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### Forest natural resource management and non-timber forest products as nature-based solutions for climate adaptation, ecosystem restoration and poverty alleviation in Mali – a case study.

Amadou Tangara <sup>1</sup>, Désiré Ouedraogo <sup>1</sup>, David Baines <sup>1</sup>, Pietro Carpena<sup>1</sup>

<sup>1</sup>Tree Aid, Brunswick Square, Bristol, BS2 8PE, [pietro.carpena@treeaid.org](mailto:pietro.carpena@treeaid.org)

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#### Abstract

Climate change, nature loss and poverty are major intertwined crises that mutually reinforce each other. This is particularly true for smallholder farmers in Africa's drylands: they are the hardest hit by the climate crisis, which contributes to the degradation of the land upon which their livelihoods depend. Further pushed into poverty, rural people are forced to resort to unsustainable land practices for survival, feeding the cycle of environmental degradation and climate change.

Intertwined crises need integrated approaches, such as nature-based solutions (NbS) that protect natural ecosystems and address societal challenges. Tree Aid works in Africa's drylands to unlock the potential of trees to tackle poverty and improve the environment. Here, we present a quantitative NbS case study looking at the impacts of the adoption of forest natural resource management (NRM) and increased production of non-timber forest products (NTFPs) among smallholder farmers in the Segou region in Mali between July 2017 and July 2020.

This project was a partnership between Tree Aid, the UK funded Darwin Initiative and local partner Sahel Eco. Its socioeconomic impact was evaluated with focus group discussions, baseline and endline assessments using the Rural Household Multi-Indicator Survey (RHoMIS) (<https://www.rhomis.org/>). Ecosystem restoration impacts were assessed by ecological surveys and data from permanent monitoring plots.

We demonstrate that NRM and NTFPs delivered positive outcomes for people (reduction of project population living below the poverty line), biodiversity (+20,404ha of land under improved management), and climate (improved climate resilience through better access to natural resources). This evidences the viability of high-quality NbS in Africa's drylands and calls for greater long-term restoration investment and deployment in the region informed by and delivered through local communities and organisations.

Keywords: NbS, NTFPs, NRM, Mali, forest governance

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#### Introduction, scope and main objectives

Mali is a fragile state facing drought, food insecurity and conflict. Mali struggles with high poverty levels; the national poverty rate is 58%, with 90% of the poorest living in rural southern areas where population density is highest. The region is particularly vulnerable to climate change due to its geographic location, south of the Sahara Desert, and strong dependency of the population on rainfed agriculture. Climate shocks worsen an already difficult situation with increasing temperatures, variability in rainfall patterns and extreme climate events (floods and droughts) resulting in loss of assets and crops; and food price shocks. Temperatures across the Sahel have increased by nearly 1°C since 1970, nearly twice the global average (Crawford 2015; Hulme et al. 2001; IPCC 2007).

Evidence from the literature shows that the valorisation of tree crops, also known as “non-timber forest products” (NTFPs), not only improves households’ food security but also enables forest-dependent households to enhance their economic well-being leading to overall poverty reduction (Arnold and Ruiz-Perez 1998; Macqueen 2007; Hill et al. 2007). Mali is the world's second-largest producer of shea nuts (*Vitellaria paradoxa*) and accounts for approximately 20% of the global supply. Shea butter is used in cosmetics and food industry. However, with the degradation of forests this important livelihood option can be dangerously affected (Tieguhong et al. 2009; Nair 2007).

In the Ségou Region, there have been sharp population increases from internal displacement from the north of the country. This, alongside poverty, poor farming practices and the effects of the climate crisis, have led to over-exploitation and degradation of natural resources, including NTFPs, that locals depend on to survive. In particular, there has been an expansion of agriculture, resulting in the clearing of natural habitats, with high forests and biodiversity loss. This progressive loss is jeopardizing the economic potential of NTFPs and pushing people deeper into poverty.

Given the present condition, the project worked to strengthen the natural resource management (NRM) of two forests in Ségou, Duwa and Sutebwo totaling 19,588 hectares, to protect and restore biodiversity while contributing to poverty reduction. The project worked with 2,672 rural households in 41 local communities living in and around the forest sites

Countries in West Africa, like Mali, are facing a triple emergency of climate change, nature loss, and rising poverty/inequality. These interdependent emergencies are interconnected in their causes and consequences, but therefore also in their solutions (Hou-Jones et al. 2021). High-quality NbS involve working with, through, and for nature, people and climate. NbS offer a cost-effective approach that can deliver multiple benefits when done well. The findings in this paper form part of Tree Aid’s NbS approach to significantly contribute to poverty reduction in rural areas by increasing revenues while ensuring the sustainable NRM through improved local governance.

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## Methodology/approach

The project is based on a multiple-benefits approach to enhance rural landscape health and resilience, with a holistic consideration of agro and forest ecosystems, rural household needs (income), alongside climate change (adaptation and mitigation).

### NbS

To protect, restore and/or sustainably manage the Duwa and Sutebwo forests the project supported farmers to implement a series of NbS addressing multiple areas of concern raised by local communities:

To reverse deteriorating natural resources, communities were mobilised to use Farmer Managed Natural Regeneration (FMNR) to restore native and threatened trees to rural landscapes. FMNR is a low-cost, innovative technique to restore and regenerate trees from previously cut (but still living) stumps. Farmers were trained to use FMNR to protect and manage trees that regenerate naturally in their field; as well as community managed forests. As farmers prune trees to stimulate natural regeneration, leaves and branches from the pruning process are left on the surface where they reduce erosion and return nutrients to the soil. The pruned shoot can also be used as firewood, reducing pressure on forests.

To restore, diversify and make more inclusive income generating potential of forests, the project helped communities focus on the regeneration of multiple-use native tree species with high NTFP potential for commercialization. Tree species such as shea (*Vitellaria paradoxa*), baobab (*Adansonia digitate*) and African locust bean or néré (*Parkia biglobosa*) all have potential to diversify local communities’ income and empower women who otherwise have limited cash-generating opportunities.

*To address fertility loss, water runoff and erosion on farmland*, farmers practiced sustainable agriculture techniques including composting, field mulching, and zaï pits, and soil and water conservation techniques including stone and soil bunds to improve water harvesting and infiltration on farmland.

*To manage bushfires*, farmers formed community volunteer fire brigades to establish firebreaks around restored areas and stop destruction of existing forests and new trees.

## **Enabling processes**

To give long-term sustainability and adoption of the NbS implemented, the project worked at putting forward a number of supportive activities to enable change and contribute to the success of NbS. These are:

### **Participatory approach to manage natural resources.**

The project established more participatory and inclusive forest governance where consensual modalities of equitable access to forest resources to meet the general aspirations and specific environmental, economic, social and cultural development of all stakeholders including the most vulnerable were discussed. Through this, the decision-making processes are more decentralised and promote the rights and responsibilities of local forest users and communities. To take on stewardship of the two forests local communities (organised through two cooperatives) were supported to develop and agree management plans and by-laws that establish rules and demarcate specific areas of the forests to meet a range of stakeholder needs including conservation, income generation, firewood and grazing. Tree planting plans are laid out to ensure long-term sustainability of threatened species and multiple-use native species. Women are actively involved in the process enabling a strong voice in forest management for the first time.

For each forest, the project established a forest dialogue group and steering committee, involving local stakeholders. This provides an open forum for discussion and addresses conflicts that may arise over forest use. The 281 brigade members (29% women), from local communities, were trained to collect data in order to monitor the stewardship efforts. Through such participatory processes, local communities feel more empowered to lead and implement NbS and can enjoy direct benefits from their implementation.

### **Empowering and organising local communities to run sustainable businesses that provide long-term and improved incomes from implementing NbS.**

Harvesting, processing, selling and consumption of NTFPs can provide a decent income for poor communities. The project helped setup 44 viable community-led small businesses (20-25 people) based on the collection, transformation and commercialisation of NTFPs. These Village Tree Enterprises (VTEs) are supported in by facilitating market linkages and introducing private sector approach marketing and customer retention and services to ensure that expanded. VTEs also received materials to improve packaging and labelling. The main strength of the approach is its systematic inclusion of social and environmental concerns alongside consideration of technological, commercial and financial aspects of a product. Training of these first-tier organisations increases individual and community revenue whilst encouraging people to protect forest resources.

Through further organisational development, Tree Aid also puts emphasis on creating strong and successful VTE producer groups and cooperatives formed by VTE members. The purpose of second-tier organisations is to channel the collective power and strengths of different interest groups. Cooperatives, in particular, are instrumental in mobilising and coordinating their members to build strategic alliances with key stakeholders, and play an important role in increasing overall capacity and efficiency of enterprise groups. To increase product volume and quality, two inter-communal cooperatives, Farakunna and Hirosin, received modern shea and honey processing units and training. Staff members participated in marketing skills training and learning exchanges. Local radio stations were used to provide market information, to improve the flow of data between producers and buyers about available products and prices offered.

### Empowering women

In Mali, women are more actively engaged in NTFP productions but at the same time are significantly more disadvantaged and affected by poverty and environmental degradation than men because of their reduced ability to access markets, access and control productive resources, access decent work, and have control over their own time. Nonetheless, VTE producer groups have been particularly important and popular with women because trees are one of the few resources which they can access, and the processing/value addition can generate more stable and higher returns than other income generating options available to them (Macqueen et al. 2015). In addition, they are endeavours that by their very nature are open to those who are needier and with fewer resources.

Also, women are more likely to invest incomes for the long-term wellbeing of the household e.g., nutritious foods or household savings that provide a buffer against climate shocks. Therefore, empowering and providing women with an inclusive platform to meaningfully participate in restoring and managing forest resources so they have better and sustainable access to NTFPs is key for NbS to deliver benefits for biodiversity, climate and poverty reductions.

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## Results

The project was evaluated using the RHoMIS, a well-established, household survey tool carefully designed for farming communities living in poverty and food insecurity. The 60-90 minutes digital survey gathers data on agricultural practices, livelihoods, food security and dietary diversity, alongside gender roles (Hammond et al. 2017). Survey modules were also developed to collect information on NTFP use and forest governance. The baseline survey was conducted in 363 randomly selected households from project communities. A repeat endline survey was conducted with 349 households, 290 (83%) of whom were in the baseline survey. Focus group discussions and an assessment of VTE and each cooperatives were also conducted. These included (a) Organisational Capacity and (b) Product and Value Chain analysis. Ecosystem restoration impacts were assessed by ecological surveys and data from permanent monitoring plots in each forest site.

### **Biodiversity:**

By the end of the project:

- Over 345,000 new trees were planted and 327,000 trees restored using FMNR
- Biodiversity improved in all land use systems as new tree species have reappeared, increasing the number of species from 37 in 2017 to 43 in 2020. Six new species returned in the area: *Terminalia laxiflora*, *Cordyla pinnata*, *Lannea velutina*, *Combretum molle*, *Monotes kerstingii*, *Albizia chevaleri*.

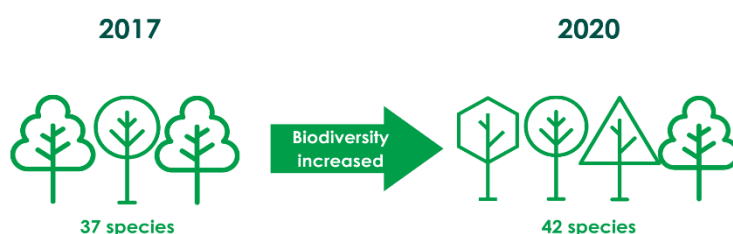


Figure 1: Biodiversity increased

- There has been a welcome comeback of *Cordyla pinnata* a locally identified threatened species, of significant importance for food and livelihood opportunities.
- A study on the distribution of trees by diameter class has shown a reduction in the loss of trees with a circumference above 30cm. In 2020, the percentage of trees above 30cm rose to 22.1% from 16.8% in 2017. Furthermore, with improved forest management, there is the appearance of larger diameter trees in the 80-99 cm category in 2020, which was not the case in 2017.

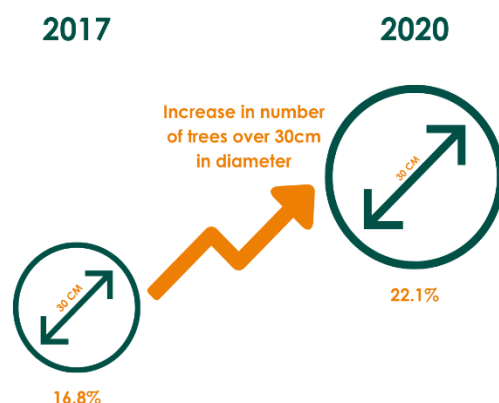


Figure 2: Trees Diameter

- These are extremely positive results that suggest a strong involvement and adoption by farmers of improved sustainable land management practices such as FMNR to improve productivity of their agroforestry systems. At the end of project, 1,435 farmers participated in NRM training and the proportion of households using FMNR increased from 33% to 86%.

### **Poverty alleviation:**

By the end of the project:

- 52% of the project participants were below the poverty line compared to 86% at the start of project based on Total Value of Activities (Cash Income + Products consumed converted into local cash equivalents) - a 34% reduction.



Figure 3: Households living below poverty line

- 15% of the project population were below the calorie line – a 5% reduction.

- 87% of women reported moderate to equal ability in choosing how to spend their own income.



Figure 4: Women control over their income

- 600 people (400 women) are now engaged directly in honey and shea butter value chains.
- At the beginning of project activities, neither Hirosin nor Farakunna cooperative reported any access to national or international markets. However, in 2020 with project support, both reported access to national markets: 50% of the honey sales for Farakunna and 25% of shea sales and 7% of the honey sales for Hirosin were made at the national level. Hirosin also reports 3% of its honey sales at international level.

**Climate change**

By the end of the project:

- Promotion of trees on farmland and improved tree cover in wooded savannah has increased above-ground carbon storage, providing mitigation benefits. Though overall improved carbon storage capacity is not quantified, data shows in agricultural fallow land and open savannah woodland there has been a marked improvement in tree density: from an average of 168 tree/ha to 182 trees/ha. This has resulted in a significant increase in above-ground biomass from 18.46 tC/ha (2017) to 25.94 tC/ha (2020).



Figure 5: Tree density

- Promoting development of more inclusive and participatory local structures responsible for the NRM promotes transformational resilience. 75% of respondents believe they now have fairer and more equal access to forest resources which provides improved income generating opportunities that can make local communities more resilient to extreme climatic events.



Figure 6: Forest access

- Restored 8,300ha of degraded forests to improve water retention and soil fertility.
- 192km of firebreaks established around restored areas to stop destruction of existing forests and new trees.

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## Discussion

The case study shows that communities in Ségou faced with increasing climate change impacts, poverty and loss of natural resources can adapt effectively to reverse the trend of environmental decline and enhance their socio-economic status through an integrated approach that combines protection, restoration and sustainable use of nature to achieve multiple objectives.

The following lessons learned during the project shed light on key success factors needed for the upscaling of this type of high-quality NbS focused on forest restoration and poverty reduction:

- NbS must be locally-led and inclusive

A crucial element from our project is that strategies to enhance voluntary adoption by farmers are crucial and require strong community engagement. The involvement of farmers and communities from the very first stage of the intervention are key ingredients to scaling up NRM practices, and to monitoring and maintaining these practices in the long run. The forest dialogue groups formed involving all local stakeholders provided open forums for discussions, to address conflicts and adopt joint plans. Those participatory approaches and strengthened community-based natural source governance structures empower local communities to lead and implement NbS and ensure that they can enjoy direct benefits from the implementation.

First and second-tier groups show that when rural communities form their own democratically run and inclusive organisations, they become better able to access credit, technology, training and markets. They are also better able to voice their needs and to increase their bargaining power within the value chain.

In addition, ensuring meaningful participation and leadership by women, such as in VTEs and in forest management, is crucial to success. Improving gender equality and empowering women to be more active in communal decision-making, local communities are more likely to monitor and assess long-term risks and manage and work with nature for long-term benefits.

- NbS must benefit local communities

The provision of the right socio-economic incentives (such as the VTEs promoted in the project) are also crucial in ensuring voluntary NbS adoption and scaling it up. Some benefits from NbS may take the long-term to materialize especially where nature has been severely degraded. To address this, the project combined short-term benefits for local and poor communities with long-term social, economic and environmental benefits of NbS. The 44 VTEs provide communities incentives to protect and sustainably use their forests.

- An enabling policy, institutional and financial environment is pivotal to scaling NbS up

This constitutes the fundamental basis upon which national and local governance structures can promote and implement well-informed land use decisions. In Mali, the legal status of cooperatives is favourable in terms of enabling decentralized forest management. The policy entrusts cooperatives a certain degree of decentralised delegated authority to uphold overall management for forest areas. Decentralised forest governance can ensure that stakeholder engagement is inclusive, collaborative and empowers locally led entities to support NbS.

However, a critical barrier to upscaling of NbS and this is linked to the lack of sufficient and accessible funding for local communities towards NRM and restoration activities both from national and international funding streams. To ensure real upscaling of multiple-benefits approaches such as NbS there must be a real drive to increase available finance to address the urgent needs of vulnerable communities, especially in the Drylands of Africa.

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## Conclusions/ wider implications of findings

The above key findings overwhelmingly demonstrate the significant impact that relatively low-cost, community focused and led, high-quality multi-purpose NbS at landscape scale in Africa's drylands can have on development outcomes for both individual participants and groups directly involved, as well as an overall impact on community management, oversight and value held in communal forest resources (Hou-Jones et al. 2021).

In a drive to scale high-quality NbS up in the African drylands, the Mali case study showcases key elements for national and international leaders to consider embedding in their political, legal and budgetary decisions and plans going forward. These should encourage and support locally-led, inclusive and beneficial implementation of NbS.

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