up alluvial land on the banks of the Nile. So it is surprising to spot a row of trees on the horizon, their darkness contrasting with the vast, glaring expanse of yellow sand. A mirage? Far from it. A narrow road, bordered by eucalyptus trees up to 15 metres tall, brings the car to the entrance to the Serapium Forest. On this 200-hectare site on the west bank of the Suez Canal, timber is growing in the scorching heat of the desert. And not just growing, but growing fast. “Look at how tall that tree has become in just 20 years,” says Hossam Hammad, tapping on the bark of a eucalyptus that has cracked from heat and drought. “One metre in circumference – elsewhere it would have taken 100 years to do that,” continues Professor Hammad, who teaches in the Faculty of Agriculture at Ain Shams University in Cairo.

Sewage recognised as an important resource

The Serapium Forest is part of a project launched by the Egyptian government more than 25 years ago. Timber has been planted at 36 different desert sites that between them

cover 4,000 square kilometres. Most of the trees are fast-growing construction-timber species such as eucalyptus, acacia, casuarina and cypress. These state forests in the desert are irrigated using pre-treated sewage effluent. This is available in abundance in the country on the Nile. Egypt’s 97 million inhabitants produce seven billion cubic metres of sewage per year. As a result of the human body waste, the sewage contains valuable fertiliser.

The Serapium Forest’s water reservoir provides the next surprise. It doesn’t smell. The giant pool of water glistens invitingly in the harsh sun. The desert wind creates waves on the silvery surface. The mixed sewage comes from the nearby city of Ismailia. Solid matter has been removed using a sand filter. In this pool, oxygen and microorganisms are added to the water. They decompose organic compounds, thus removing any smell. Every day, this process produces 2,000 cubic metres of water that is rich in phosphates and nitrogen compounds – a perfect fertiliser that normally sells for a high price. “It is largely because of these constituents that the trees grow so fast,” explains Hossam Hammad. The sun does its bit too, beating down with a force of around 2,200 kilowatt-hours per square metre per year.

A perfect example of the combination of conservation and use

Each year, the world’s deserts are expanding by up to 70,000 square kilometres – an area the size of Ireland. Forests are the most effective form of protection against desertification. Use of the vast quantities of sewage that otherwise pollute Egypt’s soils and its life-giving river, the Nile, could promote the greening of 650,000 hectares of desert. But that’s not all. There is a big market for timber in Egypt and neighbouring countries. Experts put its value in Egypt alone at 1.5 billion US dollars per year. Hitherto, Egypt has had to import almost all the timber it needs. The fast-growing trees are ready to harvest in just 11 to 15 years, and they yield an average of 350 cubic metres of timber per hectare. They provide work, too. The Serapium Forest employs just 20 people, who see to irrigation, tree care, reforestation and the cultivation of seedlings. But many more jobs could be created if large-scale timber production were to provide the basis for a processing industry that could manufacture products such as furniture and medium-density fibreboard.

“There could be all sorts of benefits from this idea,” says Hany El Kateb, an Egyptian-born



Wastewater treated at the sewage plant is used to irrigate the Serapium Forest Project. The mixed sewage comes from the nearby city of Ismailia.



Each tree species has a different function in the forest. Hossam Hammad, a Professor at the Faculty of Agriculture at Ain Shams University in Cairo, in a tree nursery.

researcher who is a forestry scientist at the Technical University of Munich in Germany. He has provided scientific advice to the afforestation project in the Egyptian desert since its inception. His latest research project, which involves collaboration with the German Academic Exchange Service and Ain Shams University, aims to advance key aspects of forest management in the desert. “We are exploring which tree species work best with which methods and how they can be marketed.” This is why, for more than five years, almost 30 different types of trees have been growing on a ten-hectare site in the Serapium Forest. In addition to the drought-resistant, fast-growing construction timber there is neem, tamarisk, the energy plant *Jatropha* and expensive woods such as teak, mahogany and Indian palisander. The dense and varied growth in this part of the forest is surprising. Hossam Hammad points to a very straight and tall specimen of the mahogany *Khaya senegalensis*, a hardwood that is particularly suitable for furniture. “Thirty-five centimetres in circumference and ten metres tall – in just five years!”

Searching for the best type of tree

While a eucalyptus forms biomass twice as quickly as a hardwood, the hardwood fetches a price ten times higher. It doesn't need much more water, but it cannot withstand drought. Moreover, the seedlings of teak and mahogany are very delicate. The hardwoods also need more attention: in particular, they must be pruned. Pines, by contrast, grow straight and tall by themselves. “Above all we want to find

out what sort of irrigation each species needs to grow best.” Each tree species has a different function in the forest. For example, the casuarina binds valuable nitrogen in the soil and its rolled-up leaves, which look like pine needles, form a thick layer on the ground that retains moisture. Both properties benefit the other trees in the plantation. This means that the research on these ten hectares could help to improve both the profitability of commercial forests and their biodiversity.

“We see the use of sewage effluent and drylands as an opportunity to develop a viable model for sustainable forestry in arid regions,” says Dirk Walterspacher of Forest Finance. The company, based in Bonn, Germany, has already established semi-natural working forests in Panama and Vietnam. “This is where action on climate change, wastewater recycling and sustainable forest management come together,” Walterspacher continues. The Serapium Forest research project has been funded mainly by Forest Finance, which has drawn on its own capital and German government funds. But it has not yet been possible to create an investment product. Too many problems stand in the way, because forestry is uncharted territory in Egypt, an almost treeless country. There are no experts and no service providers. Since the revolution of 2011, the political situation has been unstable. Postholders changed frequently, knowledge was lost, agreements were not adhered to. There was and is corruption, and damaging decisions have been taken. As a result, for example, a disease damaged the trees in one part of Serapium due to careless maintenance. The workers had to cut down all the

trees at once instead of harvesting little by little. Hossam Hammad points towards the clear-cut area where workers are struggling to plant new seedlings in the scorching sun without wind protection and shade. Shaking his head, the professor explains that this will only result in a loss of fertile soil and harms the micro-climate.

Dam project causes uncertainty

Ethiopia's new dam project on the upper reaches of the Nile is creating major uncertainty. It is leading to water scarcity in Egypt and hence to greater demand for wastewater. At present, use of wastewater to grow food is not permitted, but this may change. Providing the population with affordable food is a priority for Egypt's military government. High bread prices were after all one of the triggers of the 2011 revolution.

Despite all these problems, Hossam Hammad and his partner Hany El Kateb are convinced that forestry in the desert has a great future. The results achieved on the ten-hectare research site have proved this. Dirk Walterspacher of Forest Finance is also continuing to follow the project. So the time may soon come when the sight of rows of trees on the horizon in the Egyptian desert is no longer surprising.

Klaus Sieg writes about agriculture and food, the environment, energy, the economy and social issues. He is based in Hamburg, Germany. Contact: klaus@siegtext.de



A charcoal kiln in Ulaya Mbuyuni Village using a more efficient kiln structure fitted with a chimney.

Photos: TFCG

Transforming community forestry policy and practice – a case study from Tanzania

Making forest-based enterprises part of community-based forest management can help communities maintain areas of forest within a multi-functional landscape. Our authors present a case study from Tanzania of communities integrating sustainable charcoal production into the management of their village forests. And they describe some of the strategies that can be used to influence stakeholders to adopt innovative models of forest management.

By Nike Doggart, Charles K. Meshack and Charles Leonard

Demand for land, not trees, is the main driver of deforestation in much of sub-Saharan Africa. Although communities derive multiple benefits from forests, agriculture provides the foundation for rural economies. In the context of these competing demands for land, safeguarding forest values requires governance systems to be in place to retain areas of land as forest over the long term. Community-based forest management (CBFM) is one approach that has been widely adopted to retain community forests, including in Tanzania. However, financial sustainability has been a key challenge for CBFM. Revenues are needed both to pay for the direct costs of managing the forests and to balance the opportunity costs to communities of allocating land to natural forests, rather than agriculture or other land uses.

Charcoal: controversial, but indispensable

Charcoal is a controversial product in Tanzania. It is frequently blamed for widespread

forest loss, although studies consistently show that agriculture supersedes charcoal in driving deforestation. Since the 1990s, Tanzania's national energy policy has sought to transition the country away from firewood and charcoal, i.e. from biomass energy. However, biomass energy remains the source of 85 per cent of total national energy consumption, and there is little evidence of change. Most charcoal comes from Miombo (*Brachystegia boehmii*) woodlands on village land outside of CBFM areas. Many experts agree that Tanzania's urban households will continue to use charcoal for the foreseeable future. In 2012, three national NGOs (see Box on page 28) set out to model a scheme to integrate sustainable charcoal production into CBFM in ways that would reduce deforestation, improve livelihoods and governance, and provide sustainable energy for urban households. By integrating sustainable charcoal production, the NGOs sought to model a CBFM approach in which charcoal would cover the transaction and opportunity costs of CBFM, as well as generating a range of livelihood benefits for the charcoal-producing

communities. The Box on the right shows the model's most important features.

Strategising for change in forestry policy and practice

In promoting sustainable charcoal, the project partners needed to address the technical challenge of establishing a sustainable forest management system while building a political and financial support network for CBFM that is independent of the project. In the following, we describe how the Transforming Tanzania's Charcoal Sector (TTCS) project has forged links between policy dialogue and forest management practice in an iterative way to transform charcoal value chains and CBFM. The project has used five strategies to change stakeholders' knowledge, attitudes and practices:

Strategy 1: Capacity building

The project took a broad view of capacity building, taking inspiration from the 'five capabilities model', which covers individual and



THE MJUMITA SUSTAINABLE CHARCOAL MODEL

How does it work?

As a first step, a village prepares a village land use plan that includes a village land forest reserve. The management plan designates 'forest management units' (FMUs) as areas for sustainable charcoal production. Approximately 15 per cent of the area of each village forest reserve is designated for charcoal production. The remaining 85 per cent is for protection and beekeeping. In several villages, communities have diversified the model to include low-impact selective logging,

mainly for *Brachystegia microphylla* and *B. spiciformis*, within sustainable harvesting limits. Logging is only permitted away from sensitive areas such as steep slopes.

The harvesting rotation period is 24 years. This means that up to 1/24 or 4.17 per cent of the harvestable area can be used in any one year for charcoal production. Charcoal producers are only permitted to produce charcoal within the harvesting coupe allocated to them. Importantly, all other coupes are protected in order to allow the woodland to regenerate.

How does the permitting system work?

A prospective charcoal producer agrees with a trader on an amount of charcoal to be sold. The trader will then pay a fee to the Village Natural Resources Committee (VNRC) per bag of charcoal to be produced. The VNRC subsequently issues a permit for the producer to prepare the charcoal, which is then transported to market, accompanied by a transit permit and a production license.

What happens to the money that is paid to the village?

Decisions about how the revenue to the village is spent are made in village assembly meetings. Some of the money is used to cover the costs of managing the village forest reserve. The remainder is invested in community development projects such as constructing classrooms, health facilities and water projects. This improves the livelihood of community members and reduces dependence on limited district development budgets.

Ecological sustainability is achieved by allowing the woodland to regenerate, mainly through coppicing, as well as by financing the protection of the rest of the village land forest reserve. Improved charcoal kiln management improves the efficiency of converting the wood into charcoal. Social and financial sustainability is achieved through the participatory approach of the model, and by generating funds to pay for forest management and community development.

institutional capabilities to perform, sustain and adapt in a dynamic way. Implementation involved two capacity building components. The first component sought to build the capacity of community members and village committees, including the village councils, village land use management committees and village natural resources committees, to implement the model. The second component was a formal programme of practical and theoretical trainings, primarily for government staff. Piloting incorporated a series of trainings events, involving community members and local government, with regular backstopping and technical support, in order to establish and implement both CBFM and sustainable charcoal production. As a result, women and men in 30 communities are managing village land forest reserves and producing sustainable charcoal. By building the capacity of the Morogoro communities and by demonstrating the multiple benefits that can be generated, the project has nurtured a practical example that has informed discussions around policy change. The project's more formal training programme has worked with government staff from local, regional and central government to develop the capabilities needed to sustain and scale up the model. This involved training sessions and field trips. The training has resulted in a cadre of professionals with an in-depth understanding of how to support the model. The formal programme covers the technical side of the production model, as well as ways in which local government can generate finance to pay for their supporting role.

Strategy 2: Research, monitoring and knowledge management

The research and monitoring strategy has included research on ecological, economic, governance and policy issues relating to the CBFM model, with an emphasis on impact evaluation. Monitoring activities have included periodic deforestation studies and annual participatory evaluation exercises involving community members. The research strategy has also channelled research from other forest landscapes to inform the management of the Morogoro forests, including via networks such as the African Forest Forum. Annual research workshops have provided a forum for research findings to inform policy-makers, researchers, local government and other NGOs.

Strategy 3: Communication

At the outset, the project developed a communication strategy building on a knowledge, attitudes and practice survey that mapped stakeholder understanding and interests. Using radio, newspapers, television and online media, meetings and publications, the project has succeeded in increasing awareness of CBFM and sustainable charcoal production. High-level annual workshops involving government ministers have raised the profile of sustainable charcoal and have provided an important forum for channelling experience from the practical piloting of the model, back into the energy and forestry sector policy dialogue. Each workshop has focused on specific policy-related issues and has provided a forum for a broad range of stakeholders to discuss

critical policy issues and agree actions to bring about change.

Strategy 4: Networking

Networking has involved facilitating groups with common interests to work together and / or exchange knowledge and experiences. The project has supported formal and informal networking. Formal networking has included supporting charcoal producers to establish associations as forums for cooperation in charcoal marketing and as a step towards formalising their businesses. Project partner Mjumita has promoted nationwide networking between communities involved in CBFM. The national Mjumita network has advocated successfully for local government to place higher priority on CBFM. Informal networks have also been supported by bringing together stakeholders with common interests and responsibilities, including communication officers from different ministries and local government staff. These formal and informal networks build up a supportive framework for communities involved in CBFM.

Strategy 5: Advocacy

Advocacy involves actions intended to achieve changes in policy and governance. This is a critical strategy in linking policy and practice in a transformational way. The project has used 'outcome mapping' as a tool to guide its advocacy work around CBFM. It involves identifying key stakeholders who have influence over, and interest in, the desired outcomes of an initiative. The tool provides a planning and

monitoring framework for working with those stakeholders, and for monitoring the ways in which stakeholders change over the course of implementing the strategy. Using outcome mapping, the project identified democratically elected leaders at village, district and national level as one of the key stakeholder groups. Activities were then organised to inform and seek the support of those groups. For example, the project organised field visits for District Council members and Members of Parliament to visit villages producing sustainable charcoal, and to learn about the model directly from the communities. Seeing at first hand the ways in which communities operate the system and benefit from the revenues has been a particularly powerful and persuasive approach to building broader political support for transforming charcoal production. Other priority stakeholders identified using outcome mapping include government ministers and senior civil servants in various ministries, among them Energy, Natural Resources, Local Government and Environment. Each year, a Minister from one of these ministries has been the Guest of Honour for the Annual Biomass Energy workshops, hosted by the project in collaboration with Swiss Development Cooperation. These events offer an opportunity to engage with stakeholders from different sectors, with influence over the outcomes of the project. One result of these workshops has been the establishment of a National Charcoal Task Force with a remit to make recommendations on policies and strategies in relation to the charcoal value chain. As with other strategies, the strength of the advocacy strategy has rested on an iterative exchange between policy and practice.

Results and lessons learned

The TTCS project has supported 30 villages to apply the model in village land forest reserves covering 141,610 hectares of woodland. Deforestation rates have been halved in some villages, and the 30 communities cumulatively earn around 20,000 US dollars per month from the royalties. In terms of gender, women's participation has increased in land and forest governance, and in forest-based enterprises.

Introducing changes to CBFM has revealed three key challenges, and the lessons learnt in the project are presented below.

Trust-building between stakeholders is key. Investing in building trust and understanding between stakeholders has been key, particularly between communities, local government and the Tanzania Forest Services

ABOUT THE TTCS PROJECT

The Transforming Tanzania's Charcoal Sector (TTCS) project was launched in the Morogoro Region in Eastern Tanzania in 2012. It is being implemented by three Tanzanian NGOs: the Tanzania Forest Conservation Group (TFCG), the Community Forestry Network of Tanzania (Mjumita) and the Tanzania Traditional Energy Development Organisation (TaTeDo), in close collaboration with local and central government. The project has been financed by the Swiss Agency for Development and Cooperation. It is in its third and final project phase, which is to last up to 2022.

(TFS) agency. We found that many government staff had profound concerns about devolving authority over forests and harvesting revenues to communities. Trust between government and communities has been built by working together in developing and implementing CBFM, openly discussing challenges and agreeing, in a participatory way, on changes to the underlying model.

Changing the attitudes of those with influence and incentive to block change is difficult. One of the most difficult tasks has been to influence leaders in TFS. While the communities, NGOs and TFS share a common interest in managing natural forests sustainably, the change embodied in the model is perceived to disrupt TFS's role in collecting revenues from charcoal fees. Although communities' right to collect fees from village forests is embedded in the law, it had never been implemented to the degree achieved by the villages involved in the TTCS project. This has brought to the surface tensions between the devolved model of forest management embodied by CBFM and a centralised forest management system with all forests under one authority. These tensions remain and are characteristic of forest management debates ongoing in many countries. The project's networking strategy has helped communities and TFS to discuss and reconcile these different forest management visions.

Policy change takes time and requires flexibility. Advocacy is a continuous process of influencing the different stages in the policy cycle, and each stage can take many years. For example, Tanzania's national forest policy has been under revision for the entire duration of the project. In the meantime, new regulations have come into force at short notice, with profound effects on the model. Advocacy requires long-term engagement in the policy process as well as flexibility to respond rapidly to sudden policy changes.

How to reach economic sustainability?

While the focus of the first two phases of the charcoal project has been on piloting and consolidating the system to operate independently in Morogoro Region, the final phase of the project seeks to nationally scale up the successful model, under the leadership of the President's Office for Regional Administration and Local Government. The role of the NGOs will diminish with local and central government taking a lead and using their own resources to scale-up and refine the model, alongside funding from development partners. The third phase is also designed to expand the scope of the project's outreach to engage with practitioners and policy-makers beyond Tanzania through the Africa Forest Forum among others. SDC has put in place provisions that will allow the Tanzanian Government to source international expertise, as input for the formulation of a national forest financing strategy. The strategy will guide future financing for the national forest policy, including CBFM. Such a comprehensive strategy will further ease access to dedicated global funds such as the Green Climate Fund, allowing the scaling-up of the successful model into communities across the country.

CBFM can play an important role in maintaining forests within multi-use landscapes. However, the economic sustainability of CBFM has been a challenge for many communities. Sustainable charcoal production offers a promising potential source of revenues for CBFM areas. Nevertheless, negative perceptions of charcoal, lack of trust of communities to manage forests and revenues themselves as well as contradicting policies create significant barriers to a more widespread application. Using a suite of mutually reinforcing strategies, barriers to change can be removed, a process requiring time, human and financial resources and a commitment to engage with a broad range of stakeholders at different complementary levels reaching from local to sub-national, national and international.

Nike Daggart is a Technical Advisor at the Tanzania Forest Conservation Group (TFCG).

Charles K. Meshack is Executive Director of the Tanzania Forest Conservation Group.

Charles Leonard works with TFCG as Project Manager of the Transforming Tanzania's Charcoal Sector Project (TTCS).

Contact: tfcg@tfcg.or.tz

The invisible wall to the Beijing space

On the invitation of the African Union's Women, Gender and Development Directorate (WGDD), a meeting was held on the theme "Realizing Women's Rights for an Equal Future" in Addis Ababa, Ethiopia, in late October 2019. The event centred on a review of the implementation of the Beijing Declaration and Platform for Action, which marks its 25th anniversary in 2020. Some reflections.

By Nyaradzayi Gumbonzvanda and Monika Bihlmaier

We are women. In a room full of women. We are here to discuss how far civil society has come 25 years after the adoption of the Beijing Platform for Action. The Beijing Conference in 1995 followed the World Women Conferences in Mexico, Copenhagen and Nairobi, and for women activists, it continues to be one of the major women's rights frameworks and a key point of reference, especially in the present socio-political climate, where we can see attempts to regress human and women's rights. But in any other room full of women, somewhere in a rural community, who would have heard of it and would actually know that the Beijing Platform for Action exists? When we look around in this room full of women that we are sitting in here in Addis Ababa, who is there, and who is not?

We are in a highly secured space. In order to access the building, we had to be on the list, be online at some point, have been invited, have a birth certificate in order to get a passport, which can be a journey on its own, be literate in order to read and write our information and apply and of course pay for our tickets and hotel in order to get here. We had to have a suitcase that we could pack and be aware of the unwritten protocol that we would need to follow. We are sitting here dressed "well" in order to enter this space – would they let us enter if we weren't wearing shoes? And of course there will be the obligatory group photo of all of us. What will be the average age of the women in the picture? Will it reflect the average age of the continents' populations in Asia, Latin America and Africa?

We were given this space, by authorities. We had to make noise as the space wasn't accessible to all of us – we had to be able to walk and see in order to get to this space. We are in a room where we are facing each other. Some of us are on the podium, sitting high up there, while others are sitting below it. We are not sitting in a circle on the same level. Some of us are given space on the agenda, others are not. Who has the microphone to tell all of us their interpretation of success and failure?

How much courage will the speakers have to ask questions that might be uncomfortable, or are we only going to applaud ourselves? Are we going to allow for some time and safe space to do a women's movement

introspective? To analyse what we did wrong in the 25 years after Beijing and why we see so few men walking the talk with us. You can even speak from the floor, you might say. Well, for us to be able to talk in these spaces requires special skills. The dominant language, confidence, knowledge and experience, the belief that anybody wants to hear what we have to say.

We are women, but we do not see the babies that we might be breastfeeding – except for one. Is it that men told us not to bring along the kids that we care for?

Even in the city the conference is held, the hundreds of women and girls are naturally excluded, for there is a literal wall and an invisible wall for participation. In this citadel of the continental body, there are hundreds of women in the private sector, NGOs, the UN and diplomatic spaces who are simply unable to place their feet in the room of this meeting. If satellite meetings were held in the universities, the women's organisations, media houses, and even a special walk to the market, the real meaning of a women's conference could have been felt.

The modalities, procedures and ways of work make it feel like an achievement and a privilege to be able to access the otherwise inaccessible conference rooms. It's no longer a right, and an entitlement, and yet in the Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW) and all those other instruments, we scream the value of effective and meaningful participation.

Is there spontaneous singing in the hall, just random spoken words by inspired women young and old? We even wonder if there is meaningful participation of girls in the room. The ones we see on posters, the ones who are stories of child marriage, teenage pregnancy or school dropout. Have they remained a statistical reference, or have they had a voice, too?

Maybe the year 2020, when we celebrate 25 years after Beijing, five years into the Sustainable Development Goals, the 30th Anniversary of the Convention of the Rights of the Child and many other significant anniversaries, will be our time to develop new tactics, meaningfully engage those who are concerned, involve new partners and do business unusual to make human rights and gender equality a lived reality for all.



Nyaradzayi Gumbonzvanda is the African Union Goodwill Ambassador on Ending Child Marriage. She is a trained human rights lawyer and has worked to advance women and children's human rights, addressing issues of violence against women, peace with justice, property rights, sexual and reproductive health and rights and HIV. She currently serves as Chair of the NGO Civicus and of the Committee on the Status of Women in Geneva.



Monika Bihlmaier is a Gender and Development Expert who has worked on women's human rights across Africa for the United Nations, the German Development Service, academia as well as national and international NGOs. She is currently the Team Leader for the Region of East and Southern Africa at Plan International Germany.



Million Belay is Coordinator of the Alliance for Food Sovereignty in Africa and holds a PhD in environmental learning.



Zsafia Hock is a senior scientist with Swiss Alliance for a GMO-free Agriculture. She holds a PhD in ecology/population genetics of plants.



Tamara Lebrecht is Executive Secretary of Critical Scientists Switzerland and holds an MSc in ecology and evolution.



Judith Reusser is Thematic Advisor to Swissaid on food sovereignty and seed policy. She holds an MSc in environmental science.

“ Once again, Africa is used as a justification to push for bad legislative change in Europe ”

An article in our 3/2019 edition focusing on “Plant breeding for food security” examined the potential of New Plant Breeding Technologies such as CRISPR/Cas. However, our authors maintain that important aspects were ignored in that article, and that once again, it presents a seemingly “all-knowing North” attitude. Here is their opposing view.

By Million Belay, Zsafia Hock, Tamara Lebrecht and Judith Reusser

On the 25th July 2018, the European Court of Justice (ECJ) issued a ruling stating that organisms obtained by new genetic engineering (GE) techniques, specifically directed mutagenesis techniques, are to be regarded as genetically modified organisms (GMOs). As a consequence, these organisms fall under Directive 2001/18 and will have to be regulated as GMOs, and resulting products will have to be labelled as such.

In their article published in *Rural 21*, Volume 53, Purnhagen and Wessler do not leave any doubt: they consider the ruling of the ECJ and the regulation of new GE techniques under GMO law as absolutely unfavourable. They correctly state that the ruling by the ECJ is not a ban on new GE techniques, as it is often wrongly being portrayed. Neither is it a ban on research. They do however warn against possible additional costs arising from the GMO approval process and lament presumed indirect negative effects on Africa. In this article, we argue why the ECJ ruling is important to ensure consumer rights as well as environmental and animal protection, and why new GE techniques will fail to eradicate world hunger.

Why do we need a strict regulation of new GE techniques?

Purnhagen and Wessler falsely claim that the ECJ ruling increases legal uncertainty regarding the new GE techniques, while in fact the opposite is true. With the ECJ ruling, we finally have legal certainty that these techniques are indeed GMOs. The uncertainty mentioned is political. Proponents of exempting products of new GE techniques from regulation often argue that the technique is more precise than random mutagenesis and that some products could also have been developed with conventional breeding methods (albeit more slowly). While it is true that new GE techniques such as CRISPR/Cas can induce cuts at a pre-selected, non-random location, the article fails to mention that precise does not mean safe. For example, we still don't understand exactly how the cell repairs

these cuts. The repair mechanisms themselves can lead to errors.

Recently, the US Food and Drug Administration (FDA) accidentally found that in the case of the poster child of new GE techniques, the hornless cows, not only the intended edit, but also the whole plasmid (the bacterial DNA vector carrying the gene editing tool and the gene of interest) was integrated into the target location of the calves. The findings of the FDA scientists raised biosafety issues since the plasmid included genes conferring antibiotic resistance as well. Concerns were expressed that these genes could be taken up by bacteria present in the gastrointestinal tract or the body of the calves. The FDA scientists assume that such errors are “...under-reported or overlooked”. If new GE techniques were exempted from regulation, such and other errors could in the future go unnoticed – with unpredictable consequences for the environment and animal and consumer health.

Strict regulation of genome editing can keep costs of traceability low

When it comes to the regulation, Purnhagen and Wessler rely on the agro-industrial approach, which suggests moving from a process to product-based legislation. They claim that products of genome editing are not distinguishable from natural mutations and are thus impossible to trace, the conclusion then being that there is no need to regulate them as GMOs. This means that farmers and consumers would have to face a situation where products of the new techniques could be released into the environment and the food chain without any traceability and labelling requirements.

However, there are no legal or scientific reasons to exempt new GE techniques from these requirements, and any attempt to do so would be a denial of the precautionary principle and a restriction of the consumer's freedom of choice. Tracing products of new GE techniques must not necessarily be costly, as claimed by the agrobusiness sector. If

companies are obliged by law to provide information about the modified genomic sequence along with certified reference material and a validated identification method, identification can, in most cases, be performed as a matter of routine, as has been done with classical GMOs. Identification of the products of the new techniques is even possible in special cases, when reference information is missing (e.g. illegal imports, contamination), by combining all available information such as declarations of origin, international databases and specific signatures the techniques cause in the genome. The so-called matrix approach, the principle behind biometric methods for digital fingerprint identification, makes even the identification of small point mutations possible. Thus, the costs of traceability only depend on a political decision: for a cost-effective solution, products of the new techniques must be strictly regulated as GMOs.

Agrobusiness or agroecology for food security?

Purnhagen and Wesseler claim that new GE techniques may help with a number of challenges African agriculture could be facing in the future. To underline this claim, however, they almost exclusively draw on examples of old transgenic GM crops, such as pest and herbicide tolerant crops that are mainly useful for large-scale industrial agriculture. The assertion that smallholder female farmers get empowered thanks to the use of total herbicides in combination with herbicide resistant GM crops seems particularly provocative in this context. The opposite is true. Pesticides have caused innumerable cases of poisonings resulting in invalidity or death. While it is mainly

men who are affected, women are often left behind alone, have to bear a double workload, and are hence not empowered by the use of herbicides. The authors also fail to mention other massive problems that these crops have caused not only in Africa but also in Asia, Latin America and the US, including the development of herbicide resistant superweeds and an associated increase in herbicide use in the US, secondary pest outbreaks and farmer suicides in Asia or decreased product quality in Africa (see Box). Instead, they state that these and similar traits could be developed with the new techniques. The overall message is obvious: more of the same.

However, over the past 30 years, the global trade-based agricultural and food system has failed to eradicate world hunger and to provide fair access to food. It is well known that hunger and food insecurity is above all a poverty, access and distribution problem, and less of a production problem. The new GM techniques will not change this. Tested in the laboratory under optimal conditions for optimal yields, the organisms are designed as high-performance plants. To correspond to the lab, the conditions in the field must be standardised, which results in monocultures with high use of chemical fertilisers and pesticides. In addition, varieties bred with new GM techniques are likely to be covered by intellectual property rights, plant variety protection or patents, so that companies will have a return on investment. This makes access to such high-priced seed extremely difficult for farmers, especially where smallholder agriculture dominates and the threat of hunger and poverty is greatest.

New GE techniques are all part of one and the same global business model, a model that

will hardly contribute to the achievement of the Sustainable Development Goals (SDGs) defined by Agenda 2030. The majority of the international community today agree that our agricultural and food systems must change dramatically. The Green Revolution, which is presented by Cymmit's Director-General Martin Kropff as what is probably the only solution, has led to a dead end. A second Green Revolution by CRISPR/Cas, as predicted by Kohli et al., therefore does not raise any positive expectations. The FAO refers to agroecology as one key approach for the paradigm shift needed in our agriculture and food systems.

Agroecology supports the promotion of farmer-managed seed systems. Humanity owes the genetic diversity that is indispensable for a sustainable food production and for plant breeding to the world's farmers. For thousands of years, they have bred, cultivated and exchanged seeds and adapted them to local environmental conditions. These also include seeds with traits such as drought resistance or soil salinity resistance, often used to justify the use of new GE techniques. Farmers manage seed systems, preserve and multiply indigenous varieties and thereby conserve the huge genetic diversity. Farmers' seeds diversity and the agroecological production of food allows a rich diet of different crops and vegetables. The contribution of agroecology and farmer-managed seed systems to end hunger and reduce poverty is huge and already proven. Let us promote these two approaches in order to finally herald sustainable development as called for by Agenda 2030.

Contact: j.reusser@swissaid.ch

Africa can think for itself!

Everybody has a solution for Africa. What is not happening is asking African food producers and citizens what is best for them. We are told in the article discussed above that we need new GE techniques, or what its authors call 'New Plant Breeding Technologies [NBPTs]', to feed ourselves. Purnhagen and Wesseler imply that the 2018 ruling by the European Court of Justice, which classifies organisms obtained by new GE techniques as GMOs, endangers food production in Africa. Applying GMO regulation to these organisms, they say, puts more burden on companies and governments as it increases regulatory costs, as well as the costs of tracking and tracing the genome-edited products. The big question is, why should Africa care? Are these technologies proven to be essential for Africa?

A recent ruling by the South African government, a country where large-scale GMO-based farming and commercialisation is much more advanced, rejected the claim by Bayer that water-resistant maize for Africa (WEMA) is much more productive and drought-resistant. The government did not find any significant difference between conventionally produced maize and WEMA in terms of productivity or drought resistance. The article further advocates the use of transgenic Bt crops in Africa. It is however known in South Africa that

Bt maize does not work for small-scale farmers. The article further fails to mention that Burkina Faso abandoned Bt cotton in 2016 after a major decline in important quality characteristics or that the country experienced a 20 per cent rise in cotton output after abandoning the GM variety. The authors also encourage Africa to plant herbicide tolerant GM varieties. Obviously, they are talking about glyphosate-based herbicides, including Roundup, which has been found to be carcinogenic by the International Agency for Cancer Research (IARC) and impacts our endocrine system. So why are the authors advising Africa to endorse failed and dangerous products? Why should it be bad for an African country to carry out a serious risk assessment before a product comes onto the market? Why should the consumer freedom of choice in Africa, in contrast to Europe, not be granted by labelling products obtained by new GE techniques? Is there perhaps any fear that promising new markets in Africa could shut themselves off from northern agro companies? The answer might be much more insincere, and, we are afraid, racial. It emanates from a deeply founded belief that Africa cannot think for itself. Putting the products of new GE techniques on a par with conventionally produced crops morally shames European legislatures.

Million Belay



Interviewing a tractor driver in Bolivia.

A smallholder oil palm farm

The Food Security Standard – addressing the Right to Food in sustainability standards and certification

Although more and more agricultural goods that are produced in food insecure countries are certified, most sustainability standards do not specially address food security and the Human Right to Adequate Food. The “Food Security Standard” aims to close this gap. It has recently been tested in five pilot countries with different crops in plantations and smallholder settings in Asia, Latin America and Africa – with promising results.

By **Rafaël Schneider, Tina Beuchelt and Liliana Gamba**

With the shift from petroleum-based to bio-based economies, the international demand for agricultural commodities is growing. More and more biomass is needed for food, feed, energy and industrial purposes, leading to increasing competition between the different uses. This can have adverse impacts on food security in biomass-producing countries, for example through agricultural production for exportation and local food production competing for land and water and through labour exploitation, environmental pollution or unfair labour contracts.

Consumers and civil society in Europe are becoming more concerned about the environmental and social impacts that imported products have had in their countries of origin. In the last two decades, voluntary sustainability standards addressing concerns regarding the environmental and social sustainability of agricultural commodities have proliferated, although with great differences in the scope of sustainability and feedstock types. While some focus on a specific commodity such as the Cotton Made in Africa Standard or the Roundtable for Sustainable Palm Oil (RSPO),

others refer to multiple crops such as the International Sustainability & Carbon Certification Standard (ISCC) or the Rainforest Alliance.

Integration of the Right to Food in sustainability standards

With the adoption of the Sustainable Development Goals (SDGs), governments, business and civil society have agreed on pathways to achieve sustainability. Governments are adjusting their strategies and legislation. Companies increasingly need to demonstrate sustainability in their international value chains and have to adjust their import or production structures. The primacy of food and nutrition security is highlighted in the SDG 2 on “Zero Hunger”. Its application within the agricultural and forestry sector, especially in food insecure countries, is widely discussed at the international level and stipulated along the civil society landscape. Yet only few proposals have been made for assessing food security aspects in voluntary, private certification standards for agricultural production, and they are hardly applicable in the context of voluntary certifi-

cations because of the extensive data collection and analysis they require.

This is where the “Food Security Standard” (FSS) comes in. Developed jointly by the Center for Development Research (ZEF) at Bonn University, Germany and the NGOs Deutsche Welthungerhilfe and WWF Germany, the Standard provides a set of practicable and measurable criteria ensuring the Right to Food (see Box on page 34). It is designed as a set that can be integrated in any existing sustainability standard in the agricultural sector and is applicable to all biomass types and uses, farm sizes and business types. The FSS is based on the Human Right to Adequate Food and the four dimensions of food security, i.e. availability, access, utilisation and stability.

The auditability of the FSS criteria and indicators and the practicability of the tools have been tested in cooperation with local producers and certification schemes within the framework of regular sustainability audits in food insecure regions in Africa, Latin America and Asia. Additionally, stakeholder workshops were carried out in each pilot region. The field



on the Kinabatangan River in Sabah/ Malaysia.

Auditing a group of smallholders in Zambia.

Photos: FSS Project

tests took place in smallholder as well as in large-scale agricultural settings, while the crops involved were oil palm, sugar cane, cotton and coffee. The following shows three pilot cases with contrasting but complementary results.

Testing the Food Security Standard in plantations – the example of Bolivia

The FSS was tested in Bolivia in November 2018 within the regular audit of a group of sugar cane producers for the sustainability standard ISCC. According to the Global Hunger Index, the hunger situation in Bolivia is moderate. Food security has strongly improved in the last decade, but there are still concerns in some regions because of factors such as water scarcity and land conflicts. In the sugar cane production areas, social issues include precarious income of seasonal farm workers and their families, child labour, lack of employment contracts and bad conditions in the accommodation facilities of temporal workers. However, the situation has improved in the last decade thanks to better regulations and law enforcement.

The sugar cane is supplied to the Aguaí Sugar Mill, located in the Bolivian province of Santa Cruz. Aguaí's suppliers are diverse in size and organisational structure, but most of them are rather large, with areas varying from 800 to 15,000 ha. In addition to Aguaí's headquarters, five farms were visited on-site. They were different in their managing structure and facilities, but all were highly mechanised. Compliance with the FSS was audited through the inspection of documents, inquiries about the farms' management and interviews with farm workers about their food security situation,

labour rights, payments, etc. The auditors also interviewed representatives of municipal governments and a trade union as well as a physician. The interviews with external stakeholders are an integral part of the FSS and help to cross-check and complement information. They also serve to identify potential negative, or positive, impacts on communities in the area of influence.

The pilot audit showed that the auditors had no difficulties in assessing compliance with the FSS criteria within the framework of the ISCC audit. The interviews with farm workers and key stakeholders provided a good overview of the food security situation of workers and communities. The FSS pilot audit in Bolivia reveals that large and medium size farms are in a position to comply with the FSS with acceptable additional efforts.

Oil palm smallholders in Malaysia – close to compliance

Mixed results were obtained from a pilot test with RSPO-certified oil palm smallholders in Malaysia. Sustainability certification was commonly mentioned during stakeholder meetings and workshops with governmental departments, oil palm producers and mills, NGOs, farmers and researchers as having contributed to improving the living and working conditions on plantations and among smallholders. However, the stakeholders also pointed out that food insecurity persisted, mainly among (illegal) workers on plantations, casual workers and poor families. The visits to the certified smallholders showed that food insecurity was a problem for very small farmers with only

one or two hectares of oil palm. Smallholders with around seven hectares were food secure, had casual workers and lived in decent houses, while some even owned cars, especially when they had additional income opportunities. With some additional efforts within the farm setting (e.g. better working conditions for workers) the majority of smallholders could comply with the FSS. Additional support would only be needed for a few farmers to tackle their precarious situation – for instance through job creation programmes, promotion of other production models and by providing social security schemes.

Challenges in highly food insecure countries – the example of Zambia

In Zambia, one of the most food insecure countries of the world, the FSS was tested in the context of smallholder cotton farming. It was expected that reaching compliance with the FSS would be difficult as the majority of the cotton farmers were confronted with food insecurity situations. Therefore, besides assessing the applicability of the FSS instruments, it was important to explore the question of whether and how the FSS instruments could be used in sustainability certifications in such contexts and how to pave the way towards compliance.

The test was carried out in cooperation with the sustainability standard "Cotton made in Africa" (CmiA) and the company Alliance Gineries Ltd. The CmiA standard encompasses social, environmental and economic criteria and is designed to improve the living conditions of African smallholder farmers and to promote environmentally friendly cotton

THE FOOD SECURITY STANDARD AT A GLANCE

The Food Security Standard (FSS) is rooted in the Human Right to Food and the related 'Voluntary Guidelines to Support the Progressive Realization of the Right to Adequate Food in the Context of National Food Security' which were adopted unanimously by all Member Nations of the Food and Agriculture Organization of the United Nations in November 2004. Although these guidelines predominantly address national governments, they also oblige the private sector to respect and support the implementation of the Right to Food. In this regard, the FSS is not raising the bar, but aims to ensure the fulfilment of internationally recognised rights and hence is a means for the private sector to prove its due diligence regarding the Right to Food.

The Food Security Standard provides a set of practicable and measurable criteria. It is not a stand-alone sustainability standard but is designed as a best-practice set which is to be added as a whole to the existing sustainability standards. The FSS catalogue consists of 35 criteria categorised under 17 themes ranging from topics like the respect of national food security strategies to gender equity. It is applicable to all biomass types and uses, farm sizes and business types. The FSS was jointly developed by the Center for Development Research (ZEF) and the NGOs Welthungerhilfe and WWF. The FSS Project is funded by the German Federal Ministry of Food and Agriculture (BMEL) via Fachagentur für Nachwachsende Rohstoffe e. V. (FNR). The final version of the FSS is expected to be available by mid-2020.

For more information, see www.welthungerhilfe.org/food-security-standard-project/

production. Alliance Gineries receives cotton from around 40,000 smallholders countrywide under an outgrower scheme. As a CmiA verified company, Alliance Gineries trains the farmers not only on good agricultural practices, but also on the social, environmental and economic aspects covered by CmiA criteria. The FSS was tested within the field visits of small farmer groups located in the Central and Southern provinces.

Cotton is an important income source for the farmers. The revenues are used to cover household expenditures such as school fees and materials, medical treatment, etc. By complying with the CmiA requirements, Alliance Gineries is likely to positively impact farming practices through trainings and cotton purchasing practices. However, all farmers interviewed are confronted with at least temporary food insecurity. They have to reduce their usual food intake from three to two or even to one daily meal for several weeks or even months throughout the year. Several factors drive their food insecurity, among them the irregular rainfall pattern in the last two to three seasons. Other factors include reliance on just a few food and cash crops, poor road infrastructure, insufficient storage capacity, extremely low levels of mechanisation, limited energy supply, lack of extension systems, other employment opportunities and social services such as health and social security systems. Addressing the complexity of food insecurity among smallholders in such an extreme setting is a challenge. Cotton gineries can play an important promoting role, but their capacities

are limited when it comes to providing solutions to structural problems.

The test showed that given these multiple challenges, the audited farmers would currently not be in the position to comply with the FSS. Moreover, the pathway to compliance is expected to be long and difficult. Not being able to get FSS certified within sustainability certification could bring disadvantages for the smallholder farmers, such as the exclusion from lucrative and increasingly demanding European markets. This has to be avoided. Further disadvantages for food insecure small farmers would even worsen their precarious situation. The question is how to deal with this challenge.

Paving the way for food insecure smallholder farmers – what role for the FSS?

While highly food insecure situations are the result of several factors, the private sector can still contribute to food security as part of its responsibility and obligations regarding the Right to Food. One option in food insecure settings is to use the FSS criteria and tools for monitoring progress towards food security. This approach, referred to so far as Food Security Sensitive Management (FoSSeM), could support sustainability-certified smallholder farmers and first buyers in identifying gaps and assessing their progress towards food security. It helps all actors along those value chains to assume and show their responsibility for the Right to Food. The responsibilities and action

pathways for each actor along the value chain still need to be defined, and criteria have to be identified how these can be assessed and monitored. This is a highly complex and difficult endeavour since overcoming food insecurity requires government action. At the same time, missing governmental initiatives should not relieve private actors from their responsibility to be a driver of change.

As the results of the pilots have shown, the FSS can be integrated into a regular sustainability audit with a reasonable additional effort. With structured interviews and clear criteria and indicators, the FSS can reliably capture the food security situation of workers, farmers and communities and identify gaps. While plantations can integrate the FSS requirements without major difficulty, only better-off smallholder farmers will, with some external support, be able to meet all requirements of the FSS criteria. Stakeholder workshops in several countries highlighted the relevance of and need for a Food Security Standard. While questions regarding the FSS were of course raised, there was general agreement that it is a practical way forward to address food security in agricultural settings. Although plantations, smallholder organisations or their representatives have indicated their willingness to implement the FSS, they clearly link additional investments to comply with the FSS to market demand and price premiums. The responsibility along the value chain, especially in consuming countries, hence needs to be addressed as well, and a demand for the FSS has to be established. The European Union became the first region worldwide to call on its governments to develop specific National Action Plans to implement the UN Guiding Principles on Business and Human Rights. All actors involved in agricultural value chains, including the private sector in consumer countries, can and must commit themselves to overcoming hunger and to protecting the Right to Food. This should be done in a credible and comprehensible way. The FSS can support the efforts of companies by providing an approach to facilitate the assessment and monitoring of their impacts on the local food security.

Dr Rafaël Schneider is Coordinator of the FSS Project and Senior Advisor for Rural Development at Deutsche Welthungerhilfe e. V., Bonn/ Germany.

Dr Tina Beuchelt is Senior Researcher at the Center for Development Research (ZEF), University of Bonn.

Dr Liliana Gamba is Senior Project Coordinator Sustainability Standards at WWF Germany. Contact: Rafael.Schneider@welthungerhilfe.de



Sudhir Datta's farm, where he has a farm pond and applies the broad bed and furrow (BBF) system.

Andaman Islands farmers take on climate-adaptive solutions for agriculture

With over 500 islands, Andaman & Nicobar Islands in India face serious environmental, climatic and geological threats. Frequent cyclones, tsunamis, waterlogging, heavy rain and drought are among the challenges farmers have to cope with here. Local scientists have worked with them to find solutions that not only protect natural resources such as land and water, but also offer sustainable income for farmers and solutions to practise organic farming in tough conditions.

By Sharada Balasubramanian

The Andaman Islands, 1,200 kilometres east of mainland India, are known for their natural beauty. From the turquoise blue beaches to the tropical protected forests, these islands are ecologically fragile, and natural disasters are not new to them. The 2004 tsunami impacted their natural resources of soil and water. The islands have been prone to climate change and natural disasters like cyclones in the recent past. This entails issues like rising sea level, changing salinity, tides, floods and even droughts in the summer. “The reasons are not just climatic, but also geological,” A. Velmurugan, Senior Scientist at the Central Island Agricultural Research Institute (CIARI), explains. “When there was a change

in the movement of plates – a process called subduction – in Indonesia during the tsunami, the plate of Andaman shifted. There was already a fissure between north and south Andaman. As the plate went down further, agriculture was affected.” In areas where salt water should be present, it receded, and mangroves were replaced by new plants. In agricultural lands, salt water gushed in, making the soil fallow and unfit for farming.

Exposed to the calamities

More than 4,200 hectares of agriculture land is under permanent submergence, which has

reduced the area available for agriculture in these islands.

Sudhir Datta, a farmer whose land is just ten metres from the sea, suffered heavy losses as saline water entered the farmland. “Half of my house was inside water, and my entire farmland was washed out,” he remembers. That was not the end of the story. “As there were salt deposits on my farmland, I could not cultivate paddy or anything for almost six years,” he remembers. Fellow farmer Tapan Mondal, whose farm is also close to the sea, recalls: “Before the tsunami, we had grown everything, even pulses. After that, everything was destroyed. Now, things are almost normal, although we

do not grow paddy on my land as there is a little salinity.” Paddy cannot grow in saline water, which meant that many farmers had to shift from paddy to other horticultural crops in these islands. Sanjay Saha, who used to grow paddy before the tsunami, started growing coconut trees as they tolerate saline water.

One of the main challenges for the farmers today is changes in salinity, which may fluctuate in just one single day. “Sometimes there is salinity in the morning, and it disappears in the evening,” Velmurugan says. This is because of the turn of the tide. During high tide, the salinity is flushed out. Andaman also receives high rainfall, around 3,000 mm annually. Owing to the proximity to the equator, evaporation is very high – 10 to 15 mm a day. “Due to the El Niño effect, we have also been seeing water shortage in Andaman since 2012. Although the total amount of rainfall remains the same, the number of rainy days has come down,” the scientist explains. This creates water scarcity for agriculture in the summer. Lack of rainfall during one phase and cyclones and excess rainfall during another result in losses and cause distress to the farmers. Here, early warning systems aren’t much help either. “Even if we receive early warning about cyclones, there is little we can do during natural calamities,” says Datta. “The maximum we can do is cover the crop with nets. How can we stop water from entering the land?”

Scientist Velmurugan refers to another problem that the archipelago suffers from. “Unlike in other Indian states, there are no dams, canals, or even irrigation here,” he notes. Borewells are not present, and the farmers only practise rainfed agriculture. Every technology has to revolve around rainwater harvesting.

Climate-resilient, resource conserving technologies needed

Post-tsunami, the CIARI scientists had to work on solutions for these island farmers. The challenge was to conserve natural resources like land, water and soil here, as the ecosystem is fragile. At the same time, they had to ensure that the farmers had fresh water to farm throughout the year, and the salinity and waterlogging issues also needed to be addressed. Further, they had to look at the farmers’ crop preferences and budget, and make sure that they could earn a sustainable income as well.

The scientists did an assessment of climate change and agricultural vulnerability for the islands, and then worked to develop climate-re-



Farmer Monica Saha, who is Sanjay Saha’s mother, with her arecanut harvest.

silient, resource-conserving technologies. One of the key solutions was land shaping. This approach, with which land is modified to save water, improves drainage, enables rainwater harvesting and reduces salinity. It incorporates various techniques, and farmers were given solutions depending on their land and resource availability. “There was a need to plan agricultural activity in such a way that one looks at climate, water, land size, and then creates a window for suitable farming, which is an agro-ecological research approach,” Velmurugan explains. “In a low-lying region like Andaman, where there is no other irrigation facility, nor dams or streams, this is the best method.”

The broad bed and furrow (BBF) method has established itself as one of the most popular practices in land shaping among farmers in Andaman. Here, land is excavated and beds are raised on land to grow vegetables. The depression area (furrows) is used for rice cultivation. Fish farming can be done along with rice in these furrows. Even when there is heavy rain, the beds are safe from water logging or from salt water. Farm ponds are built on the land to store water for agricultural use in the summer. Also, fish can be reared in them for an additional income. With an investment of 150,000 rupees (approximately 2,100 US dollars) for the BBF system, scientists say that the farmers can recover the money in two years. Other solutions like fish-paddy or the three tier farming system were also tested out with farmers in the islands.

The benefits of creating ponds, furrows and bunds using land shaping methods are obvious. “If you are raising a bund, not just for one season, you can grow three crops in a year, rather than just growing one crop, which is paddy,” Velmurugan explains. “In BBF, we also make a water pond, with a certain depth to ensure that we do not hit the salty soil,” farmer Sudhir Datta says. “We create a wall around the land, so that there is height to grow vegetables. I have experienced great benefits in BBF as I grow vegetables like brinjals. The water does not stay in the land, and growing brinjals is more profitable than growing paddy.” Recently, Datta harvested almost 80 kilos of brinjal from this system. “The market rate for brinjal fluctuates,” he says. “Sometimes, it is 40 or 50 rupees. I received 120 rupees per kilo as a market price and earned profits.” Today, he grows brinjal, bottle gourd and okra, among many other vegetables.

“There is a unique feature in Andaman,” explains Tapan Biswas, another scientist at CIARI, referring to a common practice among farmers. “Sea shells are spread all over the farmland by farmers as they absorb acidity in the soil.”

Organic farming – an option for the islands?

As the region is eco-sensitive and chemicals can easily leach into the soil and water, over 2018, the Andaman & Nicobar administra-



Two fishers in Andaman Islands.

Photos: Sharada Balasubramanian

tion concentrated on making these farmlands organic. Not all farmers welcome this. Some, like Tapan Mondal, have been heavily relying on chemicals as agricultural inputs. “Without giving any fertiliser, how will we gain any productivity?” the farmer asks. “If they want us to produce organically, they should also stop bringing vegetables from Chennai or Kolkata, as they contain chemicals. We have to deal with this slowly.”

Getting organic inputs for agriculture is indeed difficult for farmers like Tapan Mondal who do not keep any livestock. This is precisely why scientists and the Islands’ administration have been emphasising integrated farming. As the administration has blocked some essential chemical fertilisers, such as urea, NPK (nitrogen, phosphorus, potassium) and di-ammonium phosphate, the farmers have to use manure. Farmer Sanjay Saha now applies coconut leaves, husk and other plant material mixed with poultry waste on his plants. And he does mulching, as recommended by the CIARI scientists. For this purpose, a basin is formed around the palm and arecanut trees. Coir waste, farm waste, dried leaves, dried grasses, sugarcane trash, paddy straw and groundnut husk is used for mulching. However, the farmer still remains sceptical. “Chemicals should not be totally phased out, but should be removed little by little,” he states. “I was given vermicompost for practising organic agriculture; however, in heavy rains, everything got washed out. It is challenging to do farming in these islands.”

Other farmers like Sudhir Datta have already successfully been practising organic farming for quite a while. “Organic is better as chemicals act like slow poison. They harm the plants, and people can get cancer or other diseases. We should stop chemicals and become organic,” says Datta, referring above all to brinjal production, which involves a high level of chemical inputs. In Andaman Islands, up to 80 per cent of total pesticide consumption is used for vegetable crops. At one end of Datta’s farm, soil is spread out in the sun. The farmer mixes poultry waste with cow dung. “When there is no rain, I turn on the motor pump and spray some water to moisturise the mass of manure. There should be no gas left in the manure. Once the hen excreta is decomposed, we can use it with soil, and then plant vegetable seeds,” he explains, and warns that if the hen excreta is used directly, it can burn the seed or plant. “If we keep this manure for six months, or even a year, there will be no damage. The plant will get strengthened,” he adds. “The fertility of the soil on my land has increased, thanks to poultry manure.”

The way forward

As the land area in the islands is limited and there is no scope for expansion here, the land needs to be used judiciously. The CIARI scientists are convinced that organic farming is the way to go. According to Velmurugan’s research results, published in a book titled *Organic Farming: Technologies and Strategies*, there is

good scope for the production of tropical fruits like mangosteen, durian, dragon fruit, rambutan, grapefruit, pomelo and longan as there is a high export potential for them. Also, poultry, pig and cattle can be integrated with the crop components for efficient resource recycling and stability to farm income.

Velmurugan and his colleagues believe that by applying appropriate organic production technologies for nutrient, plant protection, post-harvest operations, etc., and by capacity building, productivity in Andaman could be significantly increased. By intercropping, for example, more organic matter could be generated. Buffer crops could be grown reaching up to twice the height of the organic crop to protect it. For instance, when chilli is cultivated as the main crop, castor can be grown as a buffer crop. A simple certification process for all the organic farmers and the promotion of a specific brand name for the islands would greatly contribute to organic farming here. A further recommendation the scientists give is that policy should encourage private entrepreneurs to produce and sell quality manures. And the seed sovereignty of the farmers be ensured by establishing seed villages, seed banks and seed cooperatives to produce, store, share and supply good quality seeds. These are not available right now. Additionally, the scientists believe that farmer-to-farmer exchange is one of the best mechanisms to share farmers’ knowledge and innovations in organic agriculture, and that this should be facilitated. Also, Velmurugan maintains that financial assistance and specific crop and livestock insurance for organic farmers could instil confidence among Andaman Island farmers.

As tourism is expanding in these islands, there is a huge potential for the local farmers to produce and supply organic vegetables. Andaman’s proximity to the South East Asian countries can be an advantage in terms of exporting organic products. If the potential of the production system and market demand is properly linked with adequate policy support, organic farming will thrive in these islands. “It will reduce the burden on other markets like Chennai, from where vegetables are now being sourced. One can also save on the huge cargo costs which increase the prices of vegetables here,” says Velmurugan.

Sharada Balasubramanian is a freelance environmental and development journalist from Coimbatore, India. She writes on water, agriculture, climate change and conservation. Contact: sharadawrites@gmail.com

Can forest restoration solve climate change? New modelling approaches to support complex decisions

Forest restoration bears a considerable carbon storage potential and can support efforts to mitigate climate change. However, its role should not be overestimated, and neither should the costs involved in forest restoration be underrated, our authors warn. They recommend realistic models to back decision-making in what is clearly a highly complex area.

By Eike Lüdeling, Katja Schiffrers, Wulf Amelung, Keith Shepherd, Todd Rosenstock and Jan Börner

Forest restoration is one of the most ecologically beneficial land use choices at our disposal. It can help us regulate water and nutrient cycles, reduce soil erosion and degradation and conserve biodiversity. For many people, forest restoration also increases the aesthetic, cultural, and recreational value of our landscapes.

In times of global warming, forest restoration has been lauded as a prime solution for climate change mitigation. Trees store lots of carbon, so it seems evident that additional trees or more mature forests can support our quest to curb anthropogenic climate change. But just how much support can we expect from forest restoration? A recent study by Bastin et al. (2019, *Science* 365, 76–79) claims that forest restoration could potentially store an addition-

al 205 billion tons (1 billion tons = 1 gigatonne – Gt) of carbon. Indeed, sequestering this amount would render forest restoration a major part of the solution to our climate woes.

Constraints to forest restoration

Unfortunately, the actual solution potential of forest restoration is probably a lot lower. An obvious reason is time. Trees grow at fairly slow rates and it would take decades, perhaps centuries, for forests to fulfil their sequestration promises. This duration is significant, given that at humanity's current carbon dioxide emission rate (about 40 Gt of CO₂ per year, equivalent to roughly 11 Gt of carbon), it would take us less than 20 years to emit as much carbon as

our forests can store. Consequently, the net effect of business-as-usual emissions and forest restoration would still be a dramatic increase in atmospheric carbon concentrations. There is no excuse: if we want to effectively address climate change, we must tackle our emissions where they occur. We cannot rely on forests to mop up our mess.

We also have to be realistic in assessing the scope of our decision options. As we pointed out in our response letter to the restoration study (Luedeling et al., *Science* 366, 315), many natural constraints will limit forest restoration in large regions of the world. Trees do not grow well where soils are frozen, where temperature extremes exceed what trees can tolerate, where soils are depleted, where graz-



ing animals limit tree establishment, where wildfires suppress woody vegetation or where salinity, sodicity or other soil limitations prevent tree establishment. What is more, inasmuch as forests are able to protect soils from degradation, deforestation leaves its footprint in the landscape. Many soils have eroded or have been degraded by other mechanisms. If soil is lost, there is no rapid re-establishment of forest cover to a degree observed in nature conservation areas. We also need to take into account that by afforesting areas that have not formerly been forests we may destroy functioning ecosystems with unforeseen consequences for the provision of ecosystem services, such as the regulation of water cycles or the preservation of biodiversity.

Besides limitations due to natural constraints, forest restoration is held back by human land use. While there are surely many degraded forests and deforested areas that can potentially be restored, few of them are readily available. Most former forest areas are now inhabited by people whose livelihoods are intricately linked to land uses that preclude full-scale forest restoration. Where crops are grown, livestock is raised or production forestry is practised in degraded forest areas, restoration may impose unbearable costs on the people who currently depend on these areas. Where villages, towns and cities have been established on such land, these costs will be even higher.

Finally, let's not forget the costs of forest restoration. Establishing hundreds of millions of hectares of new canopy cover – which would be required for forest restoration to qualify as a major force in mitigating climate change – implies massive investments, including the establishment of seed and seedling supply mechanisms at scales without precedent. This may not be impossible, but we are not convinced that forest restoration would still look like a prime mitigation option, if all related costs were considered, particularly when including the costs for afforesting remote landscapes without a functioning infrastructure.

Impact estimation challenges

While the above issues are rather obvious, they are often not adequately considered in assessments of reforestation potential. Simplistic assumptions, such as that all of the world's grazing land can be converted to forest or that reforestation areas in the tundra can store as much carbon as tropical savannahs underlie the results published in the Science paper we referred to earlier.

Scientists, especially modellers, are often tempted to make such unrealistic assumptions when dealing with complex systems. Such assumptions help them overcome data limitations and avoid issues for which precise modelling seems unrealistic. This practice is so widely acknowledged that it has spawned one of the most famous quotes in modelling (usually attributed to the statistician George Box): “All models are wrong but some are useful.” There is surely some truth in this in the sense that models cannot exactly replicate or predict real life systems but may provide useful insights. However, when models fail to take into account important factors that can greatly affect the outcome of a projection, then they are not useful for decision support, or worse, can ultimately mislead policy decisions.

How to model for decision relevance?

Scientists aiming to provide advice to decision-makers need a reasonably complete understanding of the system dynamics, including the various aspects that need to be considered, as well as constraints that undermine the promise of decision options. In the present context, where we explore the mitigation potential of forest restoration, such considerations must include the host of factors that restrict available restoration areas, as well as the financial, social and ecological costs of implementing restoration programmes. It seems obvious that policy-makers cannot ignore such factors, and that they cannot prioritise among possible mitigation pathways without taking all relevant aspects into account.

We acknowledge that fully addressing the scope of actual decision situations in science-based models is challenging, especially when we expect all aspects of our models to be underpinned by precise and objectively validated data. The real world is so complex, includes so many ‘intangible’ factors and is so poorly covered by high-precision datasets that we cannot hope to produce precise and reliable models of all processes that are relevant in contexts such as forest restoration. Many researchers today rely on machine learning algorithms and Big Data analysis to detect patterns and correlations in global datasets. Such tools are powerful and useful in numerous contexts, but they do not change the basic dilemma: in order to adequately support decisions, we need a much better understanding of the processes that determine the outcomes of decision options, and we need effective approaches to deal with the uncertainties that arise from limitations in data and knowledge.

New modelling approaches to support complex decisions

Scientists investigating climate change mitigation approaches aren't the first to venture into complex decision situations. In fact, researchers as well as business consultants have been looking for ways to navigate such situations for centuries, and fairly sophisticated decision analysis approaches have been put forward.

Despite their potential, such decision analysis methods have only occasionally been applied in agricultural development and natural resource management. Some key work in this space has recently been done, and continues to be done, under the umbrella of the CGIAR research programme on Water, Land and Ecosystems (World Agroforestry and University of Bonn). Decision analysis approaches include systematic appraisal of the knowledge of decision-makers, academic experts and stakeholders to ensure that the widest range of possible options is considered and that no critical issues are overlooked. They also include thorough characterisation of relevant risks and uncertainties involved in decisions, as well as mechanisms to translate these uncertainties into assessments of the riskiness of each available decision option. We advocate for wider adoption of such methodologies in complex decision contexts. When the stakes are high, as in the choice of the most effective ways to avoid a climate-induced planet-scale emergency, we need decision support models that capture the scope of our options as completely as possible.

Eike Lüdeling and **Katja Schiffrers** are a professor and a scientist, respectively, at the Department of Horticultural Sciences, Institute of Crop Science and Resource Conservation at the University of Bonn, Germany.

Wulf Amelung is a Professor at the Department of Soil Science and Soil Ecology, Institute of Crop Science and Resource Conservation at the University of Bonn.

Keith Shepherd is Principal Scientist and leader of the Soils Theme at World Agroforestry, based in Nairobi, Kenya.

Todd Rosenstock is a Senior Scientist at World Agroforestry, based in Kinshasa, Democratic Republic of the Congo.

Jan Börner is a Professor at the Department of Economics of Sustainable Land Use and Bioeconomy and at the Center for Development Research of the University of Bonn.

Contact: luedeling@uni-bonn.de



A former natural forest area in Kalimantan/Indonesia in which oil palms are now to be grown.

Photo: Michael Köhl

Rainforest protection with contrary effects – high transaction costs can jeopardise the successful implementation of REDD+

If developing countries reduce the deforestation and degradation of their natural forests, they should be rewarded financially by the United Nations REDD+ programme. But high costs are jeopardising the success of REDD+. The countries themselves must prove how much forest they have conserved by avoiding deforestation and forest degradation. However, this proof is expensive and the related costs can be higher than the expected incentive payments.

By Michael Köhl, Philip Mundhenk and Prem R. Neupane

The continuing deforestation and degradation of tropical forests and the associated negative consequences such as loss of biodiversity and CO₂ emissions have motivated the international community to consider the conservation of forests as a climate protection measure. At their 13th Conference of Parties (COP 13) in 2007, the member states of the United Nations Framework Convention on Climate Change (UNFCCC) agreed on REDD+ (Reducing Emissions from Deforestation and Forest Degradation) as a national strategy for developing countries to reduce their greenhouse gas (GHG) emissions. The basic idea of REDD+ is to create economic benefits for forest conservation through incentive payments and the remuneration of emission reductions (carbon financing). The REDD+ process is currently entering a new era as many countries are about to finish their REDD+ readiness phase and are now negotiating Emission Reductions Payment Agreements (ERPA). ERPA are documents in which the seller (i.e. a REDD+ country) and the buyer (i.e. the Forest Carbon Partnership Facility Carbon Fund) agree on the commercial terms

of the sale and payment of Emission Reductions (ERs). Since deforestation is a large contributor to the global GHG emissions (Federici et al., 2015), emission reductions as set by the goals of the Paris Agreement (PA) can only be achieved by halting global forest loss. In Article 5.2 of the PA, the reduction of emissions from deforestation and forest degradation in developing countries is stated as a measure to reduce global GHG emissions and is directly linked to results-based payments (UNFCCC, 2015).

When implementing a national REDD+ scheme, countries follow a phased approach: capacity building or readiness in Phase 1, followed by the successful implementation of policy reforms in Phase 2 until compensation payments of results, that is actual emissions reductions and increase in forest carbon stocks in Phase 3 (Angelsen, 2017). The results-based payments are financed by public funding, of which more than 80 per cent is contributed by Australia, Germany, Norway, the United Kingdom and the USA. About one third of the public funding is distributed through the World Bank, the Global Environmental Fa-

cility, the Green Climate Fund and the UN-REDD Programme (Norman and Nakhooda, 2014). The funds are used to cover direct costs for REDD+ activities as well as transaction costs for information, enforcement, implementation and monitoring. The transaction costs are the decisive factor in determining the proportion of payments remaining as incentives. In order to maintain REDD+ as a cost-efficient climate mitigation action, the transaction costs must be kept low.

This is where our current study sets in, examining the implementation costs of national REDD+ programmes in more detail (Köhl et al., 2020). In order to demonstrate national emission reductions through REDD+ activities, countries need to have a measurement reporting and verification (MRV) system in place. The MRV system provides information on forest C-stocks and is a mandatory prerequisite for the comparison of national forest C-stock changes after implementing REDD+ activities with those which would be expected if deforestation and forest degradation activities of past years were to be continued unchanged.



Activity data (left): Sentinel 2 remote sensing data, with blue patches showing deforestation areas (provided by courtesy of GAF, Munich).

Emission factors (right): tree measurements in Suriname (UHH/CEN/Michael Köhl).



MRV systems use two fundamentally different data sources: (1) activity data, which refer to area change data and include deforestation, degradation and afforestation activities, and (2) emission factors, which quantify GHG emissions and removals per unit area. Activity data (AD) are provided by remote sensing sensors, while emission factors (EF) are usually obtained by sample based in-situ forest assessments (see Photos above). Costs are incurred for the collection, evaluation and verification of the relevant AD and EF, which often account for a significant proportion of transaction costs.

What sounds rather straightforward so far is much more complicated in practical implementations. The Intergovernmental Panel on Climate Change (IPCC) and the Forest Carbon Partnership Facility (FCPF) have drawn up guidelines to be applied when implementing MRV systems (IPCC, 2006; FCPF, 2016;

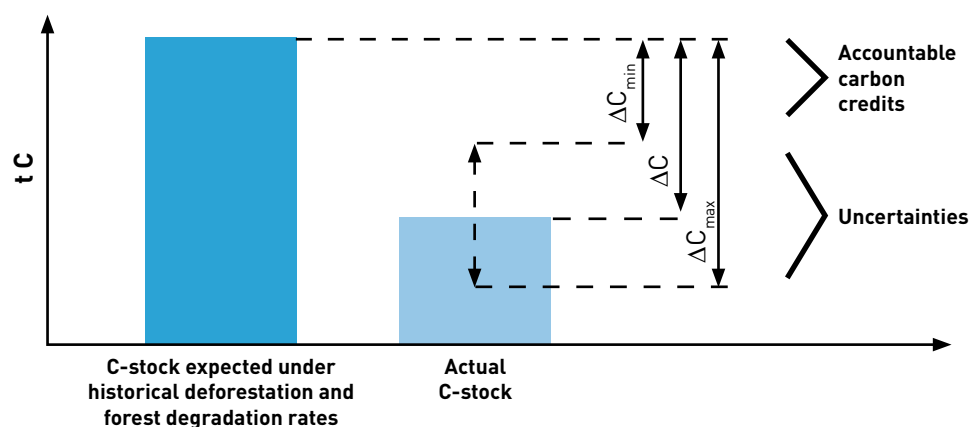
IPCC, 2019) in order to guarantee estimates that are transparent, consistent over time and accurate. An essential part of these guidelines relates to the verification of C-stock changes and the resulting CO₂ removals and emissions. Recording changes in land use using satellite data as well as determining the changes of forest C-stocks is prone to errors. These errors must be taken into account when estimating CO₂ emissions and removals, and can be considerable. For example, for Fiji, which has a forest area of around 9,000 km², a margin of error has been estimated ranging from 850,000 to 2.3 million tons of CO₂ emissions. It is not possible to specify which value actually applies within this interval. In order to avoid unjustified incentive payments, the value of the error interval that leads to the lowest CO₂ credits must always be used (see Figure).

For countries that want to introduce REDD+, this poses an optimisation problem. To what

extent should the error be reduced in order to obtain the highest possible incentive payment? Reducing the estimation errors renders investments in the application of better but also more expensive assessment methods necessary, which must be balanced against the increased incentive payments.

In our study, we show that especially for countries with historically low deforestation and forest degradation rates, the achievable incentive payments can be very low or even insufficient to cover the collection costs. With the carbon price currently paid by the FCPF at five US dollars per tonne of CO₂, additional financing is needed to successfully implement REDD+. The envisaged market mechanism for REDD+ will therefore not become operational. We recommend that the optimisation of the MRV design meet accuracy and cost requirements. The optimisation criterion for MRV systems should not be the highest possible accuracy, but the highest possible carbon credits. This contradicts the requirements for the greatest possible accuracy, as stipulated in the International Panel on Climate Change's (IPCC) and Forest Carbon Partnership Facility's (FCPF) recommendations for action.

Error margins and accountable carbon credits



Michael Köhl is a professor and **Philip Mundhenk** and **Prem Rai Neupane** are Research Associates at the Center for Earth System Research and Sustainability, Institute of Wood Science – World Forestry, at the University of Hamburg, Germany. Contact: michael.koehl@uni-hamburg.de



Roads and cattle farming are two major drivers of deforestation in the Brazilian Amazon.

Photo: Kate Evans/ CIFOR

Land prices and expected deforestation in Brazil: The role of infrastructure and forest conservation policy

The expansion of commercial agriculture in Brazil has detrimental effects on natural ecosystems. Our authors have examined how the Brazilian land market responds to transport infrastructure investments and shifts in the environmental governance regime especially in the Amazon region. Their results indicate that land users speculate based on planned infrastructure improvements and may also relocate in response to conservation policy.

By Javier Miranda and Jan Börner

Preserving tropical forests while providing food, feed, fuel and fibre to a growing population is a key challenge for sustainable development. With massive land reserves and a modern agricultural sector, Brazil has a key role to play in managing the trade-off between related SDGs, such as “Zero Hunger” and “Life on Land”. Correspondingly, Brazil’s output of globally traded commodities, such as soy and beef, has been on the rise in the last two decades while impacts on tropical forests have been quite variable over time and throughout the landscape. Extremely high levels of annual forest loss early in the 2000s were reduced by almost 80 per cent between 2004 and 2012 due to stringent conservation governance. Since these years of consistent reduction of de-

forestation in the Amazon, rates have been on the rise again with a dramatic increase of 30 per cent between 2018 and 2019.

Pressure on forests depends on the net benefits land users expect to obtain from different land use options. These expectations are based on local agro-biophysical characteristics, but also on past experiences of, and access to, information on infrastructure investments and environmental governance. The former can make forest conversion more attractive, for example, as a means to claim land which can later be sold at higher prices, whereas the latter makes deforestation less attractive. Using land market data from Brazil, we have studied whether, where, and to what extent, infor-

mation about planned road infrastructure investments on the one hand and actual changes in environmental governance effectiveness on the other have affected expected returns to land under different uses as reflected in land market prices.

Standard economic theory predicts that per hectare prices of land correspond to land users’ discounted expected net returns to its use. Without information about the future, these expectations are formed based on past knowledge about possible net returns to alternative land uses. If actual prices on land markets exceed expectations based purely on knowledge of the past, we can assume that land users are pricing in information about the future – in

other words, they speculate. In our study, we used this notion to provide evidence for causal relationships between forest land prices, road infrastructure investment and conservation policies during the period between 2001 and 2012. We focused our analysis on the Brazilian Amazon and Cerrado biomes because they host socio-ecologically important ecosystems, together with a dynamic agricultural frontier, and they differ in the degree of land use restrictions imposed by Brazil's environmental policy regime.

Land speculation

Research has repeatedly described land market speculation in the Brazilian Amazon as a process in which forest clearing is a means to secure future rights to land. Since the 1960s, road infrastructure investments and agricultural subsidies have lured farmers and investors to Brazil's agricultural frontier in expectation of a better life or high rents from timber extraction and commercial agriculture. Increasing demand for land thus has often preceded both legal and illegal deforestation.

In our study, we adopted an ex-post perspective to quantify the effect of information on the location of future road infrastructure investments on land prices. Public investment plans are regularly published and can thus inform land use behaviour. If land users and investors are sufficiently confident that planned investments materialise, we should be able to see that reflected in land prices. In fact, we found that expected improvements in travel time from forest margins to major market places do increase prices of forest land long before the actual improvement materialises. This increase in demand for land under forest can be interpreted as an 'early warning signal' for deforestation, but not equally across the region. We compared our identified zones of land market speculation with a map of deforestation hotspots and found that effects are more pronounced in areas along the South-North transport route BR-163 and in the so called MATOPIBA region (MATOPIBA is an acronym that uses the first two letters of the four states into which soybean production is expanding: southern Maranhão, Tocantins, southern Piauí and western Bahia). Both ar-

reas have experienced a massive expansion of soy and beef production in the past decade.

Land markets as a barometer for conservation policy leakage

If improvements in environmental governance reduce land users' expected net returns from forest conversion, do they relocate investments to places with weaker regulations? If so, forest conservation policies can become less effective as a result of leakage, i.e. the displacement of land uses from one to another region. Following our reasoning above, such leakage should be accompanied by an increase of land prices in the untargeted region. In our study, we measure changes in environmental governance in terms of the number of fines issued for infractions of forest conservation law by Brazilian authorities. In the Amazon biome, changes in fine intensity were associated with reductions in forestland prices. However, we also observed that forestland prices simultaneously increased in the less protected Cerrado region, thus potentially indicating conservation policy leakage.

Towards policy coherence and responsible discourse

We have looked at the well-documented trade-off between conservation and agricul-

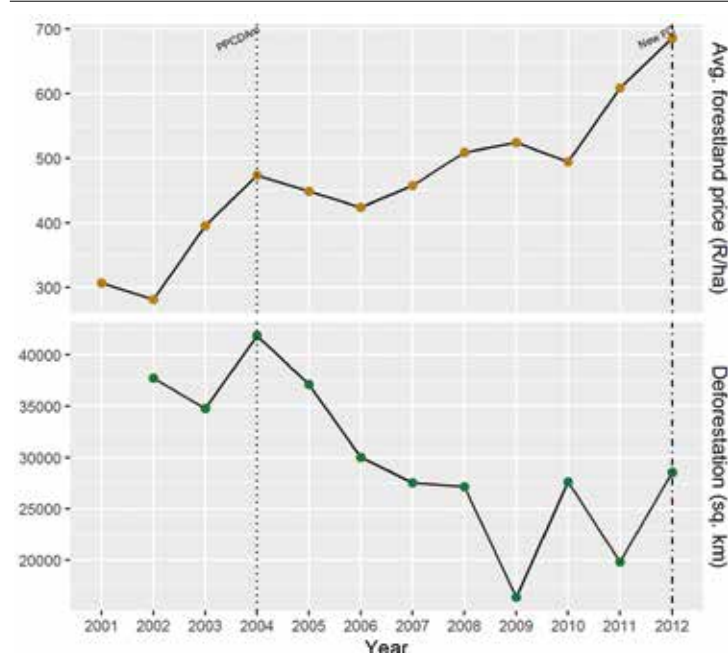
tural development at the Brazilian agricultural frontier through the lens of land markets. The role of land speculation in fuelling this trade-off has been repeatedly described, but was rarely quantified. Our results show, moreover, that studying land markets can help us to understand conservation policy leakage, another well-known phenomenon that is notoriously difficult to measure. Data on land market transaction is not always easy to come about, but digitalisation and improvements in land registry systems across the tropical world, including as a result of international REDD+ investments, are likely to change this in the future.

One key lesson from our study and related prior work is that land use governance is a nexus challenge and can only be effective if incentives to land users are coherently aligned across public policy sectors. This was the spirit of the so-called PPCDAm, Brazil's plan to combat deforestation in the Amazon that miraculously turned the country into a global conservation pioneer in less than half a decade. In addition, our findings warn against reckless communication strategies by political leaders. If political discourse raises expectations of better road access to primary forests and lower support to environmental law enforcement, irreversible damage will be caused regardless of whether politicians actually walk their talk. Land markets can be leveraged to allocate natural resources to their most productive uses, but only if coherent policy mixes safeguard equal access and promote sustainable investment decisions.

Javier Miranda is a researcher at the Institute for Food and Resource Economics (ILR) and a PhD candidate at the Center for Development Research (ZEF) at the University of Bonn, Germany.

Jan Börner is a professor at the Institute for Food and Resource Economics (ILR) and Senior Researcher at the Center for Development Research (ZEF) at the University of Bonn. Contact: javier.miranda@ilr.uni-bonn.de

Forestland prices and deforestation



Note: Our region of study overlaps the Amazon tropical forest and the Cerrado savannah. Two major changes in environmental governance occurred in our period of analysis: 1) publication in 2004 of the plan to combat deforestation in the Amazon – PPCDAm in its Portuguese acronym (dotted line); and 2) reforms to the Forest Code (dotted straight line).



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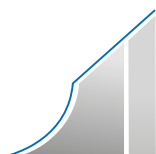
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Max-Planck-Straße 20 · 63303 Dreieich
Fon +49 6103 69 744 0 · info@argus.tax | www.argus.tax