JUSTDIGGIT IMPACT REPORT 2021

CONTENTS

INTRODUCTION

Hi there! You are currently reading the technical impact report of 2021. Every year, Justdiggit publishes an annual report which contains a summary of that year. Although the most important data about our projects is already shared there, it's not the ideal platform to publish technical and detailed data about the effect of our interventions – and we have a lot of that data! Therefore, we wrote this technical impact report. It's not a scientific publication, but it provides more detailed information about our projects for those that like to dive a bit more into the calculations and results over 2021.

The reports is structured per landscape and will present the most relevant indicators for each landscape. It provides more exact intervention locations and more detailed and technical insights are shared. Finally, the annex contains an elaborate definition of the indicators that are discussed and provides more detailed information on the used calculations.

The figure at the right presents the four main landscapes we were active in 2021, in Kenya and Tanzania. The landscapes are displayed based on their administrative boundaries, which means that these areas do not represent the actual intervention areas. The landscape chapters present the precise locations of the interventions and go into more detail of several impact indicators.

Since we apply several different interventions across our landscapes, this report will also give a refresher on the interventions we use and how they work. But first, we start with a quick summary of the total impact realised by the end of 2021.

Enjoy reading!

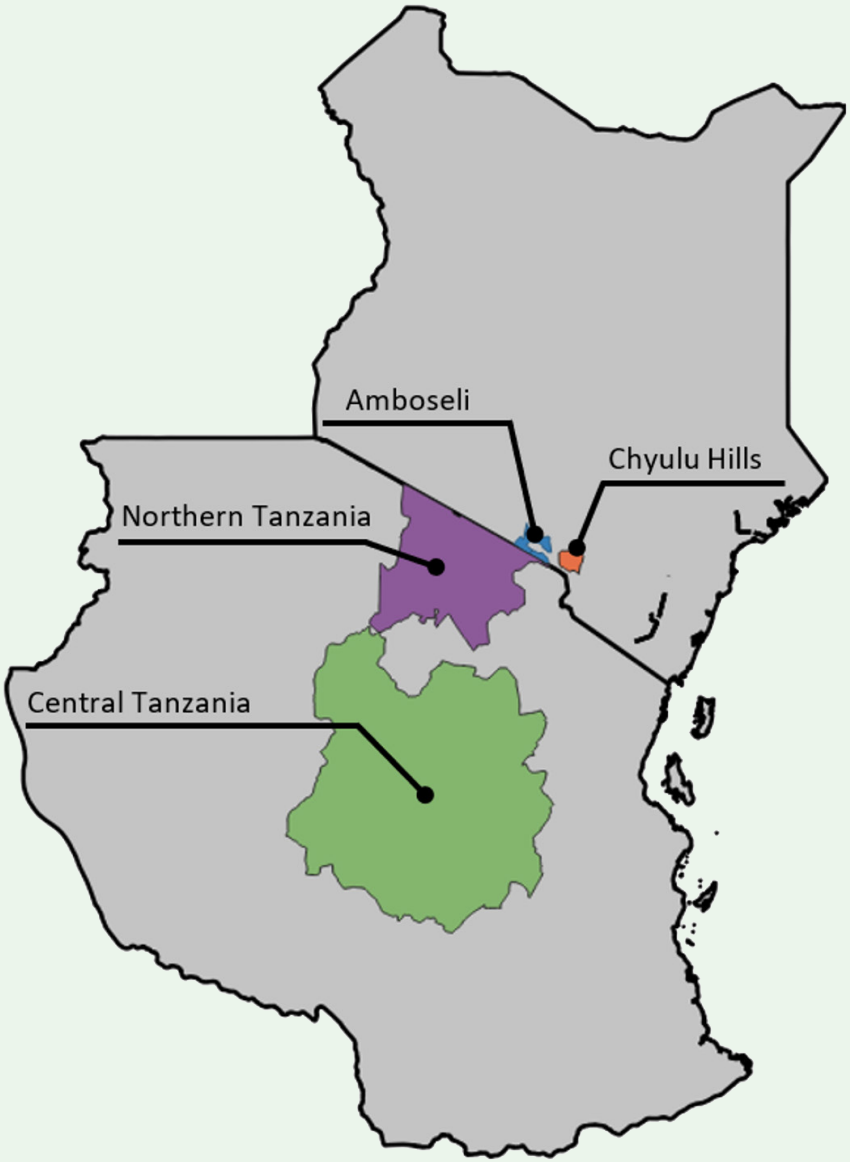


Figure 1 Overview of Justdiggit program landscapes in 2021

IMPACT SUMMARY

We start this impact report with the total impact made by the end of 2021 across the different program landscapes. The following chapters will go more into depth on these impact numbers, what this impact means and how these figures were calculated.

	Central Tanzania	Northern Tanzania	Amboseli	Chyulu	Total
Area under Restoration to date - hectares	11,720 intensive 292,980 extensive	195 intensive	17,000 extensive	1,077 intensive	**12,992** intensive **309,980** extensive **322,972** total
Bunds to date	5,143	22,006	25,132	150,048	**202,329**
Water Retention (2021) 2021 - cubic metres	2.15 million	53,000		640,000	**2.84 million**
Trees to date	9.7 million	16,762			**9.7 million**
Grass Seed Banks to date			3	5	**8**

TYPE OF INTERVENTIONS

RAINWATER HARVESTING BUNDS

One of interventions we apply are rainwater harvesting bunds, or as we often call them; soil bunds. These semi-circular structures retain rainwater and bring back vegetation in places where nature has a difficult time restoring itself again. How it works? It's actually quite simple, you just start digging! But of course there is more to it.

Many of the landscapes we work in are characterized by endless grasslands. These grasses are used by both wildlife and local communities herding their livestock. However, due to a combination of different reasons, among which are overgrazing, land subdivision and climate change, many of these areas are degrading. When this happens, typically the natural vegetation starts to disappear. Perennial grasses that have strong root systems and are resilient to rough circumstances as well as bad rains, are replaced by annual grasses, which sprout quickly and start disappearing as soon as it stops raining. The vegetation cover decreases, which makes the soil vulnerable to erosion. Fertile soil is now prone to be washed away during rainfall, which also becomes more and more unpredictable. As a result, barren and empty soil is left behind, with less and less natural vegetation.

To revert this vicious cycle, we implement soil bunds. Together with an army of diggers, coming from the local communities, we construct tens of thousands of soil bunds. These diggers get paid for every soil bund they dig, which is an extra source of income for them and their families. The bunds are constructed before the rainy seasons starts and, right before the first rains, we add seeds of perennial grasses to the bunds where needed. As it starts raining, the soil bunds prevent the water from flowing downstream, keeping the water where it is so desperately needed and stopping the process of soil erosion. With the digging of the bunds, we also remove the topsoil layer, which is often compacted and sealed and prevents proper infiltration during rainfall. With this barrier out of the way, rainwater can infiltrate the soil much easier. As there is much more rainwater available in the soils than before, more vegetation can start growing. This is how our bunds kickstart natural restoration. As the natural revegetation develops, it promotes infiltration of rainwater by itself. Grasses slow down rainwater as their roots open up the soil and allow water to infiltrate. The bunds will be there for a few more years, until they slowly erode away as the natural vegetation takes over their role.

Proper grazing management is crucial in restoring these rangelands. When the grazing pressure is too high, the developing and fragile vegetation will be grazed and disturbed so much that it is not able to maintain itself and protect the landscape from more erosion. Therefore, we work closely together with local grazing committees and rangers that prevent community members from grazing their cattle inside these bund areas, at least for the critical first years. As the area is building back its resilience, livestock is little by little allowed to re-enter the bund areas, until a sustainable level of grazing is maintained.

OLOPOLOLIS

For the implementation of soil bunds, we target the most degrading areas within the landscapes we are working in. However, not all areas are so heavily degraded that they need to be restored by physical interventions. For these areas, where the natural vegetation has been reduced but is not yet completely gone, we use a traditional way of conservation, called olopololis. An olopololi is a designated area of land that is temperately excluded from grazing, typically during and directly after the rainy seasons. In this period, as the vegetation is growing and developing, the ecosystem is most fragile, so it needs some resting. As time goes on and the vegetation gets stronger and more resilient, the olopololi is opened up for grazing somewhere in the dry season, depending on the demand of rangeland and the status of the area. Grazing committees, formed by community members, decide when these areas are opened for grazing again. Olopololis are often not fenced (with the exception of privately managed olopololis), but demarcated by certain features; at the west-side of the road, south of the river, up until these large trees, etc. In Southern Kenya, we helped showing the boundaries of these

TYPE OF INTERVENTIONS

olopololis by putting up large, white poles, so it will be clear for pastoralists where they are and are not allowed to graze their livestock. Often, olopololis are also used as grazing land for older, very young or pregnant animals that are not able to walk long distances.

FMNR / PMNR

As compared to soil bunds and olopololis, where we focus on restoring degraded rangelands, we apply Farmer Managed Natural Regeneration – or FMNR for short – on agricultural land. The landscapes we target with this intervention typically used to be covered by forests years ago, before the expansion of the agricultural area. Many trees were cut down throughout the years, as more and more forested land was transformed to agricultural land. The 'clear farm is a good farm' mindset is often leading in such areas, where all agricultural non-valuable vegetation is being removed. Although countless trees were cut down, their stumps and root systems are often still there and are generally still alive! As a result, many young sprouts emerge from these stumps every year, often growing into thorny bushes that are considered to be useless – and are thus being cut again. Furthermore, countless young seedlings naturally sprout from seeds but often disappear again due to grazing and farm preparations. This is where we come in. By teaching them a pruning technique, we motivate farmers to turn these bushes and young sprouts into full-fledged trees again. Because the root system is often still there, this usually goes much faster than through planting trees. The survival rate of FMNR is also considerably higher compared to tree planting, not least because these FMNR-trees are generally indigenous species that thrive well in the harsh climate of our project areas.

Bringing back trees has a positive impact on the direct environment in several ways. Firstly, trees reduce soil erosion as they intercept precipitation with their canopy while their roots open up the soil to allow for more infiltration. Increased biological activity improves soil quality and may increase soil organic matter. Furthermore, trees have a substantial impact on the microclimate. Through increased transpiration and water retention, the atmosphere is cooled down, which has several positive effects, such as reducing heat stress of crops.

FMNR is entirely farmer-led, which means that we just provide them the technical skills. The decision to start practising, to decide how many trees to bring back, which species and where, is entirely up to farmers themselves. Although farmers often already know how certain tree species can be used for their benefit, we add to this by teaching farmers how to integrate trees into their farming systems and, for example, improve soil fertility, their yield, access to firewood and food security. Showing farmers how to obtain these benefits, especially the short-term benefits, works as an incentive for them to bring back trees and start restoring their own land.

FANYA JUU/CHINI

On slopy farms, regenerating trees may not be sufficient to reduce surface runoff and increase retention of rainwater. In such situations, we promote and teach farmers how to implement fanya juu and fanya chini trenches. These terms literally translate to *throw it up* and *throw it down*. Trenches are dug along the contours of the slope and the excavated soil is made into a dyke either up or downhill of the trench. These trenches both retain excess rainwater and reduce erosion.

As constructing these trenches requires quite some technical skills and a lot of labour, farmers are encouraged to work together and implement these interventions on each other's land.

GRASS SEED BANKS

A grass seed banks is one of the interventions we often apply in landscapes that are characterised by degrading rangelands, such as in Southern Kenya. Here, we select a plot of about 10 to 15 acres of land together with the local leaders to become a grass

TYPE OF INTERVENTIONS

seed bank. Each seed bank is ran by a group of about 20 to 25 Masai women, depending on the size of the plot. They fence the plot, prepare the soil and sow the grass seeds with support from Justdiggit. After that, they maintain the plot by removing weeds and securing the place. Eventually they will be able to harvest the grass seeds. The revenue of the grass sales fully belongs to the women and their households and can provide a substantial additional income. Also the stems of the grasses are harvested and used or sold as hay for livestock feed during the dry season, when grazing resources are getting scarcer. At least for the next few year, Justdiggit pledges to buy the harvest from these women groups. Justdiggit needs a reliable supply of native grass seeds for new restoration areas, for example new bund plots in the area. In the future, we will set up and develop the landscape restoration enterprise, an overarching entity which will purchase and collect the harvest of all women groups, which will make access to the regional or even national market much easier.


CENTRAL TANZANIA

CENTRAL TANZANIA

PROGRAM LOCATIONS AND INTERVENTIONS

Justdiggit and its landscape partners are working in 2 large regions in central Tanzania: the Dodoma region and the Singida region. Each of them is similar in size to the Netherlands. The landscapes in these regions have degraded rapidly in the past few decades as a result of poor land management and deforestation by an increased number of people and farmers, as well as weather extremes caused by climate change. About ninety percent of the people in these regions depend on the land for their existence. As land productivity is decreasing, more and more farmers are struggling to produce sufficient livelihoods for their families. So, land degradation is one of the most significant problems affecting their lives as well as the wider ecosystem. Towards the end of 2017, Justdiggit and LEAD Foundation found each other in the fight against land degradation and developed the 'Kisiki Hai' (Swahili for 'living stump') program. This program aims to regenerate trees via 'Farmer Managed Natural Regeneration' (FMNR), a technique that protects and promotes the growth of young trees. Additionally, through the implementation of rainwater harvesting techniques called Fanya Juu & Chini, excess rainwater is retained to boost vegetation growth.

The Central Tanzania program started off in about 300 villages in the Dodoma region in 2018. In May 2021, 58 new villages in the neighbouring Singida region were added, and another 8 in October 2021. The program will include a new cluster of villages twice a year, at least for the next 4 year. Eventually, the goal is to work in a thousand or more villages by 2030 and to expand the program to parts of the Iringa, Manyara and Morogoro regions.

In every village, the program has two main phases. The first three years are characterized by many activities, organising trainings, movie roadshows, demonstration farms, mentoring of champion farmers and close monitoring and evaluation of the impact. After the third year, we transition into the sustainability phase, a period of another 17 years – which brings the total program period to 20 years – during which we will focus more on our communication approach and gradually scale down our activities. The goal of this sustainability phase is to make sure the efforts of the intervention phase are not in vain, but to integrate FMNR and the regreening movement deeply into the way of living of local communities.

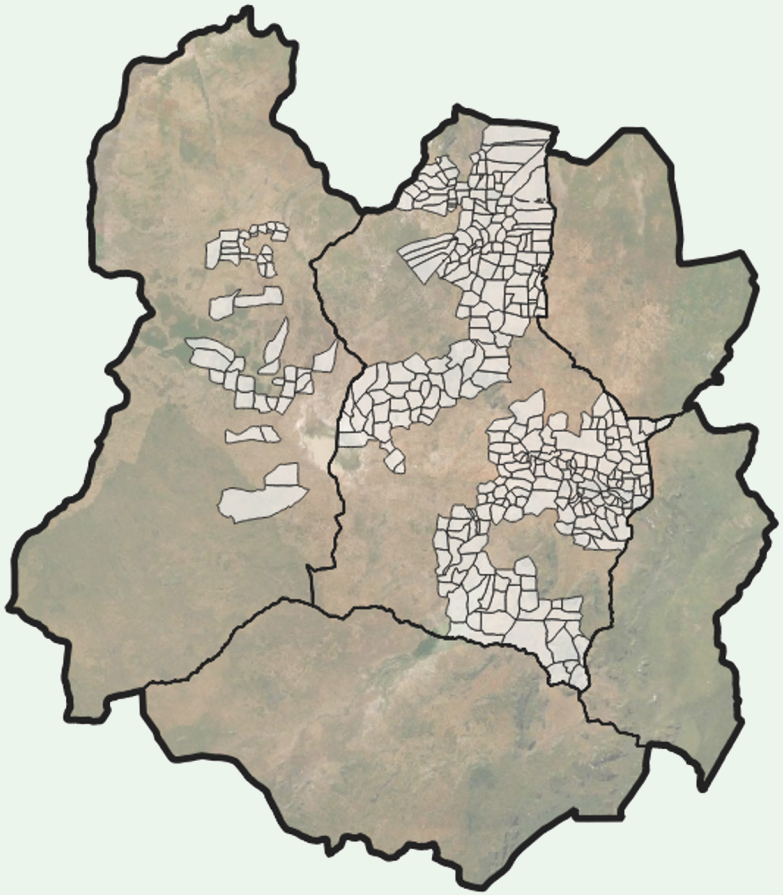


Figure 2 Locations of the project villages in Central Tanzania

CENTRAL TANZANIA

TESTIMONIALS AND EXPERIENCES

“I was here at Veta college in January 2021, together with the champion farmers we led an activity of pruning over 3,000 Kisiki Hai trees in the surroundings of the college. What I am now seeing in six months is amazing, there is a big difference, the trees have grown big within just few months. I am really impressed with Kisiki Hai, it is a technique that everybody needs to adopt, it is simple to implement and brings impact within a very short period.”

A testimony by Dr Omary Mkulo the director of Kongwa district council.

Figure 3 Fanya trench after rains

Figure 4 Farmer marking a protected FMNR tree with a piece of fabric

“I have been farming vegetables for many years now. After I started using Kisiki Hai technique in the farm, the vegetables have started tasting better. This is because the vegetables are not affected by direct sunlight, the leaves of the Kisiki Hai trees help to reduce the light intensity from the sun, this makes the vegetables to grow healthier but also to taste better”

A testimony from Fatuma Maganga from Bumila village in Mpwapwa district.

CENTRAL TANZANIA

IMPACT RESULTS

HIGHLIGHTS

People reached:	707,000
Trees regenerated:	9,700,000
Area under restoration:	*intensive*: 11,670 hectares *extensive*: 292,980 hectares
Water retention:	2.15 million m^3

ADOPTION AND TREE COUNT

Promoting and implementing FMNR start with the training of champion farmers. In every village that is included in the program, we have trained about four farmers to become our champions and local ambassadors of the program and regreening movement. Throughout the year, they have attended three trainings. During the first training, champions learn about the basics of regreening and FMNR and practice together to be sure they master the skill of pruning trees. They then learn about how to convey this message to others, how to organise trainings with groups of farmers in their own villages and on how to properly monitor and track the progress made. After this first training, the champions return to their villages to start training others and spread the regreening movement in their own villages. After the first and second year, another training session follows, where they learn more advanced skills, for example on how to make best use of the trees so they are most beneficial to farmers. Throughout the program, we have trained over 1,450 champion farmers, which in turn have trained almost 190,000 farming households in Dodoma and Singida. 65% of these household, about 121,000 households, have started practising FMNR on their own land. With an average household size of 5.6, we estimate to have reached about 707,000 people through our champion farmers. Besides that, champion farmers also train institutions, such as churches, mosques, health posts, schools and other entities that own land. In total, about 2,500 institutions were trained, of which almost 2,300 adopted FMNR. At the end of 2021, farming households regenerated 8,389,000 trees, while the activated institutions brought back 1,344,000 trees. This brings the total number of trees at the end of 2021 to 9.7 million trees![1]

Besides bringing back trees, farmers are also promoted to dig water harvesting trenches (Fanya Juu, Fanya Chini). By the end of 2021, the total length these trenches was 106,000 metres, which was an increase of 31,000 metres compared to the start of the year.

TREE SIZE

Although this number says a lot about the scale of the program, it is good to provide context to it. This number contains all different types of trees, with different sizes and species. For example, more than 3 million FMNR trees are already higher than 2 meters! On the other hand, about 1.5 million trees are still smaller than one meter. Yet, these smaller trees are expected to grow into big full-fledged trees eventually. However, long-term survival of trees grows over time. When a tree grows bigger and starts producing fruits or other benefits they become less vulnerable to being grazed, unsustainable harvesting or being cut for farm clearing. Based on our 2020 evaluation, we estimate that the survival rate of FMNR trees was about 80%! Besides, since most of the FMNR trees are regenerated from existing tree stumps, the regeneration can often start again when a tree is grazed or cut down.

AREA UNDER RESTORATION

The impact on their direct environment increases as trees grow bigger. When the size

[1] Annex A provides more information about the monitoring system we use for counting FMNR trees

CENTRAL TANZANIA

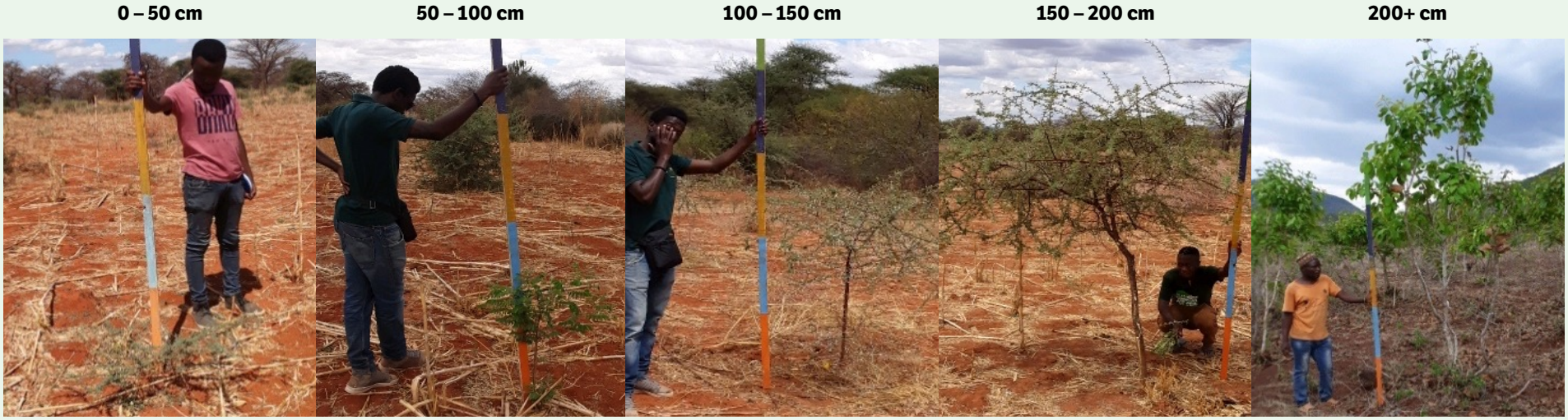


Figure 5 Different categories of tree height

of their canopy and the reach of the roots grow, the direct surroundings of the tree are affected more and more. Less erosion will take place as the canopy intercepts the rain and the root systems keeps soil together. More water can infiltrate due to the improved soil structure and the fertility of the soil can increase as a result of the added organic material and enhanced biological activity. A general rule of thumb is that the width of a tree's canopy and the root system is about the same as the height of that tree. We therefore assume a circle around each tree, with a radius equal to the its height, in which the tree has a physical effect on its environment. We call this the *area under intensive restoration*. Sometimes, these circles of influence of different trees overlap, which would lead to an overestimation of the total area.

To tackle this issue, we analysed the location, height and sphere of influence of 13,000 trees and concluded there was a 14% overlap. This percentage is therefore deducted in the calculations for area under intensive restoration and several impact indicators, such as water retention.

Besides intensive restoration, we consider an area of land that is under more sustainable land management due to the efforts of the regreening program. This area is defined as under *extensive restoration* and is more related to ownership and management, rather than being directly affected by the restored trees. For this indicator, we include the farm size of all activated households. This figure also provides, besides the area under intensive restoration, insight into the scale and potential of the program. Based on this definition, the area under extensive restoration is estimated to be 293,000 hectares of farmland. Annex A provides more details about these definitions and calculations.

CENTRAL TANZANIA

TREE SPECIES AND BENEFITS

The most common FMNR tree species is *Acacia Senegal*, which was reported in about 65% of the villages. *Vitex Doniana, Dichrostachys Cinerea, Acacia Tortilis* and *Acacia Mellifera* are also found in many villages. Table B1 (in the appendix) shows the top 10 most commonly regenerated tree species and their reported use by farmers. Better access to firewood is the most perceived benefit of FMNR by farmers, which is not surprising since this benefit can already be perceived in an early stage of tree development. As part of the training, we train champion farmers – and through them all farmers – how to sustainably harvest firewood from FMNR trees, without cutting down the entire tree. This alleviates the pressure on trees in nearby forested areas, where farmers would normally go to fetch firewood.

Benefit	Nr. Of Tree Species
Firewood	69
Timber	6
Construction	3
Fodder	3
Soil Fertility	2
Shading	6
Medicines	23
Fruits	28

Table1 Number of tree species used for different benefits

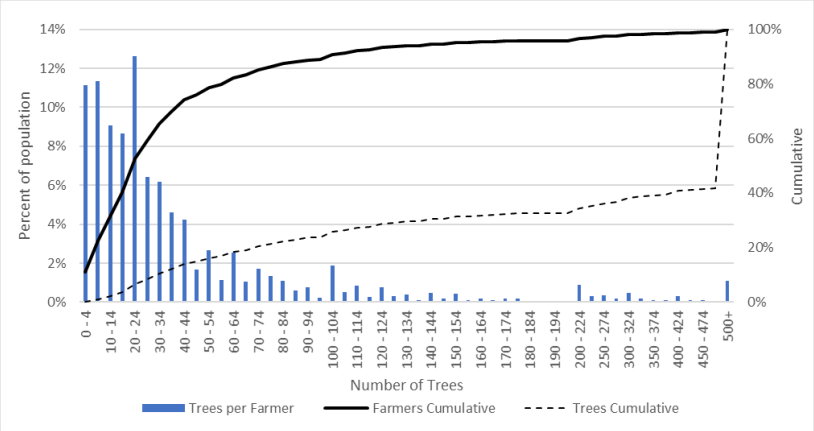


Figure 6 Distribution of number of trees regenerated by households

Other perceived benefits from FMNR trees are harvesting fruits, increased shading, harvesting timber and wood for construction, obtaining fodder for livestock, improving soil quality and obtaining traditional medicine. Some of these are longer term benefits, which take a few years to become apparent, such as improving soil quality. Table 1 shows the number of tree species that are generally used for obtaining certain benefits. It concludes that firewood, fruits and traditional medicine are obtained from relatively many different tree species.

TREES PER HOUSEHOLD

With over 120,000 households bringing back trees on their own land, the extend of regeneration differs strongly between farmers. On average, a single household regenerates about 80 trees on their land. However, most farmers nurture a much lower number of trees, with a median of 22 trees. The graph below shows that the majority of the farmers, about 63%, has 30 trees or less. About 11% of the households maintains 100 trees or more. This shows that a fairly small share of the practising households is responsible for regenerating the majority of the 9.7 million trees that are reported. This is due to woodlots, which is one of the ways we promote farmers to regenerate trees. Here, farmers dedicate a certain area of land entirely to tree growing, often partly through regeneration of tree stumps and by fostering regeneration from seeds. These woodlots can contain hundreds to thousands of trees and are therefore very significant for the total number of trees in the program.

IMPACT ON SOILS

During the last two years, we conducted some research on the effect of trees on their direct surroundings. First of all, the bulk density of the soil directly underneath the tree was compared to the soil surrounding the tree and outside of its sphere of influence. The results show that soil bulk density directly underneath trees was about 8.5% lower than in control areas, while surrounding the tree it was about 2% lower than for control areas. Soil analysis also showed that soil organic carbon (SOC) content was substantially higher

directly underneath trees compared to control areas (Figure 7). Although there are several reasons for this, some that can be considered to be external such as the fact that animals prefer to rest in shady places and leave their droppings there. However, the results are in line with what can be theorised. More tree litter can be decomposed better by increased soil biological activity, while shade and decreased soil temperature slow down loss of soil organic matter from the top soil. In the coming time, more research will be conducted to better understand the impact of FMNR trees on their direct surroundings.

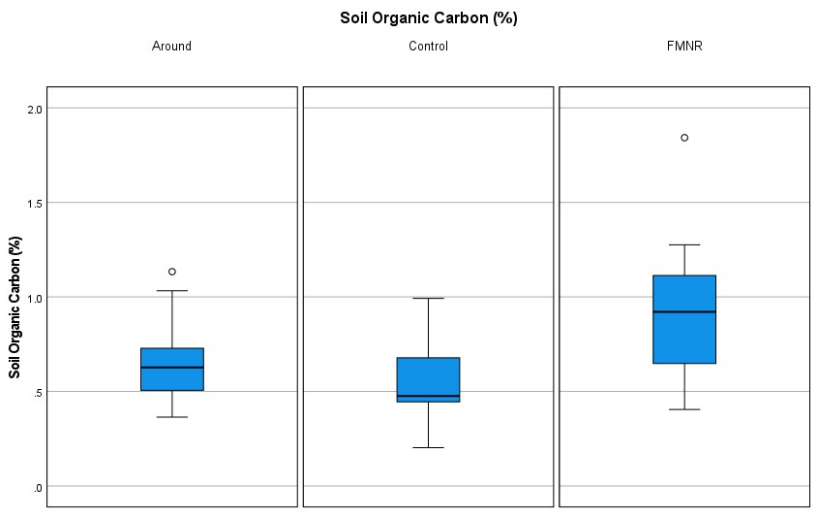


Figure 7 Soil Organic Carbon levels in soil samples underneath, surrounding and away from FMNR trees

RAINWATER RETENTION

Increased rainwater retention is an important success indicator for this program. More rainwater retention may increase yields, cool down the soil and have a positive effect on the micro-climate. Furthermore, when more rainwater is retained and runoff is reduced, severe downhill soil erosion may be prevented. Based on field experiments and literature research, a methodology was designed to estimate the total additional water retention due to the regeneration of FMNR trees. This methodology is further elaborated on in Annex A. Using this method, we estimate the total additional water retention by FMNR trees over 2021 amounts about 1.9 million cubic meters. The estimated water retention by rainwater harvesting interventions (Fanya Juu, Fanya Chini) is estimated to be about 210 thousand cubic meters over 2021.

CARBON SEQUESTRATION

Growing trees sequester carbon-dioxide from the air and turn this into biomass. For this reason, regenerating trees on a large scale can substantially contribute to reducing the CO_2 concentration of the atmosphere and mitigating climate change. As we speak, we are working with Face the Future, a Dutch organisation specialist in forestry and carbon sequestration projects, to develop a solid methodology to quantify the amount of CO_2 that is sequestered in our programs. Based on the available data, they made a preliminary analysis of the carbon sequestration, which was estimated to be about 156,000 tonnes of CO_2. A more thorough analysis will be done in the second half of 2022, for which new data will be collected.

INDIRECT BENEFITS

During the socio-economic evaluations done at the end of 2020, research was done on some possible indirect benefits of the implementation of FMNR. Farmers were asked for number of months they had insufficient food available for their households. The data showed a significant difference in this *hungry period* between villages where FMNR was being implemented (2.5 months on average) and control villages (3.2 months), with a 95% confidence interval between 0.35 and 1.1 months. It is not possible to fully attribute this difference to the promotion and implementation of FMNR, but it is highly likely that it has contributed to this decrease. As we speak, more research is being conducted on the impact of FMNR on food security and health aspects of farming households. Similar

conclusions can be drawn regarding the number of pollinators in areas where FMNR is being practiced. Farmers were asked whether they thought the number of pollinators increased, decreased or stayed the same in the previous few years. The collected data showed that farmers in FMNR villages generally perceived more of an increasing trend of their presence compared to farmers in control villages (Figure 8).

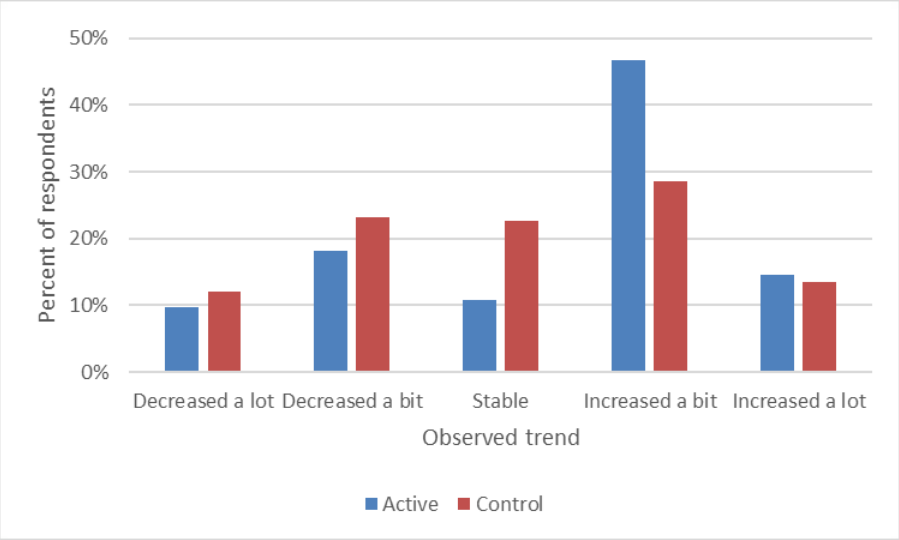
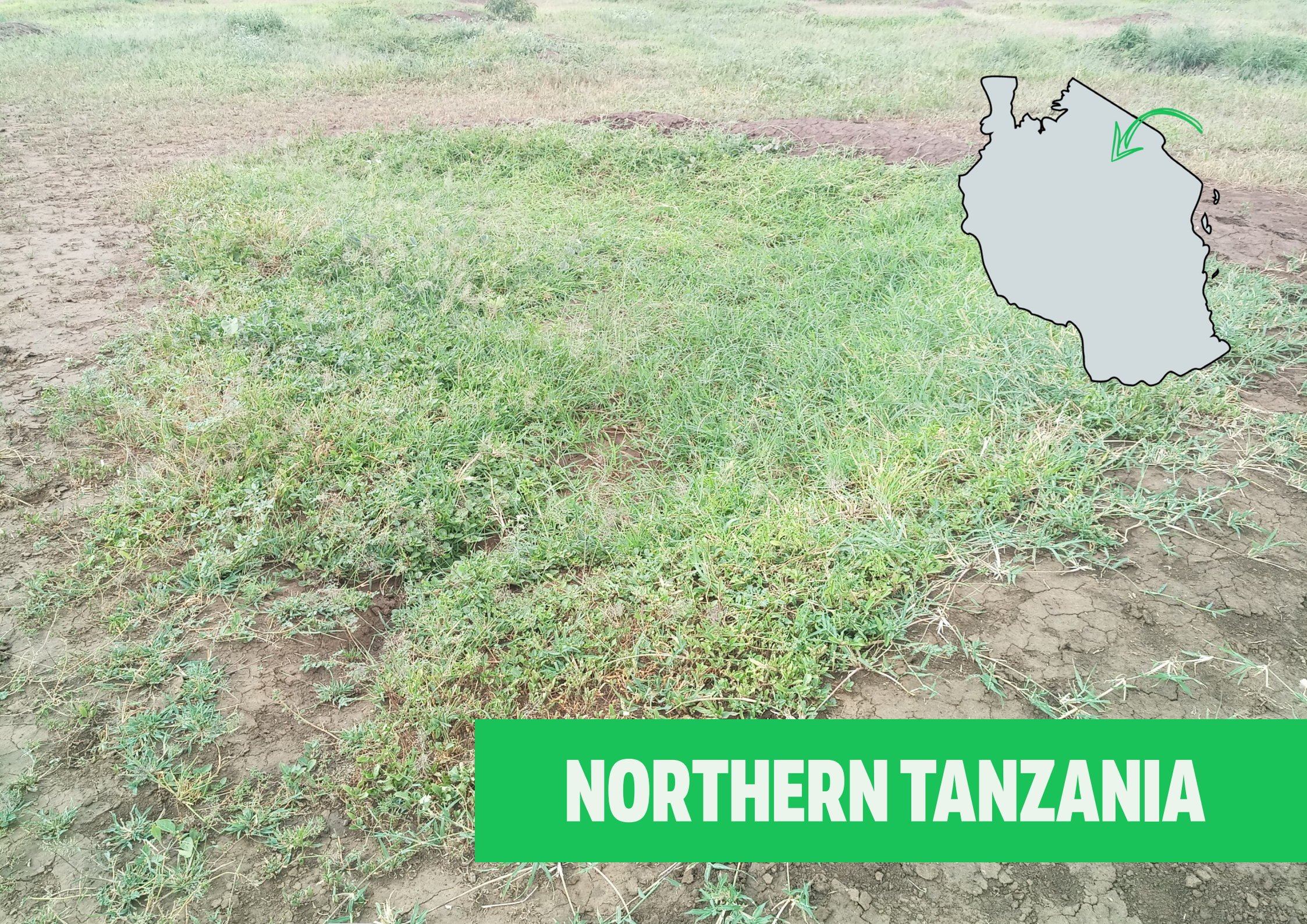


Figure 8 Perceived trend of presence of pollinators by farmers in active and control villages


NORTHERN TANZANIA

NORTHERN TANZANIA

PROGRAM LOCATIONS AND INTERVENTIONS

In 2021, we started a new program in the Arusha region in Northern Tanzania. In this program, where we work together with our Tanzanian partner LEAD Foundation and our German partner Erbacher Foundation, we focus on restoring degraded rangelands, both through the implementation of rainwater harvesting interventions – soil bunds – and natural regeneration of trees by promoting pastoralist managed natural regeneration. The Arusha region is mainly characterised by grasslands that are used by pastoralists, but also contains densely forested parts and agricultural areas.

IMPACT RESULTS

HIGHLIGHTS

Bunds constructed	22,006
Area under restoration:	*intensive*: 195 hectares
Trees under restoration:	16,762
Water retention:	53,000 m³ in 2021

NUMBER OF BUNDS & AREA UNDER RESTORATION

During the digging, the number of bunds that is being constructed is carefully being monitored by the supervisors in the field. As payments to the diggers are directly linked to the number of bunds each individual digger has constructed, a precise system is set up. The actual size in hectares of each bund plot is measured using drone images. After the bunds have been dug, we flew a drone over the bund area. With these high resolution drone images, the area of the bunds plots can very easily be mapped, after which the sizes were determined.

Bund site	Bunds	Hectares
Meserani Site 1	3,310	29
Meserani Site 2	342	3
Esilalei Site 1	1,352	12
Meserani Site 3	1,348	12
Engaruka	3,800	28
Selela	5,006	49
Baraka	3,200	30
Esilalei Site 2	3,648	32
Total	**22,006**	**195**

Table 2 Number of bunds per site in Northern Tanzania

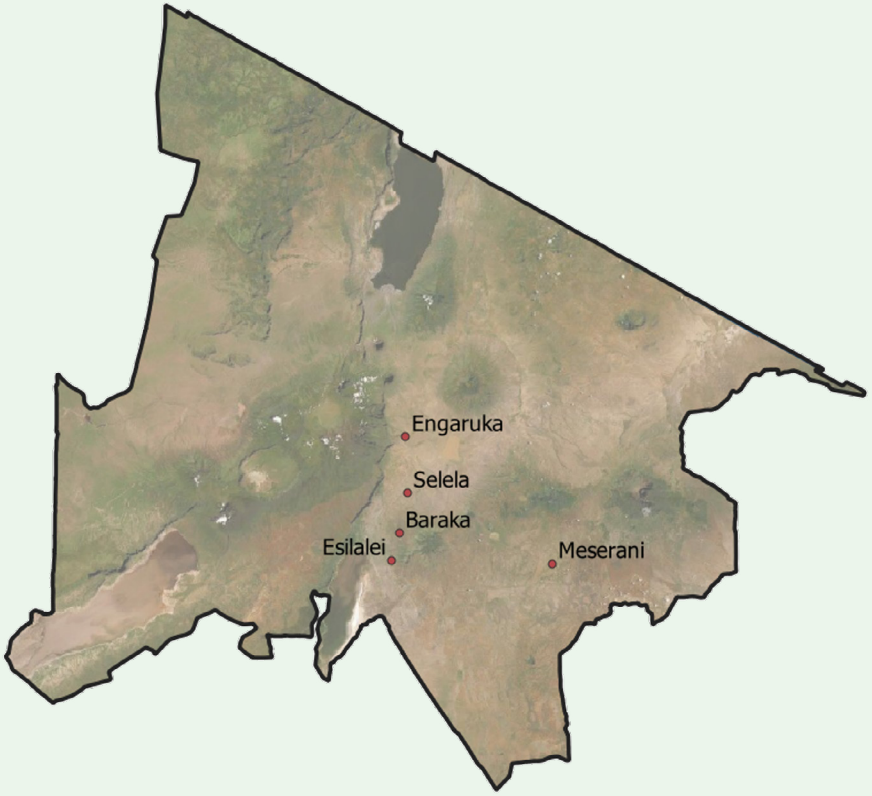


Figure 9 Location of bund areas in Arusha

NORTHERN TANZANIA

NUMBER OF FMNR TREES

The number of FMNR trees is being reported by champion farmers, with a similar monitoring structure as in Central Tanzania, using booklets. By the end of 2021, 16,762 regenerated trees were reported by over 7,100 farmers in five different villages (Table 3).

Table 3 Number of trees regenerated by pastoralists in project villages in Northern Tanzania.

Village	Trees
Meserani Juu	6,704
Esilalei	6,727
Baraka	1,055
Selela	924
Engaruka Chini	1,352
Total	**16,762**

WATER RETENTION

Water retention from soil bunds is calculated using the CN-method, as described in Annex A. Because of the lack of detailed weather data, remote sensing was used to get precipitation data. To fit this, the method needed to be slightly altered to a day-based model, rather than an event-based model. The first 5,000 bunds were dug early February. After that, the remaining 17,000 were constructed early November. After adjusting for precipitation in this region, the total estimated rainwater retention for soil bunds in this project was 53,000 m^3 in 2021. Note that water retention from FMNR trees is assumed to be negligible, as the trees under regeneration are still very small.


AMBOSELI

AMBOSELI

PROGRAM LOCATIONS AND INTERVENTIONS

INTRODUCTION

Amboseli National Park in the South of Kenya is a protected natural area that is surrounded by Olgulului-Ololarashi Group Ranch (OOGR), which is a rangeland area. These two areas form the Amboseli Landscape, where wildlife and pastoralists with their livestock live next to each other. The ever increasing human, livestock and wildlife pressures on the rangelands have led to the reduction and disappearance of woody vegetation and grass species. This has then led to heavy erosion which is causing a further decrease of rangeland productivity and loss of habitat for livestock and wildlife. Together with the occasional droughts or floods, the amount of pasture is decreasing. With that comes a decline in wildlife and livestock productivity leading to increasing competition between people and wildlife. Justdiggit and its local partners decided to counteract and start restoring and regreening this fragile environment.

Justdiggit has a long history of restoration in these two areas. Since 2015 we have created 44 different plots in which we implemented various restoration techniques, such as water bunds, Olopololis (grazing reserves), exclosures (temporarily fenced off areas to allow trees to grow back), Vallerani ploughing (a special type of water harvesting plough) and Grass Seed Banks. Landscape restoration is not just a matter of working with soils, seeds and rains, it is equally important to engage with pastoralists on the matter of grazing management and respecting the restoration plots. OOGR has more than 80,000 inhabitants, of which a big part own livestock that depend on the grazing grounds in the area. Through our local partners, Justdiggit has worked directly with communities, local leaders and grazing committees on the management of these grazing areas.

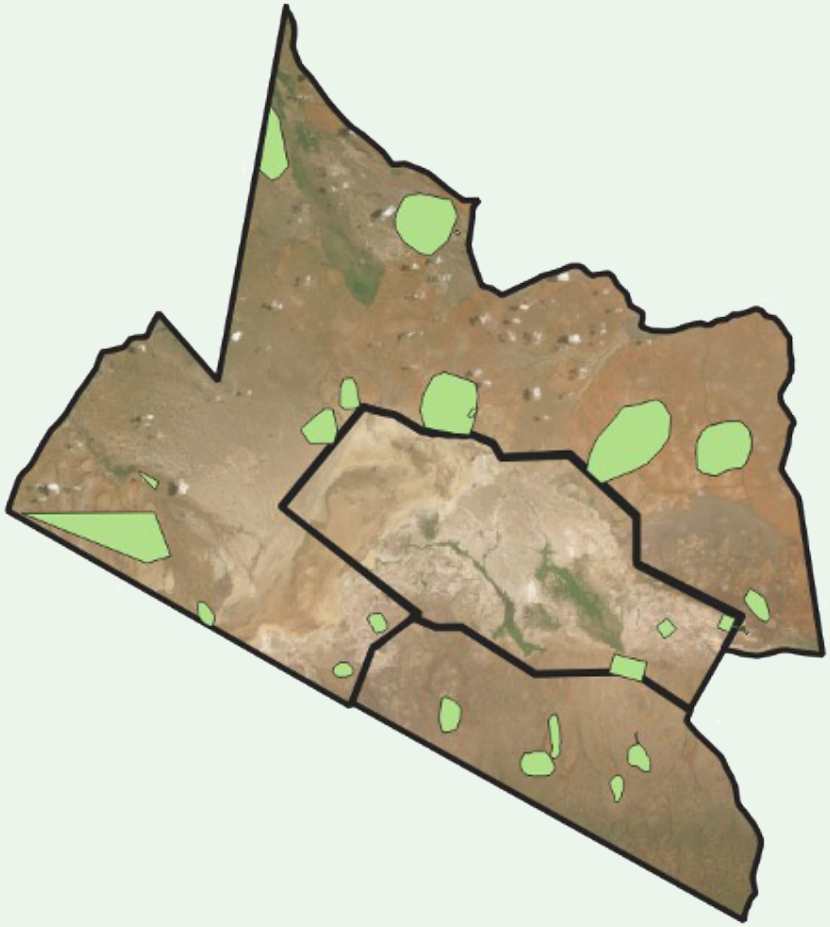


Figure 10 Location of the intervention areas in the Amboseli Landscape

AMBOSELI

IMPACT RESULTS

OLOPOLOLIS

In the last few years, an estimated 17,000 hectares of olopololis have been designated and marked by large, white poles. These poles stand out in the landscape, so it is clear to pastoralists that this area is conserved and only meant for dry-seasons grazing. Biomass monitoring shows that olopololis maintain more green biomass during the rainy season compared to control areas (Figure 11). Although the green biomass reduces to the level of control areas moving into the dry season, the total biomass stays higher throughout the whole year.

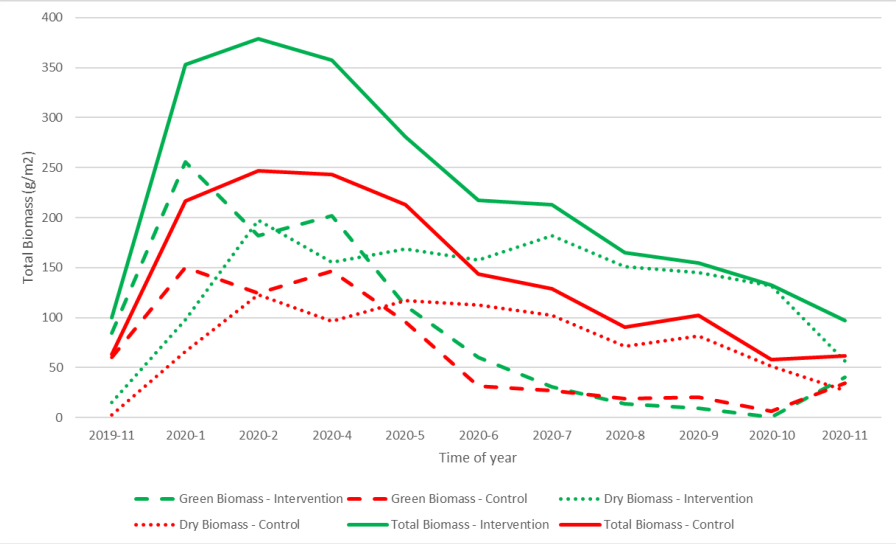


Figure 11 Measured biomass inside and outside olopololis in the Amboseli program

GRASS SEED BANKS

In 2021, we have started setting up grass seed banks with women groups. In total, three grass seed banks have been established. In 2021, there were no harvests yet as throughout 2021 the seed banks were further developed: plots cleared, fenced and women groups trained. The first harvests are expected in the second part of 2022.

SOIL BUNDS

In 2019, about 25,000 bunds were constructed in this landscape. The different bund areas are located inside olopololis and are therefore under the same management. Due to several reasons, such as improper grazing management and site selection, these bund areas do not perform as well as expected. Vegetation monitoring data suggests the bund plots perform similarly to the olopololis compared to control areas. Vegetation monitoring will continue in the coming months and will top this up with a remote sensing analysis to better understand the effect of the soil bunds on the restoration of the area.


CHYULU

CHYULU

PROGRAM LOCATIONS AND INTERVENTIONS

INTRODUCTION

The Chyulu Landscape lies within the heart of the Tsavo-Amboseli ecosystem in South-West Kenya at the foot of Mount Kilimanjaro and the Chyulu Hills. Kuku Group Ranch, where we have been working for the last 7 years, is located within the Chyulu Landscape, covers an area of 1,200 km2 and is home to about 30,000 people who heavily depend on the land. Kuku Group Ranch is an important wildlife corridor between the national parks (Tsavo West, Chyulu Hills and Amboseli National Park) and other protected areas in the region. The area contains a wide range of habitat types and has a large diversity of wildlife.

There are approximately 30,000 people living on Kuku Group Ranch. The majority of them are Maasai. The Maasai are traditionally pastoralists and live in scattered semi-permanent villages or bomas. Although pastoralism is still the main occupation of Maasai living in Kuku Group Ranch, they are also diversifying their income sources. Farming now occurs in the remaining wetland areas and along the rivers.

There is extensive land degradation in this landscape. The main drivers are overgrazing, poor grazing practices and management, and climate change. Justdiggit aims to restore the land mainly focussing on the regreening technique 'rainwater harvesting' by digging water bunds and generating income through setting up grass seed banks with Maasai women groups.

Figure 12 Intervention locations of the Chyulu program

TESTIMONIALS AND EXPERIENCES

"I have seen this project creating direct employment to many people in the community. It has helped to improve our living standard. It will also be beneficial to our livestock as there are grass already shooting up."

A testimony by Elizabeth, a community member

"I was able to pay all the school fees and bought 2 goats out of the money I got from the project. I also see the grass growing which is an indication that there will be enough grass for livestock and therefore more milk for my family."

A testimony by Kimire, a community member

CHYULU

IMPACT RESULTS

HIGHLIGHTS

Bunds constructed: 150,048

Area under restoration: *intensive*: 1,077 hectares

Water retention: 640,000 m³ in 2021

As is often the case, land degradation in the Chyulu hills occurs in a vicious cycle. Due to overgrazing and unsustainable grazing management, natural vegetation progressively disappears and is not able to sufficiently regenerate. High quality, perennial vegetation disappears and low-quality, annual vegetation remains. These die off during the dry season, leaving the landscape barren until the first rains. As a result of the minimal cover, the soil hardens and becomes less permeable, strongly reducing the infiltration rate during the next rainy season. More runoff occurs, often causing massive erosion and further land degradation, leaving less rainwater in the soil, which allows for even less vegetation growth during the next growing season.

Name bund plot	Area	Bunds
Kuku A	101	6,400
Kuku B	312	52,319
Kuku D	129	25,129
Enkii	213	32,400
Inkisanjani	304	33,800
Total	**1,059**	**150,048**

Table 4 Bund areas in the Chyulu program

Thousands of bunds are dug in these degraded areas to tackle this problem and reverse the process of degradation. As of 2017, we have constructed over 150,000 soil bunds bringing 1,059 hectares of degraded rangelands under intensive restoration.

WATER RETENTION

This cycle needs to be broken for the ecosystem to properly and quickly restore itself. This is where our interventions come in. By digging bunds, we break open the hard topsoil, which allows rainwater to infiltrate easier. The shape of the bunds also retain water, allows it to settle and gradually infiltrate the soil instead of running off downstream. This way, we let rainwater infiltrate at the location it occurred, rather than somewhere downhill. Over 2021, we estimate that the water retention due to the soil bunds is about 640,000 cubic meters[2]! The resulting increase of soil moisture allows the sown high quality perennial grass seeds to germinate and survive throughout the dry season, after which this new vegetation will increase the infiltration rate even more as the roots enhance the soil's permeability. This way, the cycle has been reversed, which allows the ecosystem to restore itself.

That is, provided that the area is not overgrazed. Therefore, promoting sustainable grazing management is a vital element of our regreening approach. Grazing committees, existing of community members, are strengthened and rangers help protect the intervention areas from illegal grazing. This way, we make sure the intervention areas have the chance to restore themselves before grazing is allowed again. As we speak, we are working on a tool to help assess the recommended grazing pressure for our intervention areas, which allows livestock of communities to slowly start grazing here again!

[2] The methodologies used to calculate this result are explained in Annex A.

CHYULU

VEGETATION GREENNESS

Using remote sensing it is possible to monitor the change of biomass production and greenness of our intervention areas in time. Figure 13 shows the greenness (OSAVI index) of Kuku D (orange line), one of the bund areas that were constructed in 2017. The strong effect of dry and wet seasons is clearly visible by the different peaks. Although it seems that the orange (bund site) and the green line (control) are moving in a similar way, we can conclude that the bund area is generally greener than the control area, whereas it was the opposite before the end of 2018. Although the bunds were constructed in 2017, they need some time before the effects start to show. As of early 2018, the bund area is continuously greener than the control area. In fact, the bund area has been about 12% greener than the control area, whereas it used to be about 40% less green in 2016 and 2017! Similar conclusions can be drawn for Kuku B, which also started in 2017. Where the intervention area used to be bare (OSAVI <= 0.2) for a similar amount of time throughout the year as the control area, the intervention area was bare for about 3 weeks less compared to the control area from 2018 to 2021. In time, this difference can make a significant impact on the communities and their livestock.

For soil bunds, because of the nature of the intervention, the entire intervention area is considered to be under intensive restoration[3]. Following these definitions, we have brought a total of 304 hectares of degrading rangelands under restoration in 2021, bringing the grand total to 1,059 hectares.

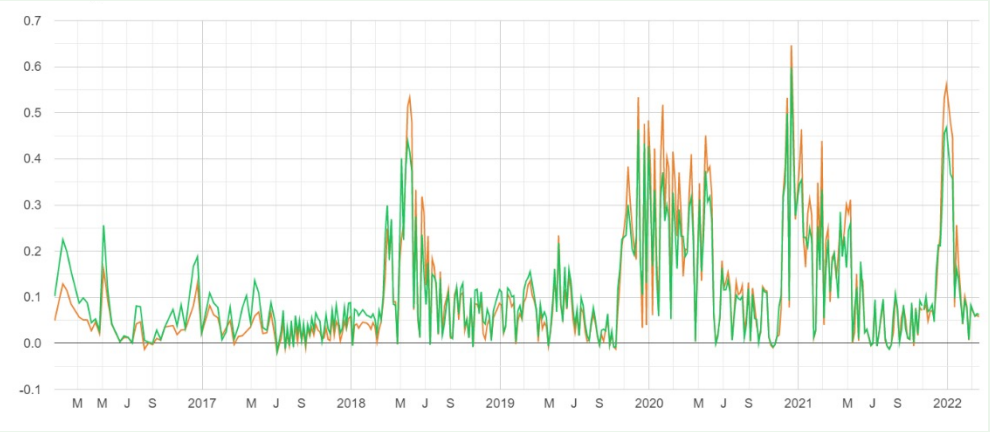


Figure 13 OSAVI index of the Kuku D bund site (orange) and surrounding control area (green)

GRASS SEED BANKS

In the Chyulu landscape, there are three different running Grass Seed Banks; Moilo, Inkisanjani and Enkii. 42 women are responsible for managing the seed bank, which includes preparing the farm, sowing the seeds, weeding, harvesting the seeds and hay and for general maintenance, for example to the fence. For the first few years, Justdiggit has pledged to buy the grass seeds from these women groups, which creates a secure income source. In November 2021, two more women groups started building their enterprise; Olkaria and Enkusero.

Over 2021, the three active seed bank enterprises harvested a total of 520 kilograms of Maasai Lovegrass seeds and 2,355 kilograms of African Foxtail Grass seeds. With prices of 500 Kenyan

Grass Seed Bank	Women	Hectares
Olkaria	25	3.7
Enkusero	23	3.5
Moilo	12	5.1
Inkisanjani	15	2.2
Enkii	15	3.9
Cumulative	**90**	**18.4**

Table 5 Grass seed banks in the Chyulu program

[3] Annex A provides more information about these definitions

CHYULU

Shillings per kilogram, the three women groups earned a total of 1.45 million Kenyan Shillings. On top of that, a total of 70 bales of hay were harvest and sold, which are used as a source of feed for livestock during the dry season. These hay bales are sold for 200 KES each, resulting in a total of 11,500 KES. The revenue from seeds and hay add up to average income of close to €300 euros per woman for their household.

RURAL COMMUNICATION

RURAL COMMUNICATION

MOVIE ROADSHOWS

In 2021, we have organised movie roadshows in 66 different villages in Central Tanzania. This full day event is organised by our partner LEAD Foundation in collaboration with champion farmers in the individual villages and fully revolves around the regreening movement. During these events, approximately 12,000 people were present, of which about 32% were men, 34% women and the remaining 34% children.

During the day, champion farmers and district coordinators give speeches about FMNR and the need of regreening and sustainable land management and community members give their own performances in the form of speech, dance, drama or song. Champion farmers also make use of the opportunity to once again explain the practicalities of practising FMNR. The day ends with a full-blown, outdoor movie show on a large screen, where the Kisiki Hai movie is shown. The intention of the event is to create awareness of environmental and agricultural issues in these areas, inspire people to act upon these issues, to teach them how to apply these practices and eventually to activate them. The movie roadshow is the first communication event that is being organised in new program villages and creates a strong foundation for other communication channels, such as radio, SMS and visuals, to build upon.

66
ROADSHOWS

12 000
PEOPLE REACHED

SMS SERVICE

For several years now, we are promoting FMNR and sustainable land management practices through an SMS service. Farmers, or other interested people, can sign up for free and will then receive weekly messages. These messages for example remind farmers about the benefits they can receive from FMNR trees, or when it is time to start pruning the trees. During roadshows, champion farmers actively promote this service and help other farmers to sign up. Mid-2021, the service had around 60,000 active subscribers.

60 000
PEOPLE REACHED

1.85 MILLION
MESSAGES SENT

During the second half of 2021, we decided to move to a different service platform. This new platform supports two-way communication, which means that subscribers can reply to messages. This way, we can receive input from farmers as well! Also, farmers can receive tailored messages based on their location, for example, on the performance of their village or ward within the program. Farmers can also send questions, which will then

be answered by our communication team in a helpdesk setting. Because of the platform switch, we were forced to re-enrol all subscribers. Due to privacy reasons, subscribers had to actively subscribe to the new service. Consequently, the number of subscribers when down to approximately 43,000 active subscribers. Yet, with this new approach, we are convinced we can reach our target audience in a better and more valuable way. Over 2021, a grand total of 1.85 million text messages were sent out.

REGREEN APPLICATION

In 2020, we started a pilot with a Regreen Application. This mobile application ran on KaiOS, a mobile operating system specifically focussing on smart-feature phones – cheap internet enabled phones without a touch-screen. Phones were provided to about 150 farmers, which then started to use the app and apply FMNR on their land. The results of this pilot were promising, after which the app was also published for Android phones. So far, the apps have been downloaded about 5,000 times. This pilot was the first step towards our greater goal of reaching millions of farmers using mobile technology. We will take the next steps for this project in 2022.

5 000
PEOPLE REACHED

ANNEX A - METHODS AND CALCULATIONS

AREA UNDER RESTORATION

Justdiggit works on restoring degraded landscapes and promoting sustainable land management. We work in different landscapes (project areas), with different types of interventions and in areas that can vary a lot in terms of the extend of degradation. It is therefore complicated to define a single definition for the area we bring under restoration. For that reason, we work with 2 distinct metrics, that being used together provide a good understanding of the actual impact of our programs on landscapes and the wider ecosystems.

Area under intensive restoration

As the description implies, the first metric includes interventions that intensively restore areas that are often severely degraded. The implementation of these interventions directly impact their physical environment, which is key for this metric.

Area under extensive restoration

Within this metric we include interventions that do not directly affect their physical environment and often require proper management of stakeholders and land users before this impact is starting to be realised. This metric can also be considered to be the focus area of our interventions where the impact is not directly apparent.

Based on these metrics, we can assess which description applies to each intervention. These metrics are mutually exclusive and collectively exhaustive (MECE) and thereby do not overlap. A more detailed explanation for each intervention will follow, including insights into how these areas are calculated.

Kenya/Tanzania – Soil Bunds and Stone Lines

Soil bunds have a clear and direct impact on their physical environment. Even though proper grazing management is crucial with this type of restoration, the physical impact of bunds is clear. Soil bunds are therefore considered to be a way of *intensive restoration*. The entire area of the bund plot is considered to be under intensive restoration, whereas there is no explicit area under extensive restoration. In some exceptional situations, for example when bund areas are strategically positioned in such a way that the grazing pressure elsewhere will reduce, this spill-over effect can be included under extensive restoration.

Kenya – Olopololis

In contrast to soil bunds, the management element is key when land is brought under restoration through olopololis. Since this intervention focusses solely on proper grazing management and resting during the wet season, the direct impact on the physical environment is less visible compared to a rainwater harvesting intervention. The area of our olopololis will therefore, under normal circumstances, be included under area under *extensive restoration*, whereas there is no area under intensive restoration assumed for this intervention. However, when olopololis are reseeded to speed up regeneration, the area will be considered to be (partly) under intensive restoration.

Tanzania – Farmer Managed Natural Regeneration

Since Farmer Managed Natural Regeneration (FMNR) is primarily done on private land, it touches on both definitions. Firstly, trees have a direct impact on their physical environment, albeit on a limited spatial scale. We assume, based on literature, that the sphere of direct impact of trees on their environment is directly related to their height, which links to the size of the root system and the canopy. Therefore, we assume the area under intensive restoration to be a circle around the tree with a radius equal to the height of the tree. Within this area, it has a positive impact on the soil structure, soil fertility

ANNEX A - METHODS AND CALCULATIONS

and water infiltration. However, trees also have a positive effect beyond this circle, for example through reduced wind erosion and surface run-off. A farmer or land owner is trained on bringing back trees, how to integrate these trees, and how to benefit from them to the fullest extent. We therefore assume that the full landholding of the farmer is under more sustainable land management. We also see this area as a potential growth area for bringing back more trees under the same management and land owner. For these reasons, we assume the full landholding of active FMNR farmers to be under *extensive restoration*. Note that the area under intensive restoration, directly surrounding FMNR trees, is excluded from this figure.

Tanzania/Kenya - Pastoralist Managed Natural Regeneration

Pastoralist Managed Natural Regeneration (PMNR) is in essence very similar to FMNR. The main difference between the two concepts is the user or land owner. Whereas FMNR is almost exclusively practiced on privately owned agricultural land, PMNR is typically practiced on communal land. If this is the case, the area under *extensive restoration* is omitted, as there is no larger scope of land under more sustainable land management. The area under intensive restoration remains, as the direct impact of trees on the physical environment does not change. When PMNR is practiced inside (existing) olopololis, the size of the olopololi (minus area under intensive restoration) is assumed to be under extensive restoration. This only applies in case of existing olopololis that which were not established under a Justdiggit program, to prevent double counting.

Tanzania – Fanya Juu / Fanya Chini

Following the logic of the formulated metrics, the area surrounding Fanyas would be under intensive restoration. For the impact of Fanyas, we assume a catchment of 15 meters upstream of the trench along its full length. However, there may be significant amount of overlap between the area under intensive restoration by FMNR trees and the area surrounding Fanyas. As we currently lack data to differentiate between area under intensive restoration by Fanyas and FMNR trees, Impact of the Fanyas on these 2 metrics are not taken into account at this moment. However, water retention by Fanyas is taken into account.

Results – December 2021

The definitions and logic above result in the following:

Country	Intervention	Type of Restoration	Area (ha)
Kenya	Soil Bunds	Intensive	1,059
	Olopololis	Extensive	17,000
	Grass Seed Banks	Intensive	18
Tanzania	Soil Bunds	Intensive	245
	PMNR	Intensive	0
	PMNR	Extensive	0
	FMNR	Intensive	11,670
	FMNR	Extensive	292,980
	Fanyas	Intensive	159
Subtotal		Intensive	12,992
		Extensive	309,980
		Cumulative	**322,972**

Table 6 Number of hectares under restoration in Justdiggit programs

ANNEX A - METHODS AND CALCULATIONS

VEGETATION MONITORING

Soil Bunds and Olopololis

In the landscapes where we implement soil bunds, our implementing partners carry out vegetation monitoring. By measuring certain physical indicators inside and outside the intervention areas, we can understand the impact of the interventions on the vegetation over time. At the moment, we use different methods across the landscapes, depending on the implementing partner. Yet, these methods have many similarities, as they aim to assess the amount of biomass present in the monitoring areas.

In the Amboseli landscape we apply a method using a pin-frame. This is a straightforward tool that has 10 pins of about 30 centimetres long. After placing the tool on random points within a monitoring location, the vegetation cover, greenness and signs of grazing are determined for the exact point of each pin. The height of the vegetation underneath the pin-frame is then also registered, which all together can be used to estimate the biomass and grazing pressure.

In the Chyulu landscape, we use a similar approach using transects to systematically determine the exact point to monitor the vegetation cover.

WATER SEQUESTRATION

Soil Bunds

The amount of rainwater that sequestered due to the interventions is an important indicator, as this is the first step in kickstarting the regeneration of these degraded areas. For soil bunds, we use the curve-number (CN) method to estimate the amount of additional rainwater that is retained. This method is event-based, which means that for every rainfall event, the total runoff is estimated. The CN method requires two inputs. Firstly, the characteristics of the area, in terms of soil texture and soil/vegetation cover, are caught in a curve number. For example, for the soil bunds in the Chyulu landscape, we use a CN value of 87 (very poor cover, soil class C/D). The second input is rainfall data. With the data we acquired from our weather station, we get a better understanding of the temporal spread of rainfall in these areas. By clustering 15-minute data based on the rainfall intensity, rainfall events are determined, which are then used to feed into the CN-method. Based on these two inputs, the method then gives an estimation of the total amount of runoff. Additionally, a 10% uncertainty buffer is added.

$$with\ S = \frac{25400}{CN} - 254$$

$$and\ rainfall\ intensity\ I\ in\ mm$$

$$if\ I \geq 0.2 \times S:\ \ R = 90\% \times \frac{(I - 0.2 \times S)^2}{I + 0.8 \times S}$$

$$if\ I < 0.2 \times S:\ \ R = 0$$

After the implementation of the bunds, we assume this runoff will be retained instead. However, the bunds have a maximum capacity (based on their dimensions) and can overflow. The estimated maximum retention capacity of a bund is 2,100 litres and, based on the spacing between bunds, every bunds has an average catchment of 124 m². Because some of the bunds break after the rains, we include a 15% reduction factor in this calculation. Combining all these aspects into one formula results in the following equation to calculate the average estimated water retention per soil bund for a single rainfall event.

$$Retention\ (L) = 85\% \times \min\left(2100\ L \,\middle|\, \frac{(I - 0.2 \times S)^2}{I + 0.8 \times S} \times 124\ m^2 \times 90\%\right)$$

Multiplying this result by the total number of soil bunds in the bund plot gives us an indication of the total water retention in this bund plot.

ANNEX A - METHODS AND CALCULATIONS

Farmer Managed Natural Regeneration

To estimate water retention by FMNR trees, we use the results of experiments from the field. Several years ago, an erosion and run-off experiment was done in Mpwapwa, one of the districts in the Dodoma region. The experiment concluded that without any interventions, about 24% of the precipitation would run off. With an average annual precipitation of 616 mm, the total annual runoff would be about 1,478 m³ per hectare. Based on Mannings coefficient, we theorise that 20% of this runoff would infiltrate anyway due to the direct effect of the tree on the surroundings. This runoff reduction then only applies to the area under *intensive* restoration. To account for uncertainties, a final reduction factor of 30% is applied. All combined, the water retention by FMNR can be calculated using the following equation:

$$Retention\left(\frac{m^3}{year}\right) = 70\% \times 616\left(\frac{mm}{year}\right) \times 24\% \times A_{intensive}(ha) \times 20\% \times 10$$

However, this equation assumes a fixed area under restoration (and thus fixed number of non-growing trees) throughout a year – which is not the case. To improve the accuracy of the result, this equation should be used for each month individually, using the appropriate number of trees (i.e. area under intensive restoration) and respective precipitation for that month. Adding the figure for each month results in an annual cumulative for water retention.

Fanya Juu, Fanya Chini

The main goal of the Fanyas is to retain as much rainwater as possible, preventing it from running off and instead allowing it to infiltrate. Typically, when farmers implement more than one fanya trench, the spacing between the trenches is 15 meters. The catchment of each trench is therefore assumed to run 15 meters uphill along the full length of that trench. Based on the nature of this intervention and the typical geography of the landscape, we assume that all rainwater running off from this catchment would settle in the trench. As for FMNR, a runoff factor of 24% is assumed. As for FMNR, the retention is calculated on a monthly basis, based on the total length of trenches and respective precipitation for each month. The equation for estimating water retention by fanyas is therefore:

$$Retention\left(\frac{m^3}{year}\right) = I\left(\frac{mm}{year}\right) \times L_{fanya}(m) \times 15\,(m) \times 24\%$$

CARBON SEQUESTRATION

Soil Bunds

In the Chyulu landscape, we work together with QuiverTree and GRASS to estimate the carbon sequestration in the bund areas. When grasses are generated, carbon is stored in that biomass and in the soils. The roughness of the surface is measured through remote sensing, which is then translated to a biomass estimation. The soil organic carbon content of the soil is determined by analysing soil samples. Combined, this methodology provides an estimation of the whole carbon stock of the bund sites.

Farmer Managed Natural Regeneration

In Central Tanzania, we estimate the carbon stock in FMNR trees using allometric equations. By measuring certain characteristics of trees, particularly breast height diameter and height, in combination with the species, these equations provide an estimation of the total biomass. For individual trees, this method can be somewhat inaccurate, but it will provide an accurate estimation of carbon sequestration when used for millions of trees. Soil organic carbon increase is neglected in this landscape, as farm practices have a major effect on the gravity and speed of soil organic matter increase.

As of mid-2021, we are working with Dutch forestry consultants of Face the Future, who are developing a carbon sequestration monitoring methodology to accurately estimate the total carbon storage in the Central Tanzania program. This method will be applied for the first time in the second half of 2022.

ANNEX A - METHODS AND CALCULATIONS

NUMBER OF FMNR TREES

The effects of the program are being assessed using the hierarchical program structure, as displayed in Figure 3. Our champion farmers regularly visit farmers and institutions they have trained, and together determine the total number of FMNR trees on that farm. Generally, each farmer is visited at least once every three months. Each champion farmer has typically between 100 and 150 farmers under their supervision. All collected data is registered in booklets and communicated to the district coordinator who in turns reports monthly to the program manager. The local program manager/MEL team at our partner institution receives the data from all district coordinators and monitors the overall progress. This structure ensures a certain level of validation. District coordinators regularly visit champion farmers to validate their booklets and go to a sample of farms to confirm the accuracy of the communicated data.

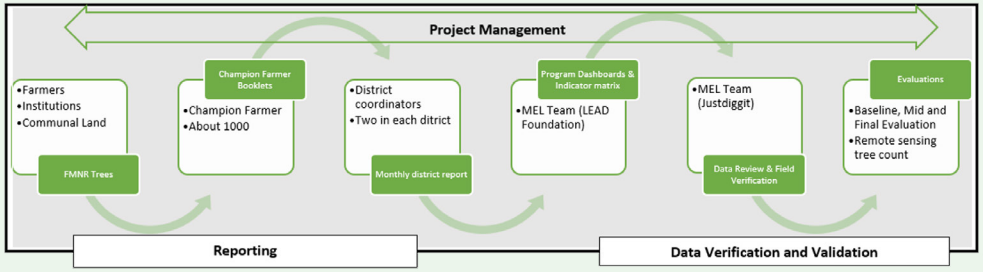


Figure A1 Data collection and verification system for monitoring number of trees in Justdiggit FMNR programs

To further ensure the accuracy of the data, checks are done at three main levels. At the first level, the LEAD foundation MEL team does regular desk reviews. This involves aggregating the data into a program dashboard which shows the impact on district, division and village and champion farmer level. The data is compared against previously reported data and any inconsistencies corrected in consultation with the district coordinators and champion farmers. At a second level, LEAD and Justdiggit teams do verification of the received data through regular field visits. At a third level, a recount is done during the yearly program evaluation in a sample of the villages, which can be used to estimate the total number of trees in the program by extrapolation. As part of this evaluation, besides field visits, we conduct surveys with farmers in both program villages and non-program villages, which act as a control group. These surveys cover a wider range of questions on socioeconomics, communication, and farming practices. Going into the sustainability phase, we will aim to do evaluations every few years.

ANNEX B – TABLES AND GRAPHS

Scientific name	English name	Representation	Main Use	Second Use	Third Use
Senegalia Senegal	Acacia Senegal	65%	Firewood (87%)	Fodder (57%)	Shading (47%)
Vitex Doniana	Black Plum	59%	Fruits (92%)	Firewood (49%)	Construction (10%)
Dichrostachys Cinerea	Sicklebush	45%	Firewood (70%)	Construction (33%)	Medicine (29%)
Vachellia Tortilis	Acacia Tortillis	44%	Firewood (85%)	Fodder (39%)	Shading (28%)
Acacia Mellifera	Blackthorn	44%	Firewood (80%)	Construction (29%)	Shading (29%)
Acacia Nilotica	Thorn Mimosa	44%	Firewood (82%)	Medicine (35%)	Shading (27%)
Boscia Angustifolia	Routh-leaved Sheperds Tree	42%	Firewood (69%)	Shading (39%)	Medicine (29%)
Bauhinia Petersiana	Kalahari White Bauhinia	39%	Firewood (63%)	Fruits (53%)	Medicine (38%)
Grewia Hexamita	Giant Raisin	36%	Fruits (66%)	Firewood (53%)	Construction (28%)
Euphorbia Candelabrum	Candelabra Tree	36%	Firewood (35%)	Medicine (28%)	Carts/Pumps (27%)

Table B1 Top 10 most common tree species regenerated in Central Tanzania. Note that the number for *representation* reflects the share of champion farmers in the program that reported this tree species to be regenerated by at least one of their farmers.