

KP15

Knowledge Product 15



DECISION TOOL: Climate Smart Pasture and Rangeland Management Options for Livestock in the SADC region

CLIMATE SMART AGRICULTURE
KNOWLEDGE PRODUCTS FOR EXTENSION WORKERS
Customised Information Tools for Agricultural Professionals

Audience: Local Level Extension Staff (Government, NGO/Civil Society, Private Sector)



Livestock



Decision
Point



Gender



Youth



Climate
Smart



Practice



Wursten, 2006



Implemented by:





WHAT IS CLIMATE SMART AGRICULTURE (CSA)?

CSA comprises three interlinked pillars, which need to be addressed to achieve the overall goals of food security and sustainable development:

1. **Productivity:** Sustainably increase productivity and incomes from agriculture, without negative impacts on the environment
2. **Resilience:** Reduce exposure of farmers to short-term risks, while building capacity to adapt and prosper in the face of shocks and the longer-term stresses (resilience). Attention is given to protecting ecosystem services, maintaining productivity and our ability to adapt to climate changes
3. **Mitigation:** Wherever and whenever possible, CSA should help to reduce and/or remove greenhouse gas (GHG) emissions. This implies that we reduce emissions for each unit of agricultural product (e.g., through decreasing use of fossil fuel, improving agricultural productivity and increasing vegetation cover).

CSA = Sustainable Agriculture + Resilience – Emissions.

How is CSA Different?

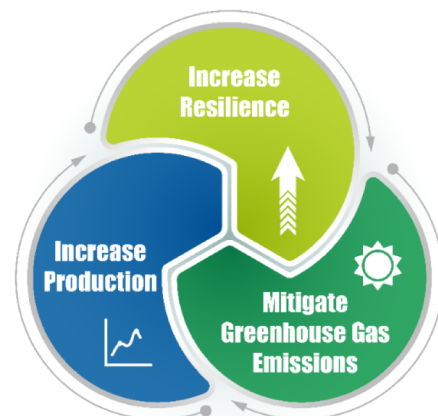
1. CSA places greater emphasis on **hazard and vulnerability assessments** and **emphasises weather forecasting** (short term) and **climate scenario modelling** (long term) in the decision-making process for new agricultural interventions
2. CSA promotes the **scaling up of approaches** that achieve **triple wins** (increase **production**, increase **resilience** and (if possible) **mitigate GHG emissions**), while at the same time **reducing poverty** and **enhancing ecosystem services**
3. CSA promotes a systematic approach to:
 - a. Identifying **best bet** opportunities for agricultural investment
 - b. Contextualising **best bet** options to make them **best fit** their specific context through learning and feedback loops
 - c. Ensuring the **enabling environment** is in place so that farmers (and other stakeholders) can invest in CSA practices and technologies to catalyse adoption.

Key Messages:

1. To make climate smart decisions on which climate smart pasture and rangeland management options for livestock best suit your farmers, you need to understand:
 - a. The farming system
 - b. How livestock is currently managed within the system
 - c. Farmers' perceptions of problems and opportunities
2. Climate smart pasture and rangeland management options include:
 - a. Improving carrying capacity
 - b. Planting legumes
 - c. Encouraging and planting fodder shrubs and trees
 - d. Increasing pasture palatability and acceptability by reducing undesirable species encroachment
 - e. Range (ecological/vegetation) trend monitoring
 - f. Cutting and carrying fodder
 - g. Introducing rotational grazing.

Entry Points for CSA

- CSA practices and technologies
- CSA systems approaches
- Enabling environments for CSA.



CLIMATE SMART PASTURE AND RANGELAND MANAGEMENT OPTIONS FOR LIVESTOCK

This **Decision Tool** aims to help field-level extension staff make **climate smart decisions** on which pasture/rangeland management options best suit their farmers' context. This tool is not designed as a technical guide to implementation. It is designed to assist extension staff in making climate smart decisions on improvements to their farming systems with their clients/farmers. Reference to technical guides relevant to the practices and technologies outlined are included at the end of the tool. The tool focuses on some of the **Best Bet Climate Smart Pasture and Rangeland Management Options** for livestock production in the Southern African Development Community (SADC) region. These are just some of the options available.

They are listed in no particular order and have been selected as best bet due to the following factors:

- They are climate smart (see Table 1)
- They are applicable in multiple agro-ecological zones across the region
- They have high potential to address major constraints to range livestock production in the region (also see Table 1).

These are **Best Bet** options. An understanding of the local context and farmer priorities is required in order to make these options **Best Fit** to individual farmer's needs.

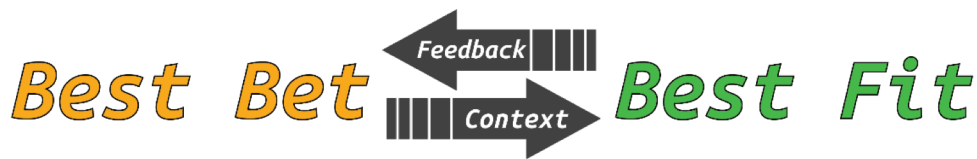




Table 1: Best Bet Climate Smart Pasture and Rangeland Management Options for Livestock in the SADC Region.

Climate Smart Pasture/ Rangeland Management Option	What is it?	3 Pillars of CSA		
		Increase production	Resilience / adaptation	Mitigate GHG emissions if possible
Carrying capacity improvement	Improving the quality of pasture and rangeland so that it can sustainably support the maximum number of livestock units	Higher meat and/or dairy production per unit area	Improved pasture (through proper management) allows higher numbers without retrogression, thus more resilient – even to drought conditions, erosion, flooding, etc.	Increases soil organic matter and plants – thus locks more carbon (carbon sequestration)
Planting legumes	Planting legumes in rangeland to be eaten as fodder; at the same time enriching the soil, thus enhancing growth of other fodder plants through nitrogen fixation	Higher meat and/or dairy production per unit area	Improved pasture will be more resilient to drought, erosion, flooding, etc.	Increases plant biomass; subsequently increases soil organic matter – locks more carbon
Encouraging and planting fodder shrubs and trees	Encouraging and planting specific woody species that livestock are known to graze and browse (leaves, seeds and fruit)	Higher meat and/or dairy production per unit area	Diversification of diet can mitigate the effects of drought on availability of fodder in pasture/ rangeland. Co-benefits in improving soil fertility and reducing erosion	Woody shrubs and trees lock carbon
Increasing pasture palatability and acceptability	Improving the composition of the pasture to make it ‘tastier’ for livestock through management practices, and/or introduction of more palatable species (grasses/trees/shrubs)	Higher meat and/or dairy production per unit area; or, time spent eating (increases efficiency)	Uniform distribution of pasture/shrub species ensures adequate soil cover and use thus limitation of soil exposure	Woody shrubs and trees lock carbon
Introducing rotational grazing	Grazing livestock in an area (paddock) for a fixed period; then moving them to another paddock to allow regrowth	Increased productivity per unit area	Gives land time to recover after grazing, and hence it becomes more resilient to extremes	Increases vegetation cover and soil organic matter, and locks carbon
Cutting and carrying fodder	Is an intensive grazing system where fodder is grown in an area, or natural fodder allowed to grow; then cutting it during time of plenty (rainy season) and feeding it to animals in corals or kolas	Fodder is harvested, as more than one harvest can be done during time of plenty, and preserved for later – instead of leaving it as standing hay, and to allow animals to graze on the stored surplus	Reduces pressure of grazing by limiting periods when animals tread on the land – thereby reducing denudation at critical periods (with less cover)	N/A

4 / CLIMATE SMART PASTURE/RANGELAND MANAGEMENT OPTIONS FOR LIVESTOCK



Climate Smart Practices that target improvements in pasture and rangeland resources can result in the following benefits:

- Faster animal growth rates
- Higher milk production
- Earlier age at first calving or lambing
- Increased incomes
- Increased fertility rates
- Reduced mortality rates
- Reduced soil erosion
- Increased soil fertility.

WHICH CLIMATE SMART LAND PASTURE RANGELAND MANAGEMENT OPTION IS BEST SUITED TO YOUR FARMER(S)?

The **International Livestock Research Institute (ILRI)** has developed a tool to help extension staff select the most appropriate options for managing feed resources in livestock production systems: the **Feed Assessment Tool (FEAST)**.

The following sections are based on the standard questions in the FEAST methodology. To decide with your farmers on the most suitable climate smart options for pasture and rangeland management, you should discuss the following:

- The farming system
- How livestock are currently managed within the system
- The farmers' perceptions of problems and opportunities.

A deep understanding of the context will help you to develop **Best Fit** rather than just **Best Bet** options for pasture rangeland management.

THE FARMING SYSTEM

Farming systems are varied and complex across the region. A farmer may only have one specific type of livestock as their sole source of income, or they may have several types of livestock as well as crops – and each part of the system may impact on another. Most smallholders will have a diverse farming system in which livestock plays a key role. It is important to take time to understand the system and what influences it before selecting climate smart pasture and rangeland management options. The following are questions that will help you when discussing and analysing the farming system.

- Who **owns the land** and how is it passed from one generation to the next?
- Is land owned by the community or individually, or both?
- Is land owned by men or women or both?
- Where is community-owned land and where is individually-owned land? A resource map may be useful here.

- **Where is water sourced** and who has access to this water?
 - Is access equal for men and women?
 - Are there some groups who have more access than others?
 - What limits access for a farmer (male and female)?
- If land is traditionally used by pastoralists, **is this land being encroached** by agropastoralists and/or for cropping?
 - Have migration routes been demarcated?
 - Are there any conflicts or dispute resolution structures?
 - »Do these work well?
 - »How many farmers with how much livestock are using the pastoral land, and how has this changed over time?

- What are the **rainfall patterns** locally?
 - In which months does it rain, and how much?
 - Has this been changing over time?
 - Were prolonged periods of drought experienced in the past?
 - What does the local meteorological office predict for the future?

- What crops are grown on the farm?
 - What is the typical yield?
 - What is done with crop residues?





HOW ARE LIVESTOCK CURRENTLY MANAGED WITHIN THE FARMING SYSTEM

- What is the **status of the soil**?
 - Slope, texture, organic matter content, soil moisture, etc.
 - Are there specific areas prone to erosion?

- When are the main **cropping and grazing seasons**?
 - Developing a detailed agricultural calendar is a smart way to identify changes throughout the year

- **What livestock** is included in the farming system(s)?
 - Does the farming system include more than one type of livestock (e.g., chickens, goats and cows)?

- What are the **sources of credit**?
 - Is credit equally accessible to all farmers (men, women, other subgroups)?
 - What are the repayment conditions?

- Where do farmers **access agricultural inputs**?
 - Is access equal for men, women and other subgroups?
 - What limits farmer access?

- Have there been **changes in land use** over the past number of years (lifetime of the farmers)?
 - What changes?
 - Why/why not?

- Are there any **agricultural projects** in the target area?
 - Whom are these targeting?
 - Can these be leveraged to help support climate smart pasture and rangeland management?

- What are the **sources of household income**:
 - What are the main contributors to household income?
 - How much does income from livestock contribute to total household income?

To make climate smart decisions on pasture and rangeland management options, discuss with your farmer/s current management practices for each type of livestock in the farming system, including the following:

- What are the **livestock holdings**?
 - What type and how many animals (age, males and females)?
- What time of **livestock housing** is being employed?
 - What housing structures are utilised, if any?
 - What bedding is used, if any?
 - What housing times are provided – are there day, night and/or seasonal changes?
 - Are animals all housed together, or are they separated by age, sex and/or species?
 - Are feeding troughs provided?
 - Where is manure collected, if at all?
 - How often is manure collected and what is it used for?
- How are **watering points** managed?
 - Where are the watering points?
 - Is there sufficient water throughout the year?
 - Who provides water to the livestock?
 - How long does this take?

- How is **livestock feeding** undertaken and managed?

- Is livestock being stall-fed or tethered, or do they graze openly – or a combination of these?
- How does this change over the seasons and years?
- Where do animals graze (if they do) and how long is this for?
- What plants, residues, crops and/or trees do animals feed on?
- How do feeding habits change throughout the year?

- Is **cultivated fodder** used?

- What are the main types of crops planted on the farm, specifically as forage material for livestock feeding (including trees)?
- How much land is used for each crop?

- Is **collected fodder** used on the farm?

- Does the farming household collect any naturally occurring fodder material?
- If so, what is it, and how much does this source of feed contribute to the diet of the animals (as a percentage)?
- If so, who is collecting the fodder? (men, women, youth or labourers)

- Is animal **feed purchased**?

- What feeds does the farmer purchase, if any?
- How does this change throughout the year (or from season to season)?
- How much does this cost?

- Does the farmer **process fodder** for use on the farm?

- Is any of the fodder processed (e.g., chopped, baled, silage or hay)

- **Use of livestock** within the farming system:

- Do the animals graze?
- If so, how much does this source of feed contribute to the diet of the animals (as a percentage)?
- Why does the farmer keep each type of livestock?
 - » For own consumption or sale (meat, dairy or other products)

- »As a coping strategy (e.g., sale in lean periods)

- »As a status symbol

- »As draught animals

- »For transportation

- »For manure for crops and/or fuel

- »A combination of reasons

- Are **livestock and livestock products sold**?

- How many animals has the farmer sold over the past three years, and what were their weights?
- How much did the farmer receive per head of livestock sold?
- What is the overall milk production from the farmer's animals?
- How much did the farmer receive per litre of milk?
- Were any of the sales a response to drought or over-grazing of pasture and/or rangeland?

- What are the **labour requirements**?

- Who performs each animal husbandry task (men, women, children)?
- How much time is spent on each task?
- Do any tasks require hired labour and if so, how much does this cost?

- How does **seasonality** affect the farm system?

- What are the sources of feed for each month of the year?
 - » This can be added to a seasonal calendar if you have one
- How much does feed availability vary over the course of a typical year?
- Do labour requirements change throughout the year (for men, women, children)?
- Do animals move from one area to another throughout the year?



FARMERS PERCEPTIONS OF PROBLEMS & OPPORTUNITIES

To select the **best fit** climate smart pasture and rangeland management options for livestock, explore with your farmer/s what they think their main problems and opportunities are. Table 2 outlines a simple problem–solution matrix that can be used.

- List the major problems faced by farmers in the area with reference livestock production
 - Do not limit the discussion to pasture and rangeland, as systems can be complex. For example, issues in relation to sorghum production may impact on availability of crop residues as supplementary feed
- What do farmers view as the solution to these identified problems?
 - It is always best to start with a discussion of local solutions, as these are much more likely to be adopted than external ideas?

These can then be ranked, using a simple pairwise ranking tool (see Table 3).

CLIMATE-RELATED RISKS IN PASTURE AND RANGELAND MANAGEMENT

Increasing temperatures and associated heat stress, delayed and shorter periods of rain, droughts and other extreme events such as wildfires and flooding, negatively affect the productivity of pastures and rangelands – livestock suffer from feed and water scarcity. Already existing problems, such as the overuse of natural resources, are aggravated by climate change and variability.

The local meteorological office can provide data on already observed and expected future changes of weather patterns and extremes. It is also important to discuss the perceptions and climate-related experiences of the farmer:

- What changes in rainfall and temperature, as well as seasons, did the farmer observe?
- What kind of climate-related hazards did the farmer experience in the past (flooding, storm damage, drought and/or fire)?

Table 2: Farmer perceptions of problems faced in livestock production.

Problem	Solution
1	
2	
3	
4	
5 ¹	

¹Include more than five problems if you wish.

Table 3: Pairwise ranking template.

Pair	Problem considered more important
Problem 1 vs Problem 2	
Problem 1 vs Problem 3	
Problem 1 vs Problem 4	
Problem 1 vs Problem 5	
Problem 2 vs Problem 3	
Problem 2 vs Problem 4	
Problem 2 vs Problem 5	
Problem 3 vs Problem 4	
Problem 3 vs Problem 5	
Problem 4 vs Problem 5	

- How did these affect productivity of pasture and rangeland:
 - Composition of the forage
 - Availability of water
 - Duration of pasture in field
 - Carrying capacity
 - Harvesting
 - Soil cover?
- What damages and losses were experienced? If possible, damages and losses can be quantified
- What stop-gap measures were instituted to mitigate the effects of the risks and avoid heavy losses (e.g., animal relocation, purchase of pastures from neighbors, culling, creation of additional storage structures, or obtaining risk insurance)?

The next section discusses what could be done in future to mitigate climate risks to pastures and rangelands.



BEST BET PASTURE AND RANGELAND MANAGEMENT OPTIONS FOR ADDRESSING CLIMATE RISKS IN LIVESTOCK PRODUCTION

Below are four climate smart pasture and rangeland management options for livestock. They are listed in no particular order. All are broadly applicable across the SADC region. In many instances a combination of these options will give optimum results. While these are best bet options, they are not universally applicable. CSA is context specific and each of these options will need to be tested under local conditions and adapted to make it **best fit** the local context.

Before assessing the feasibility of the **climate smart pasture and rangeland management options**, the carrying capacity should be discussed with the farmer.

DEFINING CARRYING CAPACITY

The carrying capacity (CC) of pastures and rangelands is the amount of grazing stock that the pasture can support, without deterioration to vegetation and or related resources, in an average year. The CC is not constant across years. The livestock should remain in good condition, if not gaining weight or producing milk, while at pasture. If livestock are losing weight and/or production is decreasing, then the carrying capacity has likely been exceeded. This assumes that animals are healthy, and that reductions in productivity are not due to pests or diseases. The range conditions will also depict the health of the range; healthy conditions (not exceeding the CC or optimal CC,) will retain the vigour, and display a good composition, of plant species.

Calculating carrying capacity accurately is complicated, time consuming, and requires specific skills and experience that are rarely available. To determine the status of the pasture and rangeland and to get an approximation of carrying capacity, a combination of **direct observation**, **indigenous knowledge** and **focus group discussions** (FGDs) can be used.

- **Direct observation** – Regular inspections of the pasture and rangeland throughout the year to assess the following:
 - Numbers of livestock
 - Health and overall condition of livestock
 - Condition of forage
 - What livestock are eating
 - The condition of the soil
 - The presence of or absence of non-palatable species (upward or downward trend).

● Focus group discussions:

- How has land use changed over time?
- How has livestock management changed over time?
 - » Has the livestock holding capacity of the land changed over time? Is there more livestock or less livestock now?
 - » Has the type of livestock changed?
 - » Do livestock feed on the same plants, shrubs and trees?
 - » Has the plant composition (foraging material) changed over time?
 - » Are livestock selective in their feeding – leaving out some previously preferred species?
- Has the size of available pasture and rangeland changed? How?
- Has the range condition changed, with certain plant species (grass, shrubs, trees) predominating/depleted; has soil cover changed over time, how?
- Have rainfall patterns changed over time?

Once the problems and potential local solutions have been identified and ranked, spend time with your farmer/s discussing the proposed solutions in more detail. Bring new ideas on solutions into the discussion, such as those just described. The **Decision Point** below outlines how establishing the context and farmer priorities lead to climate smart decisions on pasture and rangeland management.

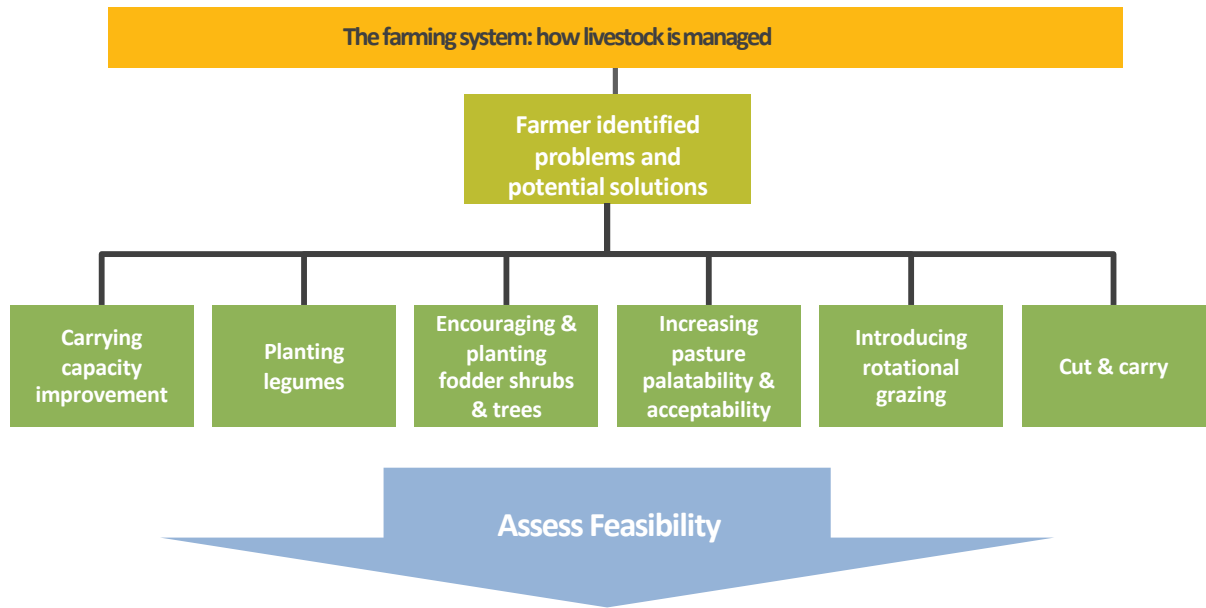
DECISION POINT



Understand context

Identify farmer priorities

Select Climate Smart pasture and rangeland management options



Regular monitoring of your range condition throughout the year will help you and your farmers to get a clearer picture of whether the carrying capacity is currently being exceeded, is at its optimum, or whether there is scope for increasing the stocking rate and when. The FGDs just mentioned will help you and your farmers to understand the trend of the range's condition, the change of land use over time, and to understand which plants may have been there in the past that are not there now.

This will help guide climate smart decisions on possible improvements. If the carrying capacity is being exceeded, then it is time to improve on the existing structures, destock and/or move out some livestock units from the land unit by either culling and selling, or moving to alternative parcels of land.

ENCOURAGING OR PLANTING FODDER SHRUBS AND TREES

There are several species of trees and shrubs that are palatable to livestock. Where these grow naturally, they can be protected and encouraged through a process called **farmer managed natural regeneration** (FMNR). If these species are not present or not sufficiently available in the pasture or rangeland, they can be planted from seed or from nurseries. Pastures/rangelands can be rested by undergoing a complete growth cycle (12 months) without being grazed, to allow regeneration. The use of trees and shrubs in livestock systems is an agroforestry practice. The selection of appropriate species is crucial, as farmers are likely to prefer species that are multifunctional – for example, the following (see also KP12 – Climate Smart Agroforestry Options):

- **Forage legumes** suitable for livestock are mostly in the *Albizia*, *Calliandra*, *Cassia*, *Inga*, *Leucaena*, *Gliricidia*, and *Sesbania* genera. The leaves of these shrubs are highly nutritious, and they can be pruned periodically to encourage regrowth. They have multiple benefits including:
 - Producing green manure
 - Providing additional fodder
 - Produce nuts, fruits, bark and leaves for medicine, fodder, consumption or sale and thus increase income/ reduce costs
 - Provide timber for construction, handicraft and fuel

- **Leguminous trees** such as *Fadherbia Albida* are slow growing trees that have the following characteristics:
 - Provide fodder, through their seeds at certain times of year
 - Fix nitrogen in the soil, encouraging perennial fodder plants
 - Improve soil fertility and moisture retention through the addition of organic matter
 - Providing shade for animals
 - Function as windbreaks and thus reduce soil erosion, evaporation and physical damage

- **Non-leguminous species:** Apart from the fact that these are generally less nutritious and do not fix nitrogen in the soil, these have the same benefits as leguminous species.

It is always best to encourage locally-adapted species, that are known to farmers, rather than introducing new species. Where suitable species have disappeared, consider trying to reintroduce these. Integrating diversified fodder production with grasses and legumes within the farming system presents various advantages, ensuring the availability of different species of fodder for livestock grazing at different times of year and performing other functions – such as soil erosion control using, for example, vetiver grass

- What is the aim of the new species?
 - Extended grazing season
 - Improve diet – more balanced diet for livestock
 - Prevent soil erosion
 - Improve soil fertility

- Where will it be planted?
 - Around fields
 - On contour/marker ridges/bunds
 - Into existing pasture
 - On steep/degraded slopes, etc.



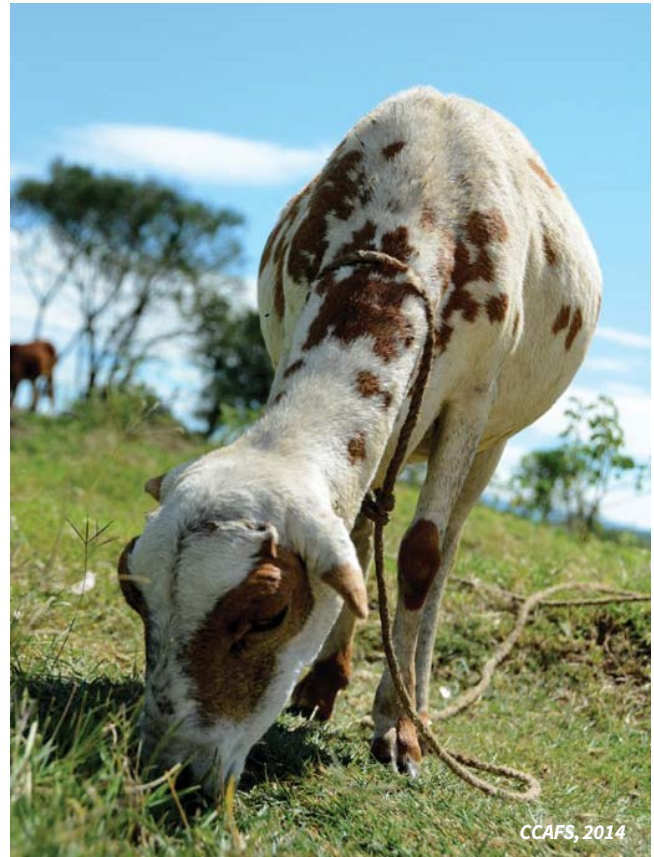
It is rare that farmers will have just one aim, especially if the pasture and rangeland are communal. It is important that as many of the farmer's aims as possible are met. This may require more than one species to be introduced. Selection of the most suitable pasture species involves the identification of grasses and legumes with the following desirable characteristics:

- The **pasture species must be adapted** to the climate and soil where they are to be sown, and suitable for their intended use (for grazing or for cut-and-carry)
- The grass or legume should be **highly productive and persistent**
- The grass or legume should be able to **provide good soil cover** and easily **compete with weed**
- It should be **palatable** (desirable to livestock)
- It should have a **high nutritive value**, that is, provide enough energy and protein, and have no toxic substances
- The species should be easy to establish from seed or vegetative propagation. Pasture plants that can be established from roots and cuttings are good because planting material can be built up with time, particularly with small-scale farmers, given the cost of pasture seed
- The species should be an **early and heavy seeder**.

INCREASING PALATABILITY & ACCEPTABILITY OF PASTURE

Palatability can be defined as plant characteristics or plant conditions that stimulate the animal to graze the plant. Having plants in the pasture and rangeland that the livestock like will result in higher levels of feeding, and increased production. Animals will select the most palatable plant in the pasture or rangeland first, and then move to less palatable plants.

The types of livestock grazing on the pasture or rangeland and their grazing habits will influence the palatability of the plants they are eating. The grazing habits of the four main animal types can generally be described as follows:



- **Horse** – short grazer
- **Sheep** – low stratum grazer
- **Goat** – multi stratum grazer/browser
- **Cattle** – high stratum grazer.

Having a combination of livestock on pasture or rangeland may enable maximum efficiency in utilization of the different layers. For example, cattle may graze the taller parts of plants – with sheep grazing the shorter plants or parts, and goats browsing on the branches of trees and shrubs. This may be efficient, but it is important to ensure that the pasture and rangeland is not overgrazed to the extent that it does not recover sufficiently.

Palatability and acceptability can be increased by introducing and promoting plants with high palatability and/or removing less palatable plants.

Over-sowing – The introduction of improved pasture species of grasses or legumes to a natural pasture – as a method of improving natural pastures – requires minimum cultivation

and little or no use of fertiliser. Over-sowing increases forage quality and productivity of natural pastures. It is the simplest and most cost-efficient pasture development strategy. Although both grasses and legumes can be used during over-sowing, the most suitable are legumes. Grasses generally have poor germination and are slow to establish on compacted soils. Benefits of over-sowing are evident after about two years.

Over-sowing is suitable in areas where you find the following conditions:

- Soils are poor and a higher cost system of pasture improvement cannot be justified
- Soils are light and/or loose
- Pastures lack good legume content.

Advantages of over-sowing are as follows:

- Very low cost for land preparation and seed purchase
- Requires less seed and little labour
- Needs minimal management
- Improves forage production
- Maintains and increases soil fertility and reduces soil erosion.

ROTATIONAL GRAZING

This is the practice of grazing an area of pasture (or paddock) and/or rangeland for a shorter period, but more intensively – and then moving the livestock to another paddock. The animals will eventually be brought back to the first pasture once it has recovered. This system is similar in principle to pastoralism, but the land is more intensively managed, and livestock are kept in a smaller area using fences and paddocks. Rotational grazing ensures pasture regrowth, and helps to maintain or improve the condition of the pasture. Usually, any given paddock is grazed for a period of one to two weeks, followed by a four-to-eight-week rest period.

This will result in optimum production of pasture, and force a break in the life cycle of most internal parasites that may be present. The grazing and resting periods should be flexible, depending on weather conditions

CUTTING AND CARRYING FODDER

'Cut and carry' is predominantly used for more **intensive livestock production**, where animals are kept **housed, penned in or tethered**, for part of or the entire year:

- At night
- During the dry season to conserve pastures
- During planting/growing seasons to stop crop damage.

The fodder can be collected from sites where it grows naturally (trees, flood plains, riverbanks, etc.) or it can be grown, especially in **fodder banks**. These are small areas that are more intensively managed to produce fodder. They are more likely to be used in intensive systems such as those with dairy cows. The fodder is cut and then carried to where the livestock are kept.

Fodder crops are high yielding and high-quality crops grown specifically for providing feed in intensive livestock grazing systems. The practice is suitable for zero-grazers and open-grazers.

Fodder crops are important for the following reasons:

- They provide a large quantity of high quality and palatable fodder within a short time
- They are acceptable to the farmer – already adopted
- They are easy to grow; the husbandry requirements are similar to other crops that are familiar to the farmer
- They provide a way of introducing farmers to the concept of improved livestock nutrition.



Disadvantages of fodder crops are as follows:

- They can be costly to produce, especially in terms of cultivation costs
- Fodder crops require an elevated level of management and husbandry practices.

Useful fodder crops include the following:

- Elephant grass (*Pennisetum purpureum*)
- Guatemala (*Tripsacum laxum*)
- Giant Setaria (*Setaria splendida*)
- Lablab (*Lablab purpureus*)
- Lucerne (*Medicago sativa*).

The use of fodder trees can overcome some of the disadvantages of fodder crops, as they only need to be replanted every 15–20 years – depending on the species and how well managed they are. These are leguminous trees and they can have multiple co-benefits:

- Provision of firewood
- Reforestation in areas where many trees have been cut down

- Soil improvement, because trees fix nitrogen. Their deep and lateral rooting habits provides a structure that stabilises the soil. The leaf-fall from trees furthermore enriches the soil

- Can be used for alley cropping, whereby the multi-purpose trees are planted as single rows in a field of food crops (see **CCARDESA KP 07 – Climate Smart Planting System Options**)

- Can be used as hedgerows, contour strips and bund stabilisers.

Certain fodder trees will grow comfortably in areas with a rainfall of 600 mm per year and above. Other fodder trees and shrubs can do well with an average annual rainfall of less than 600 mm, with some areas going as low as 200 mm – in the dry regions of tropical Africa, where they are able to withstand drought due to their deep-rooting characteristics.

Multi-purpose trees grow in varying soil types, ranging from volcanic loamy to acidic soils – hence their wide distribution. There are many different potential species, but the common fodder trees grown across the region are as follows:

- *Calliandra calothyrsus* (calliandra)
- *Gliricidia sepium* (gliricidia)
- *Sesbania sesban* (sesbania).



In areas where fodder crops and trees can only be grown during the rainy season, it may be possible to harvest excess green crops and to preserve these as silage or hay for feeding livestock during the dry season. This is known as fodder conservation.

- **Hay-making** is a process where grasses, legumes or other herbaceous plants are harvested at a time when the feeding value is high, dried quickly to conserve the high feeding value, and stored as animal fodder. The following should be considered:
 - A mixture of grasses and herbaceous legumes is desirable, because legumes increase digestibility and intake of the conserved forage
 - Most grasses are good for hay production and convenient for cutting
 - The pasture should be cut just before flowering, to have high digestibility and high protein content
 - Pasture for conservation should be cut four to six weeks after a paddock is closed
 - For good drying, the cutting should be timed between rains
 - Pasture should be cut and dried as quickly as possible, while using a rake to turn the pasture several times. This prevents mould

- Once dry, the hay should be heaped up into a 'stack' and protected from the rain. The haystack should be like an inverted 'V'. The use of a tarpaulin or polythene sheet is recommended. Alternatively, the hay can be 'baled'
- The leaves and branches of leguminous fodder trees can also be made into hay, and fed to livestock during the dry season. Branches can be cut and dried on a clean floor in the shade, or the dried, fallen leaves can be collected and stored in hessian bags. Dried leaves are fed as a protein supplement alone, or mixed in grass hay or cereal bran. To avoid wastage, the dried leaves should be mixed with some water.

- **Silage** is produced through controlled fermentation (under anaerobic conditions) of green forage material with high moisture content. The anaerobic conditions foster rapid fermentation that produces natural organic acids, which prevent further change in plant composition. If silage is made properly, it will contain nearly all the nutritive values present in the forage. Ensiling is the process of silage making; while a silo is the container used. It may be a trench, a pit, or a polythene bag.

All pasture and fodder crops can be ensiled. The most ideal would be maize and sorghum, but these are almost always grown for their grain so unlikely to be cut when still green.

High quality silage will be made if:

- Grasses are harvested when flowering
- Legumes are harvested during pod filling
- Maize and sorghum are harvested during the milk-stage.

Pastures under tropical conditions have a low feeding value, particularly the grasses. The addition of either molasses, maize bran or cassava flour will improve the quality of the silage by increasing the energy content and palatability. These additions also act as preservatives, and allow feeding in the dry season.

Video on silage making on Shamba Shape Up



Shamba Shape Up clips - Cows Feeding Silage making



FEASIBILITY

The **Decision Point** below outlines a decision tree that can be used to help make decisions on whether climate smart pasture and rangeland management options identified and selected are actually feasible in the individual farmer's context.

DECISION POINT

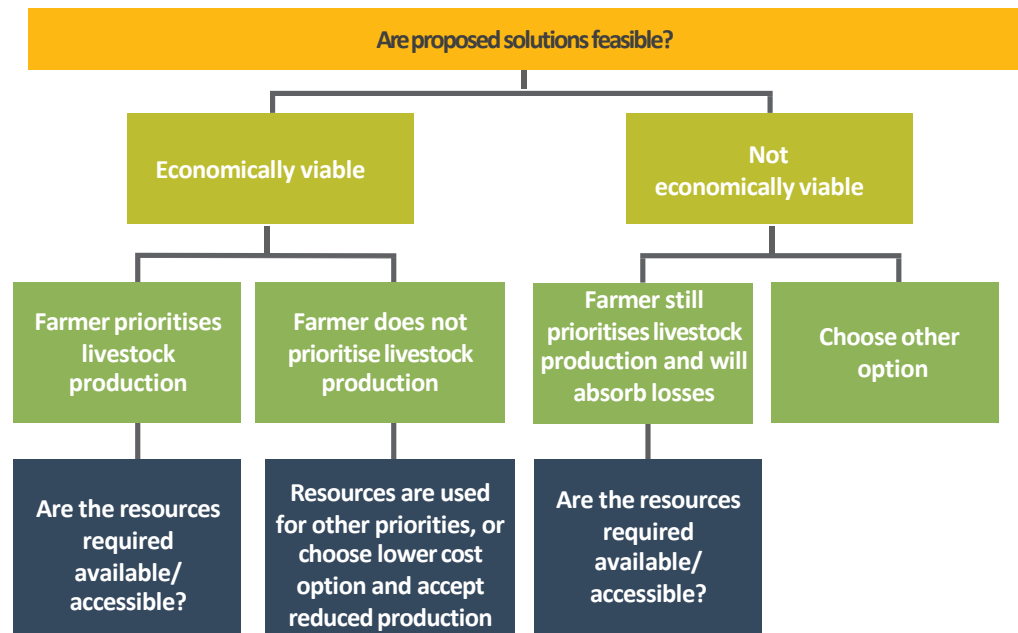


Assess alternatives

Economic context

Farmer priorities

Feasibility



Economic viability

Will the costs of the climate smart pasture and/or rangeland management option result in increased returns for the farmer, or are they unsustainable? In some cases, the farmer may lose out in the short term (high initial costs), but benefit in the longer term. Labour is a key factor that must be assessed in terms of economic viability. Farmers rarely account for the cost of their own and family labour, but will consider wage labour costs. Understanding who is responsible for key livestock management tasks is critical in assessing if there are opportunity costs associated with the option proposed. Extra labour may be required to plant trees, chop maize and sorghum residues at harvest time, or to cut and carry fodder crops. Discuss with your farmer/s the following questions:

- Who will do this work?
 - Men, women and/or children of the family, or paid labourers?

- What would they do if they were not doing these tasks? These are known as opportunity costs, and must be factored in. For example:
 - Would children miss school?
 - Would women still be able to go to the market to sell milk? How much would they sell the milk for?

Where livestock is being managed in intensive systems, such as dairy with cut and carry fodder and/or silage, it might be possible to forecast the potential costs associated with changes to more climate smart practices. This should be done by:

- Developing a cashflow forecast for the year
- Including labour requirements in the forecast
- Testing the assumptions in the forecast:
 - Will money and labour be available when it is needed?

Throughout the year, the farmer should be supported to collect accurate data on the following:

-
- Inputs
-
- Rainfall – duration and intensity
-
- Costs
-
- Labour (who and how much)
-
- Management practices (e.g., worm dose, communal grazing, repairs to sheds, etc.) and timing
-
- Productivity (milk per day, live weight-gain, etc.)
-
- Revenue generated.
-

This will enable the farmer to develop accurate **gross margins** at the end of the season. The farmer can use these to make decisions on how to improve farming practices to make them smarter, so that they are the **best fit** to their local context.

Accurate economic forecasting and analysis is not always easy as there are many factors that need to be considered. This is especially the case in more complicated farming systems, where livestock are part of agro-pastoral systems and there are more external factors to consider.

Discussing issues with your farmers can help identify major factors that might help you decide on economic viability at this stage. Collecting accurate data on **costs incurred, production attained** and **externalities** such as **climatic conditions** and/or **pest and disease outbreaks** throughout the year and reflecting on these will help you and your farmer/s make more informed decisions in the following season.

Farmer priorities

If meat and/or dairy production is a primary source of income on the farm, or livestock are a key source of draught power, pasture and rangeland management is likely to be a higher priority as it directly affects the household economic status. You should also consider the priorities of crop farmers who may not have livestock, or smaller numbers of them, as these may be directly affected by climate smart practices selected by livestock farmers. Priorities may be different for each group, but it is important to consider both – especially where communal grazing is practiced, or where crops are encroaching on pastoralist seasonal migration routes.

Livestock are often kept in mixed systems as a coping strategy, to be sold if cash is needed or as an investment or status symbol. In these systems, simply keeping the livestock alive may be more important to the farmer than ensuring optimum weight-gain and productivity. Pasture and rangeland management may be less of a priority in such cases.

Different livestock are used for a range of purposes, and may be prioritised accordingly:

-
- The bull and/or billy goat may be much more important to the farmer than calves or kids, and maintaining its productivity may come at short-term losses in productivity from other animals
-
- Cattle may be more important as a status symbol, while goats may be important for milk production for home consumption and/or sale.
-

Feasibility

Finally, you need to work with your farmers to assess if the preferred options are feasible in terms of accessibility and availability:

-
- Are the required inputs (including labour) available?
 - Where can they be sourced?
 - Will they need to be sourced regularly or once off?
 - Are savings or credit available and affordable?
-
- If available, are the required inputs accessible?
 - Will the farmer be able to access the required resources?
 - »Seeds for pasture/rangeland improvement can be hard to access
 - Are they close by?
 - Will the farmer be able to transport them?
 - Do men and women have equal access to inputs (including savings and credit)?
-



TO SUMMARISE

STEP 1: Understand the context

- What is the farming system?
- How are livestock currently managed?

STEP 2: Select 'Best Fit' options

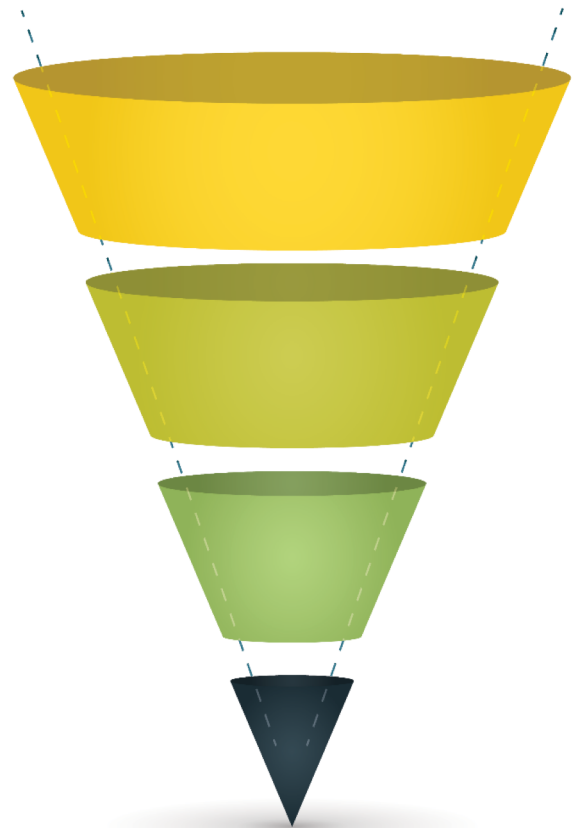
- What problems are identified by farmers?
- What local solutions are proposed?
- Are there other alternatives?

STEP 3: Assess feasibility

- Assess economic viability
- Cross-check with farmer priorities
- Are other options available?

STEP 4: Test and improve

- Try different options
- Collect data and reflect on possible improvements.



WHERE CAN I FIND MORE INFORMATION?

The following resources, which were used as reference for the development of this Knowledge Product, provide valuable additional reading on this subject. Please also refer to the CCARDESA website (www.ccardesa.org), the full series of Knowledge Products, and associated Technical Briefs.

- The [CCARDESA Knowledge Hub](#) – KPs 07, 12 and 15
- [Access Agriculture](#) – Videos on silage making and Making Concentrate Feed at home.
 - Can be very useful to show to farmers. Available in English, French and Spanish. If you sign up (free) you can get access to downloadable technical guides and much more; a valuable resource
- [Food and Agriculture Organisation of the United Nations \(FAO\)](#) – [Climate Smart Agriculture: Building Resilience to Climate Change](#) – Section IV; A Qualitative Evaluation of CSA Options in Mixed Crop-Livestock Systems in Developing Countries.
 - Provides good background information
- [International Livestock Centre for Africa \(ILCA\)](#) (predecessor of ILRI): [Forage legumes in African crop-livestock production systems](#).
 - An old resource and scientific in nature, but very useful
- [International Livestock Research Institute \(ILRI\)](#) – [FEAST](#)
 - A useful tool to help make decisions on livestock interventions
- [ILRI](#) – [The feasibility of low emissions development interventions for the East African livestock sector: Lessons from Kenya and Ethiopia](#).
 - A good overview of a range of climate smart practices that are applicable in the SADC region
- [Regional Land Management Unit](#) – [Pasture Improvement Technologies: Based on a study in Uganda](#).
 - A very practical resource that will be a useful technical guide for extension officers
- [Shamba Shape-Up](#)
 - Various valuable videos and leaflets available.