Dryland restoration successes in the Sahel and Greater Horn of Africa show how to increase scale and impact

Chris Reij, Nick Pasiecznik, Salima Mahamoudou, Habtemariam Kassa, Robert Winterbottom & John Livingstone

Farmer managed natural regeneration around Rissiam village, Burkina Faso. Photo: Gray Tappan

Introduction

Drylands occupy more than 40% of the world's land area and are home to some two billion people. This includes a disproportionate number of the world's poorest people, who live in degraded and severely degraded landscapes. The United Nations Convention to Combat Desertification states on its website that 12 million hectares are lost annually to desertification and drought, and that more than 1.5 billion people are directly dependent on land that is being degraded, leading to US$42 billion in lost earnings each year. In Africa, three million hectares of forest are lost annually, along with an estimated 3% of GDP, through depleted soils. The result is that two-thirds of Africa's forests, farmlands and pastures are now degraded. This means that millions of Africans have to live with malnutrition and poverty, and in the absence of options this further forces the poor to overexploit their natural resources to survive. This in turn intensifies the effects of climate change and hinders economic development, threatening ecological functions that are vital to national economies.

Chris Reij, Senior fellow, World Resources Institute (WRI), Washington DC, USA; **Nick Pasiecznik**, Dryland restoration coordinator, Tropenbos International (TBI), Wageningen, the Netherlands; **Salima Mahamoudou**, Research associate, World Resources Institute (WRI), Washington DC, USA, **Habtemariam Kassa**, Senior scientist, Center for International Forestry Research (CIFOR), Addis Ababa, Ethiopia; **Robert Winterbottom**, Fellow, Global EverGreening Alliance (GEA), Stoddard, USA; and **John Livingstone**, Regional policy and research officer, Pastoral and Environmental Network in the Horn of Africa (PENHA), Hargeisa, Somaliland.

In response, there is growing momentum for dryland restoration, reflected in national commitments to the Bonn Challenge globally, and in Africa, by the Great Green Wall programme and the African Forest Landscape Restoration Initiative (AFR100). Setting ambitious goals is laudable, but what is increasingly seen is that achieving them will require a change in approach as well as concerted action. At current rates of degradation, it appears that it will take a generation or more for most countries to reach their targets. So, how to speed up the process? And how can scarce financial resources be utilized more effectively? Improving our understanding of restoration successes and documenting the proven approaches, significant outcomes and lessons learned from such successes is a start. This edition of *ETFRN News* adds to the body of knowledge.

The top ten keys to successful dryland restoration

1. **Research results** have confirmed what farmers have learned through practice — that restored farmland increases agricultural yields and diversifies income, leading to improvements in food, fodder and fuel security and many other benefits, even in the short term and in drought years.
2. **Dryland restoration with native species** has had positive impacts on soil fertility, groundwater recharge and availability, and biodiversity, leading to more environmentally and economically resilient landscapes.
3. **Large-scale and centrally managed schemes**, including tree plantations, mechanical construction of soil and water conservation structures and other "top-down" efforts have proved costly, and often suffered from low tree seedling survival and lack of maintenance and follow-up.
4. **Farmer- and community-led restoration** has proved highly successful and in many cases low cost, as have government-led restoration initiatives with community support that provide livelihood benefits; and although private sector investments show great potential, they are currently limited in scale.
5. **Local organizations, institutions and governments** must have their capacities strengthened and be facilitated to discuss, develop and enforce their own local conventions, land-use plans and bylaws governing access to and use of natural resources.
6. **Communities must realize tangible benefits** from restored land and producer organizations can be a valuable entry point, supported by incentives to promote ecologically and economically viable local enterprises.
7. **The role and participation of women and youth**, and other marginalized groups, must be better understood, along with how to support interventions to ensure that they can benefit more equitably from restoration activities.
8. **Institutional and regulatory reforms** at the national and regional level are required to establish more favourable enabling conditions that support locally-led restoration initiatives, and these conditions should be encouraged and supported by international efforts.
9. **Dryland restoration improves carbon sequestration**, but more research is required to quantify increases in soil carbon, with results that will help countries meet their commitments to the Paris Agreement.
10. **Positive outcomes are proven, but issues remain**, such as ensuring truly inclusive participation, enterprise development, capacity building and investment over long time scales, and robust, standardized and transparent monitoring that includes a broad assessment of impacts and trade-offs.

Many development projects and programmes aimed at reversing land degradation have been implemented since the 1980s. Some had positive impacts, although few were integrated or well reported, and unfortunately, many proved to be failures. This edition of *ETFRN News*: Restoring African drylands, collates a selection of articles, briefs and interviews on what has worked in the Western Sahel and the Greater Horn of Africa, along with related initiatives and cross-cutting issues. This collection of information highlights the reasons behind restoration successes and identifies critical actions to increase smallholder and community participation in effectively scaling up these proven approaches to dryland restoration.

With the right support and workable strategies in each country for scaling appropriate, low-cost and effective restoration practices — backed by adequate resources for implementation — there is great potential for rapid poverty reduction, increasing ecological and economic resilience, and climate change mitigation through carbon sequestration. And by ensuring that such strategies are put into practice, governments and donors will better support the regreening of African drylands, and make great and much-needed progress in meeting Rio Convention targets and the Sustainable Development Goals.

The urgency for action

Over the past 50 years, rapid population growth, extreme weather events and the resulting decrease in tree cover saw farmers across the Sahel and the Greater Horn of Africa lose their fallow-based soil restoration systems. This led to land degradation, declining soil fertility and lower yields. The lost trees had also served as a critical safety net during crop failures and other shocks. Increasing population pressure, climate change, poverty and conflict mean that many countries are facing a critical problem.

Niger, for instance, regularly experiences drought years, but the 2020 rainy season was characterized by high rainfall, and floods occurred in many parts of the country, destroying crops and homes and damaging infrastructure. The country faces terrorist attacks from ISIS and Al Qaida-affiliated groups on its borders with Burkina Faso and Mali and from Boko Haram in the southeast. It currently has a population of about 22 million people, and with an annual demographic growth of 3.6%, its population will increase to 33 million people in 2030. Rainfed farming is largely concentrated in a small area in southern Niger along the border with Nigeria, where some regions (Maradi and Zinder) already have high rural population densities (100+ people/km^2). In the absence of urban employment opportunities, it is hard to imagine how millions more will be able to make a living in these rural areas.

Despite all these challenges, there are signs of hope. One of them is that since the mid-1980s, hundreds of thousands of smallholder family farmers have increased the number of trees on the land that they manage — not by planting them, but by protecting and managing those that regenerated naturally from rootstocks or seeds. Farmers have achieved this increase over many millions of hectares across densely populated parts of southern Niger, which makes it without doubt the greatest positive environmental transformation in Africa. Smallholders have literally been building "great green productive landscapes," and lessons can be drawn from these regreening experiences for scaling up within and beyond these regions.

Experiences described in this edition show that many countries have had restoration successes and most of these successes are based on farmers and local communities using simple water-harvesting

structures and techniques for regenerating trees and shrubs. This effectively restores severely degraded land, regreening landscapes by increasing the number of trees. The challenge is how to rapidly scale these up and out. Most countries and donor agencies have not yet developed or implemented effective restoration scaling strategies, which makes it unlikely that the very ambitious restoration targets made for 2030 can be met. Given the urgency of the situation, it is vital to accelerate implementation. And this can be done if millions of smallholders and pastoralists in the drylands are mobilized to invest their scarce resources in efficient, sustainable and easily replicable restoration techniques, and if they see that they can benefit quickly and equitably from the improvements that are a clear result of their efforts.

The aim of this edition of *ETFRN News* is to draw the attention of national and international practitioners, policy makers, social and mainstream media to restoration successes in dryland Africa. It identifies the drivers and enabling factors behind these successes and draws lessons on how they can be scaled out, especially in the context of the current momentum for landscape restoration worldwide.

This review article briefly describes the major land restoration commitments and progress in achieving them, especially those related to the Bonn Challenge, the Great Green Wall and the African Forest Landscape Restoration Initiative in the Sahel and Greater Horn of Africa regions, which are the focus of this edition. It summarizes the articles and other contributions by section, and then presents lessons learned, conclusions, recommendations, and a call for action.

Restoration commitments and progress

It is encouraging that in the last 15 years, major national and international restoration commitments have been made, and restoration is much higher on the policy agenda. We now also note the start of the UN Decade of Ecosystem Restoration (2021–2030) adopted by the UN General Assembly on 1 March 2019 (UN 2019). There are three main initiatives affecting Africa: the global Bonn Challenge, the African Union's Great Green Wall, and the African Forest Landscape Restoration Initiative. Other major initiatives are not discussed in this synthesis, though they often overlap and support these three programmes. They include the UNCCD's Land Degradation Neutrality programme, the World Bank's African Resilient Landscapes Initiative, and FAO's Action Against Desertification. In addition, the New York Declaration on Forests includes among its ten goals the aim of restoring 350 million hectares of degraded forest land by 2030. Also not discussed here are past commitments, such as the UN Decade for Deserts and the fight against Desertification (2010–2020) that has just ended, with as yet no statements regarding its achievements.

The Bonn Challenge

The Bonn Challenge is a non-binding initiative launched in 2011 by the Government of Germany and IUCN, which strives to convince governments, NGOs and the private sector to commit to restoring degraded land and deforested landscapes. The global target is to restore 150 million hectares by 2020 and 350 million ha by 2030. By 2017, governments had committed to restoring in excess of 150 million ha, and in 2020, more than 70 pledges from more than 60 countries collectively aimed to restore 210 million ha. The Bonn Challenge website provides data regarding all the pledges, but at the time of *ETFRN News* going to press (December 2020), estimates of restoration achievements were available for only five countries globally, with Rwanda the only African country to provide data.

What is restoration?

The Bonn Challenge defines forest landscape restoration (FLR) as "the ongoing process of restoring the ecological functionality of degraded and deforested landscapes while enhancing the well-being of people who coexist with these places" on its website. Other organizations expand on this. The Global Partnership on Forest and Landscape Restoration (GPFLR) adds that, "FLR is not an end in itself, but a means of regaining, improving, and maintaining vital ecological and social functions, in the long term leading to more resilient and sustainable landscapes," and the International Union for Conservation of Nature (IUCN) states that "FLR is more than just planting trees – it is restoring a whole landscape to meet present and future needs and to offer multiple benefits and land uses over time."

This question is further complicated by different understandings and definitions of the component terms. First, what is a forest? This seems to be a simple question, but it is not. FAO defines a forest as "land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ" (FAO 2020). But many people would hardly consider land that is 90% free of tree cover as a "forest." There are also many different definitions of "landscape" and its related terms (e.g. Scherr et al. 2013). And the definition of what FLR is trying to reverse; i.e., land degradation, is another issue. The UNCCD definition is complex indeed (Article 1: Use of terms, p. 4). Thankfully, that of IUCN is explained in clearer terms, as: "a reduction or loss of the biological or economic productivity and complexity of land. In drylands, land degradation is known as desertification" (IUCN 2015).

Throughout this edition, the term "restoration" is used to imply an increase in the productive capacity of land, which is often expressed in terms of increased plant production and vegetative cover. This is usually associated with increases in crop yields, and also with increases in the number and diversity of trees, shrubs and other plants, leading to improved livelihoods for those living in restored landscapes.

The Great Green Wall

The Great Green Wall (GGW) is Africa's flagship programme, launched by African heads of state in 2007. Agreements were signed with 11 countries in 2010 to combat the effects of climate change and desertification across the Sahel and the Horn of Africa. The Pan-African Agency was created to coordinate implementation and support the mobilization of resources. The original idea was to plant a belt of trees at least 7,000 km long and 15 km wide from Senegal to Djibouti in areas that receive between 100 and 400 mm of mean annual rainfall. But around a decade ago, there was a change in concept. The geographic focus to be covered broadened, with the total intervention areas of all 11 countries now 156.1 million hectares (Mha) (UNCCD 2020). The goal of the GGW also evolved, from planting a green belt to supporting an integrated ecosystem management approach in the targeted areas. This would include a mosaic of various land uses and production systems that incorporate sustainable dryland management and restoration, regeneration of natural vegetation, and associated soil and water retention and conservation measures (UNCCD 2020).

But as reported by UNCCD (2020: p36), "As of early 2020 — considering all activities that may be contributing to the GGW Initiative, applying the wider scope and definition of the GGW, and accounting

for the regional and cross-border projects and programmes, a total of 17.8 Mha land is under restoration or has been rehabilitated in GGW member states. To reach a total area of 100 Mha by 2030, it would be necessary to substantially increase the current pace of land restoration from 1.9 Mha/year on average to 8.2 Mha annually." The report adds that "land restoration in Africa incurs an average cost of USD 440/ha across all activities and countries, although such costs are likely to be higher within countries of the Sahel region. Land restoration costs for existing projects in the region such as the SAWAP [Sahel and West Africa Program] reach an average cost of 530/ha. Applying these basic estimates to the remaining land area in need for restoration to reach the 2030 vision would mean that land rehabilitation measures alone would cost between USD 3.6 and 4.3 billion per year, or a total that varies between USD 36 and 43 billion up to 2030" (UNCCD 2020: p36).

The African Forest Landscape Restoration Initiative

Ten African countries launched the African Forest Landscape Restoration Initiative (AFR100) in 2015 to restore 100 million ha by 2030. By 2020, 30 African countries had pledged to restore 125.7 million hectares. AFR100 contributes to the Bonn Challenge, the African Union Agenda 2063, the Sustainable Development Goals, and other targets. Supported by more than 40 technical and financial partners, in its first five years the initiative has focused on mobilizing countries and partners, piloting activities, building capacities, and creating a strong international standing and recognition, as explained by the AFR100 Coordinator, Mamadou Moussa Diakhité in Section 4. Restoration assessments have been completed in 18 partner countries using the Restoration Opportunities Assessment Methodology (ROAM) tool developed by the World Resources Institute (WRI) and the International Union for Conservation of Nature (IUCN). WRI's Global Restoration Initiative has also trained and supported a cohort of young African restoration entrepreneurs through its Land Accelerator programme.

The AFR100 website does not yet include data about progress made in achieving its targets. A monitoring working group was established in 2020 to develop and roll out a comprehensive system to track restoration efforts and measure socioeconomic impacts, as AFR100 increases its emphasis on implementation and scaling. However, the Covid-19 pandemic and resulting restrictions halted this effort. The aim for 2021 is, come what may, to establish a robust system that ensures that information from all partner countries is collected in a systematic and standardized manner and analyzed and reported, leading to the first comprehensive AFR100 Report on the State of Restoration in Africa.

Farmer and community-managed restoration

Section 1 includes examples of successful restoration led by farmers and communities across the Western Sahel and Ethiopia. People who believe that little or nothing has changed despite decades of investment must read these case studies. Hundreds of thousands of farmers in Niger, for example, have protected and managed the woody species that regenerate naturally on their farmland over five million hectares, making it the largest restorative transformation in Africa [1.9].

Hundreds of villages in Senegal's densely populated "peanut basin" now have many more trees than 30 years ago. In two villages surveyed, tree cover and density on farmland doubled in that time period, while protection of and regeneration in community grazing lands have transformed them from degraded shrub to dense wooded savanna with 61% cover [1.1]. A key conclusion from this article was that these sustained increases from locally controlled initiatives are in stark contrast to the limited longer-term impacts from many large, centrally managed projects that funded infrastructure investments and disparate activities rather than focus on capacity building in rural communities.

Yacouba Sawadogo is an innovative farmer in Yatenga, Burkina Faso, who demonstrated how to improve traditional *zaï* planting pits. This technique has been widely adopted, and he received the 2018 Right Livelihoods Award for his impact on restoring degraded land in the Sahel. On 11 December 2020, the United Nations Environment Programme announced that he is one of the laureates of the 2020 Champions of the Earth Award, the UN's highest environmental honour.

This is confirmed elsewhere in Senegal, where World Vision field staff reported in 2019 that more than 20,000 farmers across 45 communes in Kaffrine, Fatick and Kaolack regions had been trained in farmer managed natural regeneration (FMNR), managing an average of 40 trees/ha [1.6]. Between 2015 and 2020 the area under FMNR in Kaffrine Region alone increased by almost one-third to 85,000 hectares, as farmers saw the benefits of these practices, and were supported by training and extension. Furthermore, with no costs for nurseries, transport, planting or fencing, FMNR is estimated to cost only US$50/ha, whereas tree planting costs US$500/ha or more and typically suffers from low survival rates. The most common trees regenerated and managed by farmers include *Balanites aegyptiaca, Combretum glutinosum, Faidherbia albida, Piliostigma reticulatum* and *Ziziphus mauritiana*. They provide poles, firewood, fodder, fruit, oil seeds, honey and medicine; with some farmers earning an additional US$170–340 per year from tree products alone. Trees also improve soil fertility and crop yields. Research shows a more than 2.5-fold increase in cereal production, from 296 to 767 kg/ha, related to increased soil organic matter [3.5].

In Mali, Bankass and neighbouring districts on the Seno plain were a largely treeless landscape in the 1980s. But with the promotion of FMNR since the early 2000s, the regrowth of trees covered an estimated 450,000 hectares by 2010, with tree densities of more than 250 trees/ha, mostly on rainfed millet fields and in short-term fallows [1.5]. By 2019, 90% of the farmers interviewed were practising FMNR, a 50% increase over 20 years. The planting of trees was limited by a lack of water, but farmers who adopted FMNR increased tree cover on their farmland to an average of 277 trees/ha. The data

collected showed that restored land was dominated by *Combretum glutinosum* (82%), with *Gueira senegalensis* and *Balanites aegyptiaca* making up a further 10%. In the neighbouring Koro District, *Faidherbia albida* dominates on land restored through FMNR. Farmers noted that of the 49 species of trees, grasses and wildlife they identified as most useful to them, 35 had become more common. Farmers also noted increased millet yields, due to protection against winds and to enhanced soil fertility, and that so much more grass and foliage was available for livestock in the dry season that a surplus could now be cut and sold. FMNR also reduced the time needed for women and girls to collect fuelwood, since they could use the pruned branches from trees. It was also important that farmers noted fewer conflicts between villagers over natural resources, and that stronger relationships had developed, with a key factor being local institutions that are respected and effective.

Similar cases were seen in Burkina Faso's Yatenga Region [1.4] and Niger's Tahoua Region [1.2]. Both faced droughts and food shortages in the 1970s and early 1980s. But investments in simple water harvesting techniques in the mid-1980s — including improved traditional planting pits (*zaï*), half-moons and contour stone bunds — restored land productivity and recharged groundwater levels. Both regions are now much greener and all their wells have water year-round, along with new vegetable gardens that even produce a surplus for sale to neighbouring villages. In Niger, project funding ended in 1995, but farmers further expanded the restored areas using these easily replicable techniques, especially planting pits. As in Yatenga, vegetables are now grown on what was a barren plateau 30 years ago.

Farmers across the Sahel have always had to cope with droughts and famines. In recent decades they have now also faced more extreme weather events, even in years of "normal" rainfall. A review of experiences in Niger shows that an increasing range of techniques helps farmers adapt to the impacts of climate change [1.7]. These include water harvesting techniques and FMNR, mulching to conserve humidity and control weeds, use of early maturing crop varieties, and crop rotation — developing their own climate-smart agriculture. Simple water harvesting practices introduced in the early 1980s, and FMNR, introduced in the 1990s, helped farmers build resilience to climate change and to harvest crops even in drought years, with increased number of trees on their farms that produce fodder, fruit and fuel that they use or are also able to sell.

In Senegal, researchers have also developed a "climate-smart village" approach. It is based on strengthening local governance of natural resources, in combination with promotion of agroforestry, planting fruit and fodder species, FMNR, and management of inter-village pastoral areas, among other practices [1.8]. This has not yet been applied at scale, but has the potential to do so, and it shows how researchers working closely with land users can make a difference, and how communal pastoral areas can be restored.

Northern Ethiopia — greener than it has been during the last 140 years — is a remarkable example of large-scale transformation (Nyssen et al. 2009). This is illustrated by the story of a village in Tigray Region that was considering relocating in the mid-1990s due to severe land degradation, but is now an award-winning showcase for the results of restoration [1.3]. Of the 6,766 ha of Abreha We Atsbeha watershed, most of which was comprised of severely degraded rangelands, 69% was restored using area exclosures, and 1,500 ha were reforested. The rest of the watershed was restored using assisted natural regeneration supplemented by terracing, contour bunds and other techniques to conserve soil and water. An additional 899 ha of farmland was restored, and following the construction of

Natural regeneration in Burkina Faso, with crop residues stored in the trees for dry season fodder.
Photo: Gray Tappan

55 check dams and associated regreening, this improved groundwater recharge, and increased the irrigable portion of the watershed to 450 hectares.

The experience of area exclosures from Tigray is just one example of rangeland "rehabilitation," as it is often called (rather than "restoration"). This also includes rotational grazing, reseeding and building bunds and water diversion channels, among a wide range of other techniques. These techniques, whether alone or in combination, improve rangeland resilience and productivity, which leads to higher livestock production and improved pastoral livelihoods (e.g., Behnke et al. 1993; Liniger and Mekdaschi Studer 2019). Another example of the successful restoration of grasslands, from Kenya, is also detailed [2.6].

Private-sector and project initiatives

Innovative private enterprises

There are few examples of dryland restoration that have been led by the private sector. But Section 2 starts with one, which built on the successes of FMNR in Niger. Sahara Sahel Foods was established in 2014 as a social enterprise to improve livelihoods by processing and marketing products from indigenous trees. Overcoming many constraints on the way, today it purchases some 80 tonnes of produce annually, paying €18,000 to 1,500 collectors, mostly women, from 70 villages, employing 21 permanent staff and 300 to 400 women as temporary workers [2.1]. Fruits, nuts and leaves are collected from more than 20 indigenous species; they have different production cycles, so work lasts year-round. Six of its products have won awards, including the Prime Minister's Award in 2017, showing that it is possible to create acceptance for foods once considered as "only for the poor."

A farming planting a baobab (*Adansonia digitata*) seedling in his farmland in Kaffrine, Senegal.
Photo: Sidy Diawara

Another innovation is Seedballs Kenya, pioneering a method for efficient and low-cost reintroduction of tree and grass species into degraded areas in East Africa [(ii)]. Seeds of native trees and grasses are coated in waste charcoal dust mixed with nutritious binders, which protects them from predators until rains arrive, and encourages germination. Spread by hand, slingshot, crop-spraying planes, helicopters or drones, for as little as US$0.05 per established seedling, this greatly reduces costs compared to planting seedlings.

Forest and farm producer organizations

The largest private sector in the world is probably the aggregate total of all smallholder producers, informal and often unrecognized associations, and small – and medium-sized enterprises – together referred to as producer organizations (Pasiecznik et al. 2015). And although many of these groups came together spontaneously, many have greatly benefitted from project support. Building on experiences, interviews and local surveys in Ghana's savannah zone, producer organizations changed theirs practices and have rebuilt climate-resilient landscapes ensuring that local communities benefit through restoration [2.3]. In meeting restoration targets these groups are often overlooked, in spite of the fact that they offer logical entry points for effective actions to restore degraded landscapes, provide platforms to demonstrate and lobby for improved tenure systems and access rights, motivate implementation, facilitate access to markets and capital, and offer capacity-building services for members. But in Ghana, as elsewhere, they face challenges such as limited technical knowledge, unfavourable tenure arrangements, limited involvement in landscape planning and decision making, and lack of financial support. Policy makers must acknowledge the significant local knowledge and expertise of these groups and ensure that they are included in dialogues on national restoration agendas.

The exploitation of gum arabic in Sudan provides smallholders with up to 38% of their annual income, although with limited access to finance, they sell their gum for low prices to village traders. The Structuring the Gum Arabic Sector pilot project in North Kordofan State (2014–18) introduced transparent contracts that paid producers the competitive auction market price [2.5]. Organizing producer groups also enabled smallholders to increase the quality and quantities sold, attracting buyers who were willing to pay a premium. This led to a new proposal: Gums for Adaptation and Mitigation in Sudan. Many public-sector donors say they appreciate efforts to involve the private sector, producer groups or larger companies, but projects that include them often lead to concerns that public funds may subsidize activities that could be funded through private investment, or could make powerful companies take advantage of small-scale producers. This was avoided in Sudan by using public funds only for capacity strengthening for producer groups and by facilitating interactions with commodity buyers and microfinance institutions.

Commercial plantations

There have been significant efforts globally to promote dryland afforestation, but they have had mixed results (FAO 2015). Evidence indicates that positive results can be achieved from participatory planning and implementation, empowering local communities, capacity building, and securing land-use rights. In Uganda, the Sawlog Production Grant Scheme became the country's first private-sector forestry initiative in 2002, supporting smallholders and medium-scale farmers to invest in timber plantations. This included provision of seedlings and money: around US$250 per ha towards planting costs [2.2]. The third and current phase includes a campaign to promote afforestation in Karamoja, the driest part of the country (400–700 mm mean annual rainfall), through demonstration sites and training courses. Convincing communities of the economic benefits was the overriding factor in success, with financial incentives to trigger interest. But subsidies alone are not enough, and innovative financing models — such as credit financing and low-interest loans with long repayment periods — are needed.

Experiences in Tigray, Ethiopia, showed that seedling quality and management matter in successful dryland restoration, and that research can help to improve tree planting techniques and post-planting care to increase survival rates. Participatory community and private-sector models will also help to resolve issues related to trade-offs between plantations and sustainable livelihoods [2.4]. In the same region research showed that the drought-tolerant and fast-growing Australian *Acacia saligna* can also generate income for smallholders, with farmers selecting two ecotypes that best met their needs [(iv)].

Developing sustainable charcoal value chains

Charcoal production is a key driver of dryland deforestation and degradation, and promotion of sustainable initiatives is an urgent priority. Two examples show how projects are supporting this aim. In the driest part of Cameroon. Sustainable wood fuel value chains are an important component of restoration, and an initiative in the Far North Region is defining and testing options to manage trade-offs between social and ecological impacts and transboundary trade [(v)]. In Ghana, charcoal production and sale is a major source of income for local people, traditional authorities and local and national government [(iii)], but effective new policies at the national and regional level need to be developed, with the participation of all stakeholders, in order to reduce environmental impacts and promote dryland restoration.

Restoring rangelands

Dryland restoration is often associated with increasing tree cover, but improving the productivity of grasslands and pastures is also an important component. An example from the Rift Valley in Kenya shows what can be achieved by one organization's long-term efforts to demonstrate that sustainable pasture restoration is possible, and that it can improve livelihoods and food security while also reducing conflicts. Their tried and tested methods are being widely replicated by the government and NGOs, and most importantly, by pastoralists themselves [2.6]. Stakeholders are consulted and involved at every stage, with special attention paid to youth, women and cultural norms. The approach facilitates restoration in response to community requests on a cost-sharing basis by providing training and advice, with 2,400 hectares of grasslands restored, resulting in significant increases in farm incomes. Carbon sequestration is another, often hidden, benefit. The organic carbon in the top metre of soils worldwide is more than all that is held in the atmosphere and vegetation combined, and research shows that after 20 to 30 years, restored grasslands contained 45 tonnes of soil organic carbon per hectare, 50% more than degraded areas did (FAO 2017).

Cross-cutting issues

Empowering farmers and their communities

The chances of restoration succeeding in African drylands are greatly improved when local communities, institutes and governments are empowered to work together in planning and implementing conventions and bylaws that define the rules, sanctions and enforcement for managing resources [1.3; 1.8]. In Burkina Faso and Niger [3.1], 17 local conventions at the commune (rural district) level now support sustainable landscape use, strengthen responsive decentralized governance, and reinforce rights and responsibilities. This has led to improved resource management, increased FMNR, and, most importantly, has reduced violent conflicts by an average of 74% in targeted communes.

An example from Ghana shows that achieving equitable resource governance in FMNR requires a shared vision for restoring landscapes [3.2]. Mapping local-level power dynamics related to resources helps mitigate potentially inequitable outcomes, especially with communally managed forests and pastures. Also, all land users, including pastoralists, must participate in decision-making processes. Asking "by whom and for whom?" is important, as well as "where?" — which affects upscaling and who can participate. But the key is strengthening resource governance by supporting community-led, inter-community collaboration, with cross-jurisdictional and cross-sector support from government, traditional institutions and NGOs.

Focus on women and youth

Participation is the core of sustainable restoration. But there are many definitions of the term, and neither they nor the indicators needed to measure them are clear [(vi)]. Externally led initiatives are still being designed and implemented where "local participation" is hardly more than mere rhetoric. Women and youth are often involved in the hard work of restoration, but are not always the main beneficiaries. In contrast, they benefit from more farmland trees, which reduces the time needed to collect firewood (Reij et al. 2009). In addition, with groundwater recharge following water harvesting structures [1.2; 1.4], nearby wells are full again and the long march to faraway water sources has become a thing of the past.

Women also face constraints to implementing restoration practices as they do not have the same rights and resources as men due to entrenched gender norms. Gender is an important part of

Training in tree establishment techniques for women in Rigal Saude, Niger. Photo: Sahara Sahel Foods

determining who does what, who makes which decisions, who has access to resources and who benefits from restoration initiatives. An excellent analysis in Burkina Faso [3.3] analyzes gender differences and inequalities in rights and responsibilities, and sees that women find innovative ways to participate, such as collective action and mutual support groups. Ultimately, however, it is the quest for land security and economic opportunities that drives improvements to women's living conditions and their engagement. Other projects promote youth involvement in restoration, such as in Ethiopia, where youth are now leasing and managing nurseries and plantation sites, giving them control over the forests they are planting [(vii)].

Dealing with the paradox of too many trees

The invasion of woody weeds, both exotic and indigenous, is a serious issue over many millions of hectares in dryland Africa, and their impacts certainly meet the definition of land degradation: "a reduction or loss of the biological or economic productivity and complexity of land" (IUCN 2015). *Prosopis* species are by far the most dominant invasive exotic trees in tropical African drylands, covering an estimated 12 million hectares in the Greater Horn, and double that area across the continent [3.4]. Of the many indigenous invaders, *Acacia* species are the most common, affecting more than one million hectares in southern Africa, and now also spreading in the Greater Horn [viii)]. This is not an insignificant issue.

"Control by utilization" for fodder, charcoal and other tree products is increasingly seen as the answer. Advances in recent years have created new enterprises and more resilient agroforestry systems [3.4]. Proliferation of woody weeds also enhances above-ground and soil carbon stocks, but these impacts require further research. Improving the management and use of these species will help overcome the challenges of food, fodder and fuel insecurity, rural unemployment and migration, land degradation,

and climate change adaptation and mitigation, and can generate benefits on a huge scale. But this requires support to develop new markets and viable enterprises based on value-added products from invaded land that has been profitably restored and converted to drought-proof agroforestry systems that meet local needs.

Soil fertility and water availability

Soil and water are the fundamental basis of life, and the final two papers in Section 3 look at their interactions with dryland agroecosystems. Increasing soil productivity and reducing vulnerability requires overcoming a complex web of challenges. Research in Burkina Faso, Niger and northern Togo [3.5] revealed the crucial role of soil organic matter in maintaining soil fertility, with positive effects on yields and fertilizer-use efficiency, particularly on sandy soils. Most benefits come from humus, which binds the soil. Since humus can hold many times its own weight in water, it is very effective in retaining moisture, especially in sandy soils during dry periods. The loss of fallows due to agricultural intensification, and the use of crop residues for fodder and fuel, had led to decreasing inputs of organic matter. Farmers realized the value of trees as providers of large amounts of leaf biomass as well as other services. Millions of farmers have promoted the regeneration of trees, especially *Faidherbia albida*, known across the Sahel as the "fertilizer tree." Research over many years has shown a doubling of soil organic matter under tree canopies and a doubling of crop yields, as well as fodder and fuel provided by trees.

Water, or the lack of it, is the principal factor defining drylands. Yet the impacts of tree cover on water are often neglected or misrepresented in discussions and studies of forest landscape restoration [3.6]. Decision support tools tend to focus on tree products and ecosystem services, whereas investing in increased tree cover needs to account for wider implications, especially in terms of water. Tree cover has considerable potential for improving water security, but there is still a need for more research in order to tailor guidance to local needs and contexts. The protection and restoration of natural vegetation are nonetheless likely to provide more benefits than alternatives, as natural ecosystems have evolved as effective systems for conserving water. Local observations should be recognized.

International actions and intentions

The ongoing Regreening Africa programme (2017–2022) aims to restore one million hectares and improve the livelihoods of half a million smallholder farmers across eight African countries (Ethiopia, Ghana, Kenya, Mali, Niger, Rwanda, Senegal and Somalia) through a bottom-up transformation of degraded lands [4.1]. Survey data, alongside real-time monitoring, show that FMNR is the most commonly adopted practice, with uptake ranging from 48% in Rwanda to 94% in Niger. Next most common is tree planting, with uptake ranging from 47% in Niger to 82% in Rwanda. This article offers valuable information about other impacts, which also vary by country. The project team is now reviewing approaches to scaling to better address existing barriers, aiming to promote learning and behavioural change so that more households will adopt land restoration within project sites.

The Drylands Development Programme (DryDev) was a six-year initiative ending in 2019 that facilitated restoration in Burkina Faso, Ethiopia, Kenya, Mali and Niger. It used the "options by context" approach to promote interventions prioritized by smallholders that were informed by local realities and by the integration of local and expert knowledge. Article 4.2 focuses on achievements in Ethiopia and Kenya, where some 80,000 smallholders were engaged in applying various interventions. The main lessons were that success depended on access to high-quality seedlings and to technology and finance; appropriate policy and institutional mechanisms that facilitated community participation,

tailoring interventions to local contexts and co-learning with farmers; and access to extension services through producer organizations. Options must also be affordable, generate tangible benefits to encourage participation, and be supported by farmer-to-farmer extension. Large, integrated and long-term investments are critical for impact at scale, requiring public–private partnerships to promote innovations and leverage resources to help expand beyond the project's target landscape.

Interviews

Complementing the articles are interviews with four experts. They are: Dennis Garrity, Chair of the Global EverGreening Alliance and former Director General of ICRAF; Mamadou Moussa Diakhité, Coordinator of AFR100, hosted by NEPAD; Elvis Paul Tangem, Coordinator of the African Union's Great Green Wall in the Sahel and Sahara Initiative; and Nora Berrahmouni, Senior forestry officer with FAO at the Regional Office for Africa. They were asked to address three common questions.

What has worked and not worked regarding landscape-level restoration"
The answers to this question bore many similarities. Garrity emphasized the need to build on previous successes and foster grassroots movements to drive the spread of restoration solutions. Tangem stated the need to build on indigenous knowledge, experiences and leadership. Berrahmouni supported regenerative restoration efforts such as FMNR that have proved to be cost-effective and should be used wherever possible. Diakhité noted that national and sub-national assessments of restoration opportunities have created an awareness that forest landscape restoration is more than just planting trees. And there was consensus that engaging communities is at the heart of restoration.

What priority interventions would trigger and accelerate the scaling up of restoration?
Here the answers showed some differences, but shared an urgency to increase restoration actions, which require innovative forms of funding. Diakhité emphasized the need to mobilize private investors, including small- and medium-sized businesses, to kickstart forest landscape restoration, develop agroforestry and agricultural value chains, and tap into carbon funds for upscaling. Tangem also suggested actions to encourage involvement by private businesses and impact investors, and would like to see new sources of restoration funding such as investments by pension funds, and also through green bonds and carbon certificates. Berrahmouni advocated large, long-term public and private-sector investments, which must include a value chain approach. Garrity highlighted the creation of the Global Evergreening Alliance. It now has 50 members, including most of the major development and conservation organizations that have pledged their joint capacity to restore millions of hectares of degraded land through the spread of tree-based systems; this should lead to the capture of 20 billion tonnes of CO_2 annually by 2050.

What can governments, the UN, donors and regional agencies do differently or additionally to further restoration?
Berrahmouni proposed avoiding investments in small, scattered, short-term projects and favoured support for the Great Green Wall initiative, underlining the importance of developing sustainable and resilient value chains for landscape products and ecosystem services.

Tangem pointed out that the Great Green Wall still has not received the US$4 billion promised at COP 21 and suggested that donors should fund long-term and large-scale transboundary projects. Diakhité noted that AFR100 spent its first five years mobilizing countries and partners, piloting activities and building capacities, and will now shift to implementation, scaling and tracking restoration efforts and their impacts. He felt that there is a lack of information regarding potential funding opportunities, and that those who implement restoration should develop bankable projects that they can successfully "sell." Garrity emphasized the need for governments and development organizations to drastically change their mindset and switch from top-down to bottom-up approaches, recommending that countries stop investing billions of dollars in plantations of exotic tree species, and instead learn from the experiences of successful grassroots restoration implemented at scale.

The final article in this issue looks at the key question of how to improve the monitoring of forest landscape restoration in Africa [4.3]. Achieving the ambitious pledges made to date requires the tracking of progress — not just of tree survival and growth, but also of trees' ability to store carbon and provide social, economic and environmental benefits. Systems must be efficient and transparent and incorporate lessons learned from successes and failures. They must document this in a credible and compelling way to encourage donors to invest and help identify the best approaches for scaling up. But this is challenging. Restoration takes years before changes are visible, and objectives vary widely between countries and rely on diverse approaches that affect landscapes in different ways. This requires adaptable frameworks that are tailored to this complexity but can still produce standardized and comparable results. Seven existing tools are presented, alongside an analysis of their strengths and weaknesses; organizations should support and facilitate their implementation for the consistent tracking of progress throughout Africa. Investors and funders also need to include the cost of high-quality monitoring into their proposals. Finally, although it is essential to have solid data, they will be useless unless they can be acted on in the field. This needs to be acknowledged.

Conclusions and recommendations

We are not yet winning the battle against land degradation in the drylands

In most countries, land degradation continues to outpace landscape restoration, meaning that each year more natural resources are lost. Substantially increasing funding to expand conventional approaches to support restoration does not seem to be a realistic option and experiences appear to show that unless well targeted, nor is it likely to be particularly effective. If we want to win the battle against land degradation — in the context of climate change, improving livelihoods and creating economic opportunities, especially for young people — then new approaches must be developed. More attention needs to be given to capitalize on what can be achieved through proven restoration practices, and to mobilize support for comprehensive and effective scaling strategies. This edition of *ETFRN News* contains inspiring examples of restoration successes in African drylands, several of which have already been scaled up. A key lesson is that the challenges of resource degradation can be sustainably addressed only when millions of farmers and pastoralists in each country decide to invest in relatively low-cost restoration actions, which already produce short-term economic and environmental benefits.

We must agree to and adopt effective scaling strategies

This can best be achieved by taking account of the lessons learned and outcomes achieved from the experiences documented in this edition of *ETFRN News* and in related publications. This includes greatly expanded communication that catalyzes grassroot movements, mobilizes rural communities, strengthens the capacity of producer associations, and increases the engagement of donor organizations and governments to support key actors in restoration. Projects that restore even thousands of hectares are important to the people who immediately benefit from them, but they are not enough to reverse the process of land degradation over millions of hectares, and this is urgently required. This can be assisted by increased investment in rural communities, though it is as important to develop and implement forestry and land tenure laws that are appropriate to local contexts. This takes time, however, since policies and legislation need to be approved at various levels. Experience shows that farmers and other rural producers will invest in trees when they perceive that they "own" them, and when rights to manage trees and other resources have been devolved and decentralized resource management has been enabled. Rural communities will be much more likely to invest in water harvesting and other sustainable land management techniques when they have secure land-use rights.

A six-step scaling strategy for regreening has already been developed, based largely on experiences in the Sahel. They do not need to be conducted sequentially, and countries can adapt the actions needed to implement these steps to their own specific socioeconomic and environmental conditions (Reij and Winterbottom 2015).

Step 1. Identify and analyse existing regreening successes.

Step 2. Build a grassroots movement for regreening.

Step 3. Address policy and legal issues and improve enabling conditions for regreening.

Step 4. Develop and implement a communication strategy.

Step 5. Develop or strengthen agroforestry value chains and capitalize on the role of the market in scaling up regreening.

Step 6. Expand research activities to fill gaps in knowledge about regreening.

The framework of these six steps has, for example, been adopted by the Regreening Africa project and has contributed to its emerging successes [4.1].

Shift the focus to simple, low-cost restoration techniques

If the Great Green Wall is to achieve its aim of restoring 100 million ha by 2030, it will need to restore 8.2 million ha every year. This would require an investment of US$36–43 billion (UNCCD 2020) based on an average cost of US$440–530/ha, a level of funding that is unlikely to be mobilized. Scaling up the implementation of restoration techniques can be achieved only if the focus changes to the promotion of proven, locally adapted, relatively simple, low-cost and easily replicable restoration techniques with the best potential for scaling. These include farmer managed and assisted natural regeneration, area exclosures and simple water harvesting techniques such as improved planting pits and contour stone bunds, complemented by tree planting and other restoration techniques where they are likely to succeed. As shown in the articles in this edition, a change in strategic priorities that can significantly help to achieve the many ambitious restoration targets already set — must be adopted by donors and international initiatives.

Natural regeneration will not work in every situation or in every place, such as on soils with a hard crust, even if land was left alone for decades. But where farmers have dug pits and added manure to them, this has led to the re-emergence of agroforestry parklands. Many farmer-led initiatives have succeeded in drylands where population densities are high, with mean annual rainfall of 400–900 mm and on sandy soils. Where population pressure is low, farmers can leave some land fallow to restore its fertility, and firewood is more readily available from natural vegetation, and the consequence is that land degradation continues unabated. But where farmland dominates, with little remaining natural vegetation, farmers have an incentive to increase the number of on-farm trees, as shown in Section 1. A quantum shift to simple, replicable, low-cost and clearly effective restoration techniques, as many cases in this report show, will also help overturn the common belief that when project funding ends, nothing is sustained.

Empower local communities

As is so well stated in an article in this publication, "Restoration is a process, not a single act, and will be successful only if undertaken by local people themselves – massive investments alone cannot succeed" [(vi)]. Regreening landscapes is as much a social enterprise as it is a biophysical and technical one [3.2], and without exception, everyone agrees that local communities must be involved in all aspects of restoration, from initial analysis to planning and implementation. Restoration options should be economically attractive to communities so they invest in them and sustain them; these options must also be underpinned by secure tenure, equitable responsibility and benefit-sharing mechanisms. This in turn has to be supported by government policies and legislation. For instance, current forest laws in most countries do not explicitly recognize rights for smallholders over trees on the land they farm, a constraint that governments can immediately address.

There are examples in most countries of local conventions and bylaws that can be used as a source of inspiration and as models that communities can adapt to their specific circumstances. This demonstrates that when bylaws are inclusively developed and enforced by networks of village groups, they can limit uncontrolled wood-cutting, grazing and bush fires, prevent continued land degradation, reduce conflicts, and increase tree cover [3.1]. But building village and inter-village institutions for rationalizing land use and managing natural resources is more complex than the technical aspects of restoration. Strengthening community-based organizations and increasing the capacity of local government institutions are key pillars to enhancing, sustaining and monitoring the positive impacts of restoration initiatives (Kassa et al. 2017).

Effective documentation and communication is key

This edition of *ETFRN News* illustrates that many countries have already demonstrated restoration successes at a range of scales. One shortcut to achieving progress is to spread the word about these successes and identify men, women and youth to share their experiences. Farmers listen to other farmers who are working in similar environmental and economic conditions more than they listen to experts. And an increased flow of economic benefits associated with the adoption of restoration practices and developing associated enterprises helps to reinforce the behavioural changes needed to sustain and scale up restoration. By capitalizing on many different low-cost forms of communication, thousands or even millions of land users can learn about simple and replicable restoration techniques. Increasing funding for restoration is important, but increasing the rate of progress depends at least as much on enabling the exchange of experience among land managers as it does on the empowerment of local communities and institutions. Unless millions of smallholder farmers and pastoralists

Village in Gourcy province, Burkina Faso that has benefitted from dryland restoration.. Photo: Gray Tappan

decide to invest their scarce resources in restoring the productivity of their land, restoration of African drylands will remain an unrealized ambition – just a dream. For example, it is essential to communicate that investing local labour in FMNR, planting pits, half-moons or contour stone bunds can yield significant benefits from as soon as the first and second year, with increased crop yields and firewood and leaves for fodder or to enrich the soil from thinning and pruning emerging saplings.

Identification and analysis of restoration successes can be achieved quickly — as has been shown in the production of this volume in half a year — to inspire enthusiasm and renew or establish communication among communities, organizations and policy makers. Many people in dryland countries are not aware of successes in land restoration, so it is essential to inform every urban and rural citizen about what has already been achieved in order to foster a "yes we can" attitude, and to counter the common beliefs that nothing is being done and that no progress has been made. Such communication can involve inviting journalists to visit sites of restoration successes and produce stories where land users share their experiences for national and international audiences.

Develop value chains and enterprises

Developing value chains is also crucially important, because it puts more money in the pockets of those who live in the landscape being restored. For women, who often play a key role in the transformation of products, it will help strengthen their economic position. An increased flow of economic benefits — associated with the adoption of restoration practices and the development of associated enterprises — helps to reinforce the behavioural changes needed to sustain and scale up restoration. These economic benefits can be related to the increased production, processing and marketing of non-timber forest products from indigenous trees [2.1], timber [2.2], and sustainable charcoal [(iii), (v)] among others. Much hope is vested in mobilizing private-sector funding for restoration activities. In

Large-scale regreening in Niger. Photo: Robert Winterbottom.

2017, public funding for restoration and conservation was calculated to be US$41 billion per year, four times that of private funding, with an estimated annual shortfall in the global investment required to meet restoration goals in the order of US$300 billion (Ding et al. 2017).

Building viable enterprises is a long and hard road [2.1], but is vitally important for job creation and for providing income opportunities from agricultural and tree-based value chains. It is unlikely, at least in the short term, that private-sector funding will contribute significantly to meeting restoration targets. Governments can, however, facilitate the development of value chains and enterprises by reducing bureaucratic complexity, offering financial incentives and implementing more favourable enabling policies. An increasing number of studies are looking at innovative ways of financing restoration (e.g., Ding et al. 2017; Louman et al. 2019; Shames and Scherr 2020; Zoveda et al. 2020), but we see only theory and rhetoric at the moment. As with much talk about carbon credits, REDD+ and similar initiatives, the hopes raised by these were not realized on the ground. And once again, there are no immediate signs that any significant amount of private-sector financing and investment is going to materialize in the immediate future.

Improve monitoring of land restoration

Neither AFR100 nor the Bonn Challenge can at this moment show significant progress toward meeting its restoration targets. In 2016, the Restoration Barometer was developed to help pledgers identify, assess and track action on their restoration commitments. But to date, data is available for only five countries (Dave et al. 2019). Regarding the Great Green Wall, details from all 11 countries have been published (UNCCD 2020), but there are discrepancies between the figures and impacts reported, and those on the website of the Pan-African Agency for the Great Green Wall. And while monitoring the number of trees and hectares is a challenge, measuring the impacts of restoration on social,

economic and environmental indicators appears to be an impossibility, at least for now. Fortunately, much progress has been made with remote sensing technologies and other means for assessing, mapping and reporting on changes in land use and land cover. Interest is also increasing in collaborating on data-sharing platforms to facilitate real-time tracking of restoration and outcomes, such as the global restoration monitor being developed by the Global EverGreening Alliance. These technologies can help to identify additional restoration successes and can significantly improve the monitoring and impact assessment of activities aimed at scaling up restoration.

Projects that invest tens of millions of dollars of public money have to justify such huge expenditures to the global taxpayers who are ultimately supporting them. This could be addressed in part by the development of a "barometer" similar to the Restoration Barometer that quantifies and transparently reports the amounts of funding pledged by donors, governments and organizations, and the amounts that are actually dispersed to implementing restoration activities.

Linking restoration with carbon sequestration

Commonly, people think of sequestered carbon as what is fixed in trees, in wood, and in above-ground biomass. This means that drylands and dry forest get limited attention. But what is shown in some of these articles is that restoring drylands may have perhaps the largest potential for sequestering carbon in the world, but in the soil (FAO 2017), rather than in the trees themselves, as much of the carbon in the wood will be returned to the atmosphere when it is burned as firewood or charcoal. Many articles in this volume made the important link between dryland restoration and soil carbon sequestration (e.g., [1.6], [2.6], [3.4], [3.5]). Soil organic carbon, fundamental to plant growth, is much lower in dryland soils than in soils in more humid or temperature regions, and has been further reduced by land degradation. But research shows that improving tree cover and rehabilitating farmland and rangeland can massively increase soil carbon stocks. And if these stocks are measured and incorporated into calculations of nationally determined contributions (NDCs) to meet pledges to the Paris Agreement, this could leverage much more funding for dryland restoration.

Develop research to fill gaps in knowledge

There is an urgent need for additional robust data on restoration costs, and on the benefits to crop yields and food security, wood and fodder stocks, income diversification and poverty reduction, household resilience, carbon sequestration, water supplies and groundwater flows. More attention needs to be devoted to an analysis of aggregate and broader impacts of restoration on people, with less focus on counting trees and hectares.

Some researchers recently stated that quantitative evidence for bold claims about FMNR is built mainly on experience in Niger, and they recommended further research (Chomba et al. 2020). However, field observations in various countries show that smallholder farmers in and outside the Sahel and the Greater Horn of Africa are keen to invest in FMNR [4.1]. Another study assessed how human impact, land degradation and limitations on seed dispersal affected regeneration across 316 plots in agroforestry parklands (Lohbeck et al. 2020). They concluded that the presence of desired species is a precondition for successful FMNR and that regeneration needs to be protected from grazing, but the study was limited to two similar areas on either side of the Ghana-Burkina Faso border.

Articles in this edition clearly contradict these two papers. Also, many people do not realize that the scale of FMNR in Niger was first observed between 2004 and 2009 (Reij et al. 2009) and began to be

promoted more widely from about 2005. Though the massive increase in trees cover in parts of the Sahel that is now evident had already begun at least 10–15 years before this, since the 1980s. This is seen in findings based on the analysis of high-resolution satellite images in combination with field visits, many of which are presented for the first time in this publication. The growing interest of agroforestry researchers in FMNR is to be applauded and will generate more hard data about multiple impacts, but this must be conducted over much larger scales and time frames than the two examples discussed in the previous paragraph.

Complexity constrains implementation

Every donor agency and environmental think tank now emphasizes the need for a landscape approach or integrated landscape management (e.g., Shames and Scherr 2020; UNCCD 2020). But the experiences documented here show that the landscape approach did not play a role in most cases. In Niger, transformation was achieved on 5 million hectares because of decisions made by individual farmers to invest in on-farm trees, with no landscape planning [1.9]. This was also the case on Mali's Seno plain [1.5] and in Senegal's peanut basin [1.1]. The only example where a form of land-use planning played a role was in Tigray, Ethiopia [1.3], in an area characterized by steep slopes that made it necessary to terrace or revegetate slopes before undertaking restoration activities in the valleys below. Adopting a landscape management approach from the start tends to involve "outsiders" and increases the complexity of projects, which slows implementation [4.2]. This may also lead to disconnected initiatives with varying goals, such as conservation or economic, or even increase conflicts between people or groups in different parts of the landscapes concerned. To achieve ambitious restoration targets, it helps to start simple, and to gradually build complexity based on emerging needs and opportunities.

A call for action

Now is the time to build on the impressive set of restoration successes documented in this issue, and to make full use of the lessons learned from these very encouraging experiences. Locally managed restoration must be promoted as a matter of urgency, supported by local institutions, organizations and governments, with public funding. Private funding may follow, but is far from guaranteed, especially since the inherently low levels of productivity in drylands are much less likely to yield the rate of return that investors could obtain elsewhere. Farmer managed and assisted natural regeneration, area exclosures and simple water harvesting and soil conservation techniques have been highly successful and at a low cost. Much can be achieved by mobilizing rural communities and catalyzing grassroots movements led by restoration champions.

And in all cases, to effectively support restoration programmes and projects, all it is vital that those involved must do their utmost to guarantee that these basic tenets are adhered to.

- **Ensure full participation** of all land users, build on their knowledge and strengthen their capacities.
- **Support communities** to realise clear economic benefits, especially for women and youth.
- **Enable local institutions** to develop and enforce their own inclusive conventions and bylaws.
- **Engage governments** to elaborate policies and legislation that stimulate investment in trees.

Large-scale regreening is possible, at scale and at low costs, as has occurred for example in Niger over millions of hectares. But monitoring the impacts also needs to be much improved. Photo: Robert Winterbottom.

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