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# Achieving food security and reducing poverty through land restoration

Restoration of degraded land for food security and poverty reduction in East Africa and the Sahel: taking successes in land restoration to scale

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## Application of the research in development approach to scale land restoration

Land restoration and avoiding further degradation can be a key pathway to achieving food security and exiting poverty for some of the most vulnerable people living in Africa's drylands. Achieving the UN's SDGs requires that successful restoration efforts reach larger numbers of farmers and hectares over the coming decade.

A key constraint to scaling is that the ecological, economic, sociological and institutional context varies from household to household, let alone village to landscapes - there are no silver bullets. There are multiple reasons for poor adoption - and no simple solution. What is urgently needed are locally relevant restoration options that will work for different people in different places - participatory technological adaptation. This project is developing innovative ways to achieve scaling through adopting a co-learning approach that accelerates development impact by embedding research in development initiatives (for example, using research methods to document and monitor the experiences of the farmers and then adapt the technologies to local context).

This research in development model operates through engagement with key development partners, including IFAD Country Loan Programmes, NGOs, EC Country Programmes, as well as government, universities and the private sector, influencing the way they interact with one another and smallholder farmers.

The project monitors interactions amongst research and development partners, allowing us to track the way research results and tools are being used by stakeholders. This dialogue helps development actors

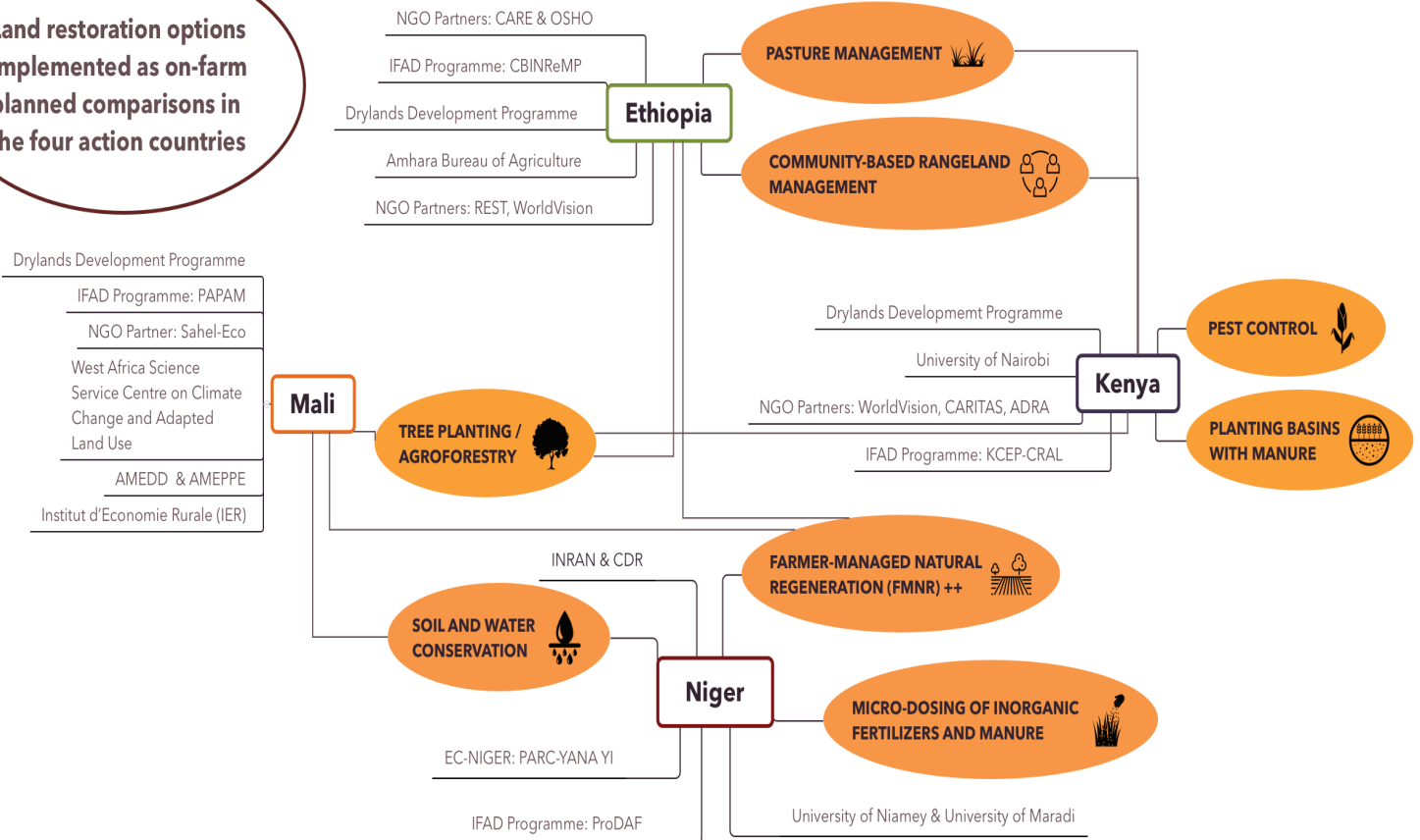
and researchers understand each other's needs and expectations. This is done through nested communities of practice which facilitates the generation of timely research outputs to be incorporated in the development cycle.

### Livelihood Trajectories

Land restoration options will only be adopted where they have positive impacts on the livelihoods of smallholder farmers. Livelihood impacts arise directly from increased food production and income as well as indirectly through system intensification and diversification. These knock-on effects can include freeing up time and labour for non-agricultural income-generating activities and stabilising crop yields in times of drought. Using data from the planned comparisons with farmers, we can project how livelihood systems will change over time if different suites of restoration options are adopted to variable extents.

This provides evidence on the extent to which restoration can, directly and indirectly, contribute to reducing poverty and increase food security in different contexts and the return on investment of the various options. Our results indicate that incremental adoption, that allows early adopting farmers to gain confidence in innovations and adapt them, creates the fastest pathways to transformational change as impact accumulates on individual farms and across communities.

**Land restoration options implemented as on-farm planned comparisons in the four action countries**



Explore the land restoration options implemented in each country using the icons displayed in the illustration above

The project is co-developing land restoration options with thousands of farmers across social, geographic and economic contexts through on-farm planned comparisons in Kenya, Ethiopia, Niger and Mali (see figure above). These planned comparisons allow us to answer key questions about what restoration options work where and for whom, why, and at what cost.

#### Scope

The goal of the project is to improve food security and livelihoods of poor people living in African drylands by restoring degraded land, and returning it to effective and sustainable tree, crop and livestock production, thereby increasing land profitability and landscape and livelihood resilience.

The project has five integrated outputs and this brief focuses on outputs 2 and 3 in line with where we are in the project cycle:

1. Ingredients of success and gaps in knowledge of land restoration techniques and approaches in the drylands.
2. Tools for targeting up-scaling land restoration activities, for use by organisations, to help them to select appropriate land restoration options and match options to sites and farmer circumstances.
3. Enhanced understanding about what land restoration approaches work, by how much, where and for whom.
4. Tools for targeting out-scaling land restoration activities and options.
5. Nested communities of practice with tools, methods and guidelines for taking land restoration to scale.

In the following case studies we show progress in scaling restoration in profitable ways for farmers and pastoralists so that their livelihoods are sustainably improved and the capacity of land to produce in the future is enhanced.





## Eating even when the rains fail through tree planting and soil and water conservation in Kenya and Ethiopia

The eastern drylands of Kenya suffer from low soil fertility, high vulnerability to soil erosion, low agricultural productivity and unreliable rainfall. In collaboration with large development projects in Kitui, Makueni and Machakos counties, farmers are implementing on-farm planned comparisons to compare various land restoration options, including plating basins with and without farmyard manure and tree planting/agroforestry practices with a selection of tree species.

Over 1800 farmers are currently implementing the on-farm tree planting planned comparison (i.e., comparing planting hole size, management techniques, across six species of trees). Approximately 5000 tree seedlings planted in November 2016, continue to thrive. Mango trees planted with farmyard manure had the highest survival rate. As did trees planted within cropland, as part of home gardens or along terraces. Mango production is important for income generation, as recent government investment in processing plants can supply an immediate and local market for this product. A second round of tree planting was conducted in November 2017 with monitoring ongoing.

Performance of crops in the planting basins with inputs such as manure, was better compared to those planted using normal farmers' practice such as ox-drawn ploughing (Table 1 shows preliminary results).

	Farmer Practice (kg/ ha)	Planting Basins (kg/ ha)	Planting Basins + Manure (kg/ ha)
All counties	242 ± 522	568 ± 725	1360 ± 1417
Kitui	116 ± 305	563 ± 757	1253 ± 1098
Makueni	908 ± 902	NA	2255 ± 2042
Machakos	175 ± 268	605 ± 609	756 ± 1126

Mean number of basins across the counties was 78 (+ 187). Despite the labour demands to dig the basins, farmers are already planning to increase the number of basins on their farm. While this approach is only applied to a portion of the farm, these basins contribute to food security, even in drought years.

In Ethiopia, almost 200 farmers across four woredas (Boset, Samre, Tsaeda Emba and Gursum) have engaged in active tree planting, comparing the influences of different watering regimes and management practices on tree survival. Over 2000 trees were planted with an average of over 90% survival. Farmer Managed Natural Regeneration is also underway as are community-based exclosures to promote revegetation and restore land.

“When I started with 200 basins in a corner of my farm, the idea was to compare the maize yields in the planting basins with our normal practice of farming. But in 2016, when we all lost our entire crops except those in the basins, I decided to switch and make more for myself. I have now covered half of my two acres with basins. Last season, during yet another drought, many of us with the basins were able to feed our neighbours who were not part of the project. They came to get some ears of maize every day. And even at harvesting period, I still got 270 kilograms, which kept us going until the following planting season. I didn't need the government hand-out anymore. Now others come to us to teach them how to do their basins.

Veronica Ngau, Kalawa, Makueni County.





## Pasture Rehabilitation and Community-Based Rangeland Management in Kenya and Ethiopia

In the Ethiopian highland sites in the Amhara Region, rehabilitation of pasture exclosures across six districts is being explored, while at our pastoralist rangeland sites in various dryland areas of Ethiopia and Kenya we are exploring a suite of technical options comprising several variations on alternative pasture resting systems and bush thinning methods.

These ILRI-led studies on technical options are nested within the broader “institutional option” of community-based rangeland management, which will be assessed through remote sensing of changes in rangeland condition.

In this way, knowledge on which planned grazing, pasture resting, and bush thinning methods produce the best results under which conditions are being developed, while also deepening understanding on which approaches to strengthening community governance of rangelands are likely to be most effective

in which contexts. Understanding the latter is important because the nature of local level resource governance is a key element of the institutional context for feasible implementation of the technical options.

For the use of exclosures for rehabilitation in Amhara, direct beneficiaries are approximately 3950. At our pastoralist rangelands sites in Ethiopia and Kenya, the direct beneficiaries will be approximately 7,650.

However, because in these communities the vast majority of the population depends on extensive livestock keeping as their primary, and sometimes only, livelihood, and the pasture resting systems that are being applied can benefit the entire rangeland territory of these communities, if the systems prove successful and are adopted, essentially the entire population of the target communities, approximately 83,000 people, will benefit. When scaled out, the ultimate beneficiaries will be far more.







## Combining soil and water conservation with fruit tree production for parklands in Mali

In West African Sahelian countries low productivity of crops is caused by a variety of factors, including erratic rainfall distribution, which leads to heavy storm events and severe erosion. The erosion removes the organic matter in the topsoil, thus reducing soil fertility and water holding capacity. To combat this, three different on-farm land restoration options are currently being implemented in Mali: 1) Soil Water Conservation (SWC) measures; 2) Improved Farmer Managed Natural Regeneration (FMNR) and 3) Tree Planting.

SWC planned comparisons, using earth bunds and stone lines, with and without vegetation, were conducted with 318 farmers on a land area covering 1050 ha. Key assessment parameters included monitoring the ability of the intervention to reduce runoff and erosion and the influence on crop productivity. Preliminary results indicated that, vegetated earth bunds with *A. gayanus* species were more resistant to water runoff, though they require extra effort from farmer perspective.

Together with farmers, ICRAF designed on-farm planned comparisons to identify suitable planting practices to ensure greater tree seedling survival and growth. In total 1600 farmers (1430 men and 170 women) planted 10 seedlings each for a total of 16000 *Ziziphus* tree seedlings.

Each farmer applied alternative planting options for five of the seedlings in order to understand which option had higher survival (i.e., small size planting hole (60 x 30cm) vs. big size planting hole (60 x 60cm)). Preliminary results indicated that survival and growth rate were nearly two fold in the bigger size planting hole as compared to the smaller one. Farmers also indicated that they are eager to adopt big planting holes, as the effort yielded a higher return to labour.

Enhancing fruit production from FMNR contributes to household nutrition and income generation.

Farmer managed natural regeneration (FMNR), enriched through in situ grafting of indigenous fruit trees is currently on going with over 238 farmers in 24 villages. The technique is simple and promotes early fruiting after only a few months or years as well as yields good quality fruits from selected varieties. Furthermore, grafting improved varieties on wild root stock is an opportunity for enhancing FMNR (a land restoration practiced already being scaled up in the region) and creates incentives for farmers to increase the tree densities on their farmland. A total of 2000 scions of three varieties (Ben Gurion, Kaithly and Umran) were collected from the ICRAF field genebank and farmers identified a plus tree of *B. aegyptiaca* named (Aduwa Messadje) which fruits twice per year with a particular sweet taste. Production of these fruits is contributing to household nutrition and increasing income from fruit sales in local markets.



Photo: P. Savadogo / World Agroforestry Centre





Photo: L. Winowiecki / World Agroforestry Centre



## Farmer Managed Natural Regeneration with microdosing and manure application in Niger

Farmers in Niger have been combining different crops, trees, traditional practices and improved technologies to enhance synergies and minimize risks. However, more integrated production practices such as agroforestry could help develop management options to improve soil fertility and agricultural productivity. Surveys and focus-group discussions in Niger revealed that farmers were aware that the direct causes of land degradation were overexploitation, poverty (lack of financial resources to afford inputs and technologies), non-availability of fallow and organic manure, tree cutting, deficit in rainfall, soil erosion (silting caused by wind and water) and population and animal pressure.

Therefore, Integrated Management Options (IMOs) that combine FMNR, Soil and Water Conservation technologies and microdosing of fertilizers prove to be interesting innovations to better manage cropping systems to improve soil fertility, restore degraded lands and thus agricultural productivity. The relevant IMOs for testing were selected in a participative mode with farmers through surveys and focus-group discussions.

Volunteer farmers, the most dynamic and open to innovation, were selected to implement the field tests. During the 2017 cropping season, testing of IMOs was conducted with 1789 farmers in 156 villages in Niger in the regions of Dosso (42 villages, 266 farmers), Maradi (6 villages, 106 farmers), Tahoua (6 villages, 100 farmers), Tillaberi (40 villages, 497 farmers) and Zinder (62 villages, 720 farmers), led by ICRISAT.

Results indicated that grain yields from a pure millet crop varied from 30 to 385 kg/ha with a mean value of 113 kg/ha. Millet grain yields increased with millet-legume intercropping, varying from 18 to 987 kg/ha with a mean value of 205 kg/ha. As an indicator of the

adoption of FMNR, shrub density was also evaluated with an average of 206 plants/ha and a high variation from 0 to 1288 plants/ha. While the aim of integrating FMNR into the farming system is to bring the positive ecosystem services which come with increased tree cover, bringing resilience to farm livelihoods requires us to devise increased food security and income earning opportunities based around tree-crop-livestock interactions and synergies. These impacts must be measured at the farm household scale so the 2018 work will consider these aspects more directly.



Photo: L. Winowiecki / World Agroforestry Centre





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Visit the project website here:

<http://www.worldagroforestry.org/project/restoration-degraded-land-food-security-and-poverty-reduction-east-africa-and-sahel-taking>

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