Theme 2: Pasture and Rangeland Management

RESEEDING WITH RANGELAND GRASSES AND LEGUMES

A publication sponsored by the ICSIAPL project

Learning objectives

- Advantage of reseeding with rangeland grasses and legumes,
- Steps to follow on how to do reseeding; a comprehensive guide on arid and semi-arid reseeding with rangeland grass and legumes
- Learn different methods of reseeding

Background

Kenya is a country located in the eastern part of Africa with a land area of approximately 581,309 km². Over 80% of the country's land area is classified as arid and semi-arid lands/regions (ASALs).

These regions are characterized by low and unreliable rainfall, frequent droughts, and high temperatures, which make them less or even unsuitable for crop farming.

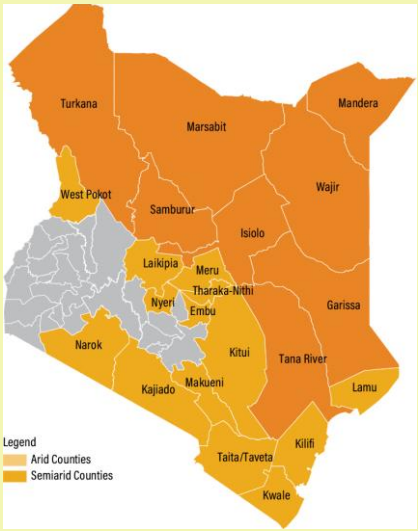
Rangeland grasses and legumes play a crucial role in supporting pastoral livelihoods and maintaining ecological balance in these areas.

Overgrazing, soil erosion, and climate change have led to the degradation of these grasslands, leading to a decline in biodiversity, and productivity.

People in the ASALs areas in Kenya depend on drylands for a variety of goods, products, and services. ASALs are particularly vulnerable to unsustainable land use and climate change, leading to severe degradation of these ecosystems.

Reseeding is a crucial strategy for rehabilitating these degraded rangelands and restoring their ecological and economic values.

Map of Kenya showing counties on the ASALs



Cattle on the way to graze in the ASALs

Introduction

Shortage of feed is a major problem facing livestock farmers in ASALs. This can be aggravated by frequent droughts, soil erosion, climate change, and overgrazing of the available pastures by both livestock and wildlife.

Rangeland reseeding using naturally adapted pasture grasses can improve forage production and provide a steady supply of good quality feed.

Reseeding for pasture recovery in ASALs is a process of introducing new seedlings or seeds to an area to create a more robust and varied pasture.

This helps to replenish soil fertility, increase water retention and reduce soil erosion, as well as improve grazing capacity.

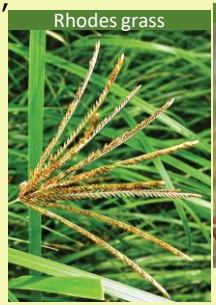
Reseeding with rangeland grass and legume species

Rangeland grass species:

- Rhodes grass (*Chloris ssp*),
- Guinea grass (*Panicum maximum*),
- African foxtail grass/Buffel grass (*Cenchrus ciliaris*),
- Bush rye grass (*Enteropogon macrostachyus*),
- Maasai Love grass(*Eragrostis superba*),
- Red oat grass (*Themeda triandra*),
- Star grass (*Cynodon ssp*).

Rangeland legumes species:

- Stylo (*Stylosannthes ssp*),
- Tropical kudzo (*Pueraria phaseoloides*),
- Siratro (*Macroptilium atropurpureum*),
- Butterfly pea (*Clitoria ternatea).*


Rhodes grass


Red oat grass


Rangelands pastures are shared between livestock and wild animals


Desmodium


Stylo

How climate change has affected forage production in ASALs

Climate change has had a significant effect on forage production in the arid and semi-arid lands (ASALs) of Kenya.

Increase in average day temperatures and decrease in rainfall will have a decrease in vegetation cover, in these vulnerable ecosystems resulting in a reduction of forage availability for livestock.

Less forage availability will cause a decrease in livestock production, which will in turn impact the livelihoods of livestock keepers in the region.

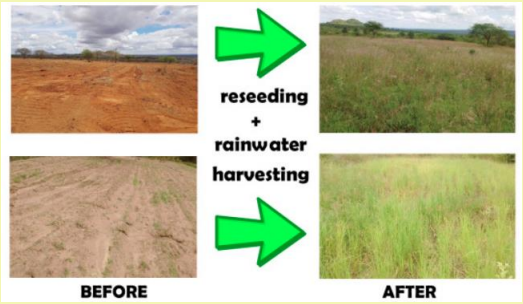
Rising day temperatures will cause a decrease in water availability in ASALs, for example in water pans, dams, or rivers the evaporation rate will increase.

This is likely to cause now and in the future an increase in water stress for both livestock and humans, as well as a decrease in soil moisture levels.

A rise in extreme weather events such as droughts, floods and storms has caused further disruptions to forage production and has had a detrimental effect on livestock production.

These extreme weather events have also caused increased erosion and land degradation, further reducing the amount of available forage.

Changes in climate will cause a decrease in biodiversity in the ASALs regions, for example, some species are unable to adapt to the changes in temperature and rainfall. This will likely have a negative impact on herbage (forage) production and availability.



Example of after resending and rainwater harvesting

Rain gauge

How overgrazing has affected the ASALs degradation of pastures

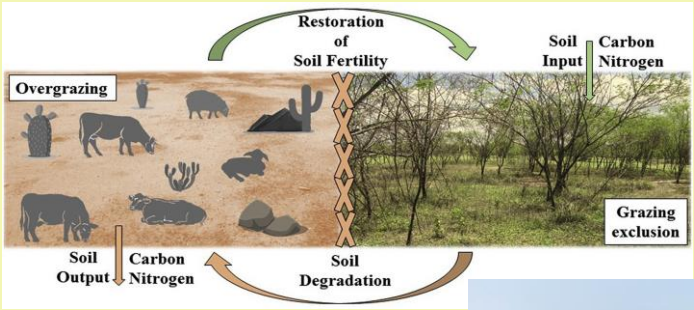
Overgrazing has had a significant impact on the ASALs leading to the degradation of pastures. Overgrazing occurs when livestock consume more vegetation than the land can produce, leading to land degradation. This can cause a decrease in plant cover, soil erosion, soil compaction, and the loss of soil fertility.

These changes have a direct impact on the pastoralists of these regions, who rely on the vegetation for their livelihoods. Overgrazing has been aggravated by a number of factors, including increasing population pressure, the use of traditional grazing practices, and a lack of access to markets for livestock and livestock products.

The result has been a rapid decline in the productivity of pastures, leading to a decrease in soil fertility, water availability, and the loss of plant cover.

This has been aggravated by the effects of climate change, which has caused shifts in precipitation patterns, leading to longer dry spells and more extreme weather events.

To address the issue of overgrazing the poor practices have to be changed. These include the establishment of rangeland management plans, the promotion of communal grazing areas, and the introduction of payment for grazing areas.



Comparison between overgrazed fields with rested fields.

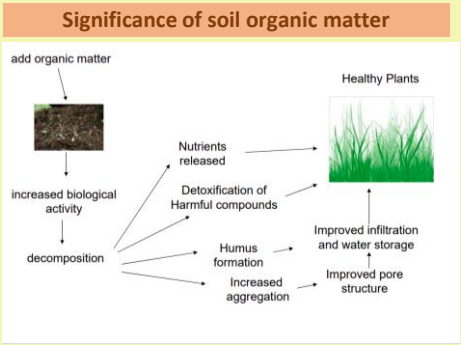
Advantages of reseeding of the ASALs

Improves soil fertility

After reseeding the new vegetation helps to replenish soil fertility, increase water retention and reduce soil erosion, as well as improve grazing capacity.

This process of replenishing soil fertility involves incorporating organic matter, such as dying plant parts of grasses and legumes which cover the soil. Plant residues left into or onto the soil improve physical, chemical, and biological properties.

This helps to increase soil fertility, improve soil structure and improve the availability of nutrients to plants.



Water retention and erosion

Reseeding, once the plants have established and developed a robust root system, helps to improve water infiltration and storage, reducing the risk of erosion and increasing the capacity for water retention.

This will in time also help to increase the water-holding capacity of the soil and reduce runoff.

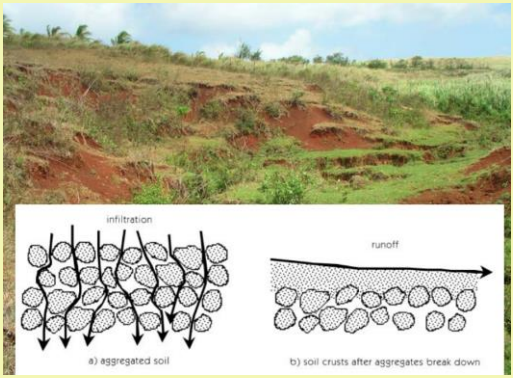


Illustration of the difference between infiltration and runoff

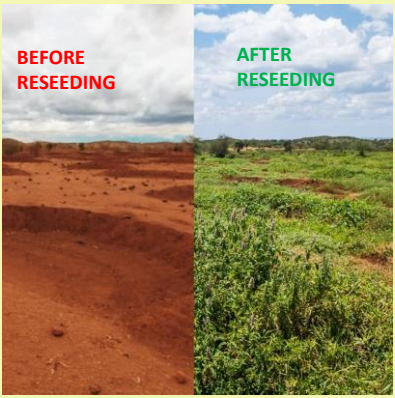
Benefits of rangeland pasture reseeding to humans and animals

Increase in production of good quality and grazing capacity,

Increased availability of livestock feed, which will increase the yields of livestock products and increase livestock production per acre,

Increased household incomes from the sale of surplus hay, seeds, and straw,

Improve food security and enhance biodiversity.



Comparison between before reseeding and after reseeding

A comprehensive guide on arid and semi-arid reseeding with rangeland grass and legumes

Step 1: Site Selection

The first step when reseeding rangeland or certain areas within an existing landscape is to select suitable sites for reseeding.

The selection process should take into account the ecological, economic, and social factors that influence the success of reseeding.

A community learning how to work together to restore their grazing fields

Key factors to consider when reseeding:

- Soil type and soil fertility,
- The sites slope (angle) and aspect (the orientation of the slope),
- Water availability and distribution,
- Climate and weather patterns,
- Vegetation cover and biodiversity,
- Grazing pressure and intensity,
- Land tenure and ownership,

Once suitable sites have been identified, it is essential to engage with the local communities and stakeholders to ensure their participation and support.

Site visit to identify the rangeland region to be set aside for reseeding

Step 2: Seed Selection

The success of a reseeding project largely depends on the selection of appropriate grass and legume species.

It is important to select species that are adapted to the local conditions and can tolerate the harsh climate and soils of the area. The seed should also be of good quality and free of contaminants.

They should also be able to provide the desired ecological and economic benefits, such as improving soil fertility, enhancing biodiversity, and providing high-quality forage for livestock.

Seed selection and sorting to determine quality of seeds before reseeding

Rangeland grass species

- Rhodes grass (*Chloris ssp*),
- Guinea grass (*Panicum maximum*),
- African foxtail grass/Buffel grass (*Cenchrus ciliaris*),
- Bush rye grass (*Enteropogon macrostachyus*),
- Maasai Love grass(*Eragrostis superba*),
- Red oat grass (*Themeda triandra*),
- Star grass (*Cynodon ssp*).


Red oat grass


Rhodes grass


Bush rye grass


Maasai Love grass


African foxtail grass

Rangeland Legume species

Stylo (*Stylosannthes spp*),
Tropical kudzo (*Pueraria phaseoloides*),
Siratro (*Macroptilium atropurpureum*),
Butterfly pea (*Clitoria ternatea).*


Stylo


Tropical kudzo


Siratro


Butterfly pea

Step 3: Seedbed Preparation

The success of reseeding largely depends on the condition of the seedbed.

The soil should ideally be loosened (1-3 cm) for good seed-soil contact and proper seedling emergence.

To keep the vegetation short before and after reseeding to reduce competition with the existing vegetation.

Importance of land Preparation

- Loosens the soil surface
- Reduces the rate of runoff hence controls soil erosion
- Enables better infiltration of rain water into the soil
- Eases the penetration of roots of the crop into the soil
- Prevents grass seed from being blown away by wind
- Removes all weeds to give the target crop a head start after planting

The soil loosened before reseeding

Step 4: Seed Sowing

Planting techniques should be based on the local environment, such as planting in rows or broadcast sowing.

Seed sowing can be done manually or using specialized equipment such as seed drills or broadcast seeders.

The seeding rate will depend on the species and the desired level of ground cover.

In general, a seeding rate of 10-15 kg/ha for grasses and 2-5 kg/ha for legumes is recommended.

The seeds should be sown at the appropriate depth, usually between 1-3 cm, depending on the size of the seed.

Reseeding by broadcasting on the pastures

Step 5: Post-Seeding Management

Proper management and maintenance of the rangeland are essential to ensure its success. After sowing, the newly seeded area should be protected from grazing and trampling for at least 6-12 months to allow for proper seedling establishment.

It is also essential to provide adequate moisture and nutrient supply during this period.

Depending on the species and site conditions, the newly established grass and legumes may take 6-12 months because they need to develop strong and robust root systems that can withstand animal trampling and grazing.

It will therefore take time to establish and provide significant forage production.

It is important to keep in mind that reseeding is an intensive process (manual labour and type of machinery) that requires careful planning and management because you need to allow the grass to establish and strengthen.

Fencing the reseeded area from both livestock and wild animals.

Fencing the reseeded area

Electric fencing is an effective way to protect newly seeded areas in arid and semi-arid lands (ASALs).

This type of fencing helps to keep out livestock and wild animals that may be attracted to the rested vegetation.

The electric fence should be placed at least one meter away from the reseeded area to ensure that any wildlife that comes in contact with it will be discouraged from entering.

Fencing next to the benefits of reseeding will also allow the existing vegetation to recover and increase in vigor, resulting in an overall improvement of the plant population in the area.

When the fence is installed, it should have a good power source (for example solar energy) and a reliable grounding system to ensure it is effective in keeping out unwanted animals.

The fence should also be checked regularly to make sure it is still functioning properly.

Additionally, it is important to remember to turn off the power when not in use to avoid any shocks or other injuries.

Electric fence with wires and wooden posts.

Newly germinated seeds needs time to develop a robust the root system.

Different reseeding strategies

Reseeding by leaving the existing vegetation

Reseeding is also called the gap filling method, it is an economical and low-input form of reseeding in the ASALs that helps to improve vegetation diversity and biomass production.

This technique involves leaving the existing vegetation in place and introducing new species to fill any gaps.

It is especially useful in areas with degraded soils and sparse vegetation.

Reseeding provides quick results and can be a cost-effective solution for re-vegetation in ASALs.

Example of a field that needs to be reseeded because the vegetation is scattered.

Reseeding by removing the existing vegetation (cultivation in the rangelands)

Reseeding by removing the existing vegetation in rangeland ASALs involves a multi-step process. First, the existing vegetation is cleared from the selected area.

This can be done either manually by hand or with the help of special machinery that can be used in rangelands such as a chisel plough or a disc harrow.

Once the area is cleared, the soil must be prepared for seeding. This involves loosening the soil, amending the soil with nutrients, and leveling the area. After the soil is ready, the appropriate seeds can be selected and spread across the area.

Finally, proper management should be done that includes fencing the area to avoid grazing animals, as well as providing adequate moisture and nutrients.

Chisel plough

Disc harrow

Reseeding using animals to distribute seed

In order to seed a pasture, seeds has to be deposited onto the soil. This can be done manually by hand, or it can be done mechanically or by animals.

For cattle to deposit the seeds the most common method is to mix seeds through their feed. Then the animals will deposit the seed through their manure.

This method has the advantage that it is relatively cheap and easy to do. The manure from cattle contains the seed, which can then be spread on the soil.

This method of reseeding allows farmers to quickly and easily increase the fertility of their soil without having to buy or transport large amounts of seed or fertilizer.

It also helps to spread out the seed more evenly, allowing for a better germination rate and a more even distribution of nutrients.

The manure acts as a medium for the seeds to germinate in the dry environment because it contains moisture and nutrients needed for development.

If the seeds are harvested at the very mature stage (ripe stage) they can not be digested by the cow. This is because the seeds have a protective layer covering them that can not be broken down by cows.

The seeds will pass through the cows' digestive system intact and be deposited in the manure, which can then be used for reseeding.

Cows feeding of feeds mixed with seeds intended for reseeding through dunging

A cow's dung with visible seeds that were either intentionally fed to the cows or consumed after grazing on pastures that are in the seeding stage.

The rate/amount of seeds in the feeds of cows

The amount of seeds that can be fed to cattle for reseeding pastures in ASALs depends on several factors, such as the type of seed being used, the nutritional needs of the cattle, and the size and condition of the grassland to be reseeded.

Generally, it is recommended that cattle should consume no more than 5-10 kg of seed per head per month (150-300grams per day).

The type of seed used for reseeding pastures in ASALs should be selected based on the local climate, soil type, and other environmental factors.

Furthermore, the nutritional requirements of the cattle must also be taken into consideration when selecting the seed.

Additionally, the size and condition of the pasture should be assessed to determine the amount of seed that needs to be used.

Moisture to support reseeding

Rainfall water

Due to the unpredictable nature of rainfall in ASALs, available moisture is a major limiting factor for the regrowth of pasture.

The amount of moisture available in these areas is highly variable, depending on the season and the intensity of the rainfall. In the wet season, when higher rainfall is expected, moisture levels can reach up to 35% of the soil's water-holding capacity.

However, during the dry season, when rain is scarce, moisture levels can drop to as low as 10% of the soil's water-holding capacity.

Rainfall on dry rangeland

Elders from a community selecting seeds for reseeding program

In order to maximize pasture reseeding and regrowth in ASALs, it is important to take advantage of the available moisture.

Reseed when rainfall is available for the seeds to germinate and establish.

Additionally, water harvesting and storage systems can be used to capture and store rainwater and use it to irrigate the seed to germinate and maintain them till they establish.

Flood-based irrigation and road water harvesting

Flood-based irrigation and road water harvesting are two viable and low-entry methods to boost fodder production in drylands.

A high soil moisture content and prolonged plant growth can be ensured by spreading water on the field or by capturing it through trenches.

These will allow the water time to infiltrate slowly, this water will move in both vertical and lateral directions, thus recharging groundwater and soil moisture.

Systematically introducing the spreading of short term floods from ephemeral rivers and from road drainage combined with water retention in trenches will lead to an increase of soil moisture levels.

Water dams either natural or man-made can be used to store water for irrigation

Contraction of trenches to hold water during rainy seasons

This can revitalize drylands into a highly productive production system in terms of return to labour. Growing fodder with flood and road drainage water has several advantages;

- It turns a threat (flood/drainage water) into an asset,
- It reliefs the pressure on the dry rangelands and creates an economically rewarding production system,
- It requires almost no land preparation and hence it can also be applied in areas that are short in skills and labour.

Evidence showing vegetation development where water was held in the trenches.

Bunds

Bunds are pits in the ground in the shape of a crescent moon. By digging, the hard top layer of the earth is opened up, ensuring rainwater is retained.

These special holes capture rain which would otherwise wash away over the dry and barren soil. The rainwater is slowed down and stored temporarily behind the bund, enabling the water to infiltrate the soil.

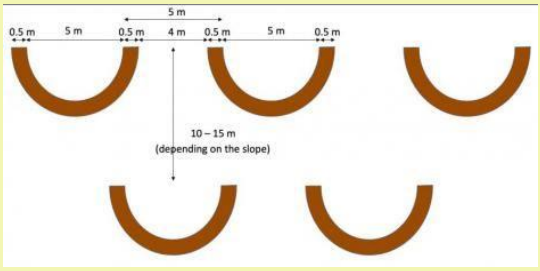
Seeds which are present in the soil start to grow and re-green the bunds and also the spaces in between. And further destructive erosion by gullies is prevented and even reversed.

The semi-circular shape of the bunds is an optimal balance between the amount of water captured and the labor requirements.

The holes are 2.5 meters long and 5 meters wide, which is estimated to be the size of an adult elephant.

They are dug on slopes, with the 'closed' side of the bunds directing downhills. This way they can capture the water running downhill.

They do not only capture the rainwater, they also make sure that the water running downhills in between the bunds is slowed down. Now the water also has a chance to enter the soil in between the bunds.



Diagrammatic expression of the rainwater harvesting bund
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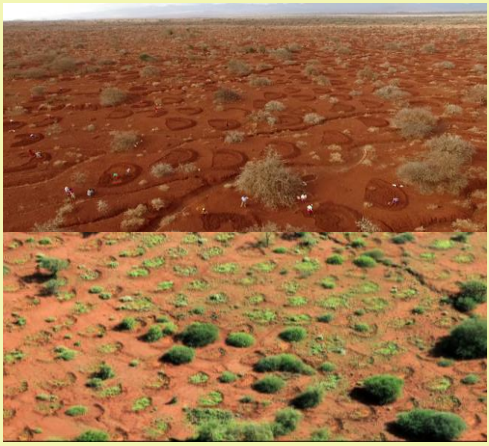

Evidence of vegetation growing in areas where rainwater was stored temporarily behind the bund, enabling the water to infiltrate the soil.

Ministry of Foreign Affairs of the Netherlands

About the ICSIAPL Project

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KALRO
Kenya Agricultural & Livestock Research Organization

SNV