KP05
Knowledge Product 05

SOUTHERN AFRICAN DEVELOPMENT COMMUNITY · SADC · TOWARDS A COMMON FUTURE

CCARDESA
Centre for Coordination of Agricultural Research and Development for Southern Africa

OPTIONS PAPER:

Best Bet Climate Smart Agriculture Options for Livestock in SADC

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

Audience: Local Extension Staff

Livestock | Options Paper | Gender | Youth | Climate Smart | Practice | Technology

ILRI, 2008

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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. **Adaptation:** Reduce exposure of farmers to short-term risks, while building capacity to adapt and prosper in the face of shocks and 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?

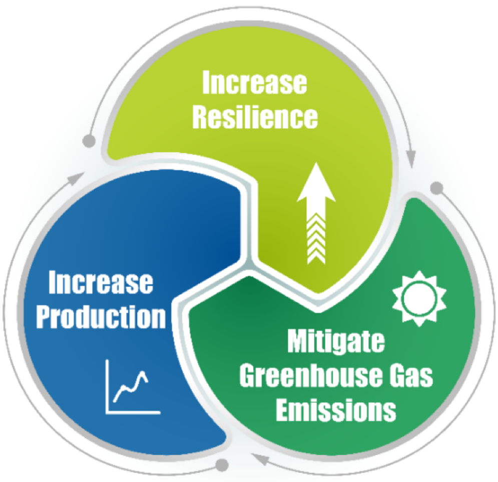
1. CSA places greater emphasis on **hazard and vulnerability assessments** and **emphasises weather forecasting** (short term) and **climate scenario modelling** (long term) in the decision-making process for new agricultural interventions
2. SA promotes the **scaling up of approaches** that achieve **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. Changes in rainfall distribution and increasing temperatures are expected to adversely affect livestock production **directly** as a result of increased heat stress and reduced water availability; and **indirectly** from reduced quality and availability of feed, and the emergence of livestock disease & increased competition for resources
2. This paper outlines some 'best bet' climate smart options for livestock production in the SADC region
3. CSA is context specific – Best Bet options should take account of the farmers' own context and priorities, and be adapted to become Best Fit CSA solutions.

Entry Points for CSA

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



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BEST BET CLIMATE SMART AGRICULTURE OPTIONS FOR LIVESTOCK IN SADC

This **Options Paper** focuses on some of the **Best Bet Climate Smart practices** and **technology** options for **Livestock Production** in the Southern African Development Community (SADC) region. These are just some of the many options available. They are listed in no particular order, and have been selected as best bet because:

- Each of them has been identified as a priority CSA option in the CSA country profiles completed so far for the SADC region (Mozambique, Zambia, Tanzania and [in draft] Malawi)
- They are widely applicable across the region
- They have high potential to address major constraints to livestock production in the region (Table 1).

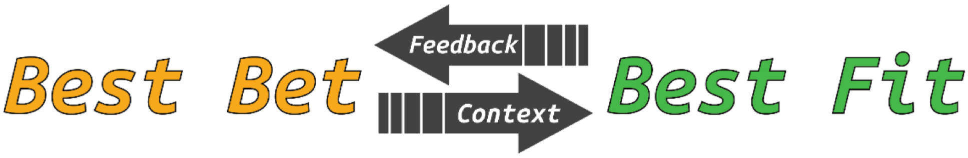

Table 1: Best Bet options for addressing climate risks to livestock production with smallholder farmers.

Best Bet Climate Smart Option for Livestock	Climate risks
Diet management	The changing climate can make feed and water availability less predictable. Ensuring animals have adequate diets throughout the year increases their productivity (weight gain/dairy/egg production/draught power, etc.) Increasing the efficiency with which livestock convert food to weight/production reduces the emissions per unit of production
Pasture/rangeland management	The livestock sector is vulnerable to the impacts of climate change through increased heat and reduced pasture productivity, especially in drought-prone dryland areas
Manure management	Overall nitrogen losses from manure are approximately 40% (IPCC, 2006). Most nitrogen is lost as ammonia (volatilisation) and nitrate (leaching and run-off). This equates to about 28 million tonnes of nitrogen, which accounts for about a quarter of the total global nitrogen use with synthetic fertilisers (FAO, 2016) Manure improves physical soil structure – reducing erosion during extreme rainfall events. Biodigesters can be used to capture greenhouse gases (GHGs) released by decomposing manure (e.g., methane) and use it as a renewable energy source, while still producing manure to be used as organic fertiliser
Genetic improvement	The global livestock sector, particularly ruminants, contributes approximately 14.5% of total anthropogenic GHG emissions (Gerber et al. 2013). Animal breeding exploits natural variation between animals (both within and between breeds) to increase productivity, reduce emissions, and to improve resilience to environmental stresses. This strategy is cost-effective, permanent and cumulative
Pest and disease management	Climate change is affecting the distribution of transboundary pests and diseases across the SADC region. Understanding the changes in the ranges of various pests and diseases through improved monitoring will help to better manage outbreaks Climate smart management of pests and diseases will result in more productive livestock. This will in turn reduce GHG emissions per unit of production

CLIMATE HAZARDS TO LIVESTOCK PRODUCTION

Climate change poses serious threats to livestock production. Increased temperatures, shifts in rainfall distribution, and increased frequency of extreme weather events are expected to adversely affect livestock production and productivity around the world in the near future. These adverse impacts can be the direct result of increased heat stress and reduced water availability. Indirect impacts can result from the reduced quality and availability of feed and fodder, the emergence of livestock disease and greater competition for resources with other sectors. Table 2 outlines the **direct** and **indirect** impacts of climate change on grazing and non-grazing livestock production systems.

The effects of climate change on livestock are likely to be widespread. The most serious impacts are anticipated in grazing systems, due to their dependence on climatic conditions and the natural resource base, and their limited adaptation opportunities. Impacts are expected to be most severe in arid and semi-arid grazing systems at low latitudes, where higher temperatures and lower rainfall are expected to reduce yields on rangelands and increase land degradation.

Table 2: Direct and indirect impacts of climate change on livestock production systems.

	Grazing system	Non-grazing system
Direct impacts	• Increased frequency and magnitude of extreme weather events, including droughts and floods • Productivity losses (physiological stress) due to temperature increase • Change in water availability (may increase or decrease, according to region)	• Change in water availability (may increase or decrease, according to region) • Increased frequency of extreme weather events (impact less acute than for extensive system)
Indirect impacts	Agro-ecological changes and ecosystem shifts leading to: • Alteration in fodder quality and quantity • Change in host–pathogen interaction, resulting in an increased incidence of emerging diseases • Disease epidemics	• Increased resource prices (e.g., feed, water and energy) • Disease epidemics • Increased cost of animal housing (e.g., cooling systems)

Source: FAO, CSA Sourcebook: Module 8

BEST BET OPTIONS FOR ADDRESSING RISKS IN LIVESTOCK PRODUCTION

Before selecting any climate smart option for improving livestock management at the farm level, it is vital to understand the farming context:

- The farming system
- How livestock are currently managed within the system
  - Who manages them?
  - What effects does weather/climate have on the management of livestock?
    - »Developing a detailed farming calendar is highly recommended
  - How is each type of livestock prioritised within the farming system?
- Farmers' perceptions of problems and opportunities
  - How do farmers currently manage problems?
  - What opportunities are they aware of to adapt to or mitigate risks?
  - Are perceptions of problems and opportunities the same for men and women?

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

To follow are five of the best bet climate smart options for livestock production. These are covered in more detail in a series of **Decision Tools** developed by CCARDESA for field level extension staff.

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Diet management

Improving the feed-to-food conversion efficiency in animal production systems is fundamental to improving the environmental sustainability of the sector. Climate smart practices and technologies that target improved feed resources can result in faster animal growth rates, higher milk/egg production, earlier age at first reproduction, increased incomes, increased fertility rates, and reduced mortality rates.

Climate smart options for improving diet management in livestock include the following:

- Use of non-conventional feeds
  - By-products of agro-industrial processes
  - Multipurpose shrubs/trees (e.g., Moringa, Neem tree)

- Improved digestibility
  - Grazing in dry season can be particularly low in nutrients and have poor digestibility
  - Options include making silage (adding molasses or urea), chocolate maize, dual purpose (fodder & grain) crops, diversifying composition of grazing sward

- Improved protein content:
  - Leguminous plants are high in protein and may be a viable source of supplementary feed or fodder for livestock
  - These can be included in rotations, alley farming or intercropping systems

- Use of supplements
  - Provided when grazing and/or browsing is not sufficient to meet production requirements
  - Supplements come in many forms, some of which are also classed as non-conventional feeds
  - Concentrates and mineral licks are among the most common supplements provided.

The **International Livestock Research Institute** (ILRI) has developed the **Feed Assessment Tool** (FEAST) to help extension staff select the most appropriate options for diet management in livestock.

See **CCARDESA KP14** for more details on making climate smart decisions on diet management options for livestock. Table 3 illustrates the climate smart credentials of diet management – identified during CSA country profiling in Malawi, where fodder shrubs were prioritised as a best bet CSA practice to be promoted.

Table 3: Fodder shrubs for goats was identified as a priority CSA intervention to be supported/promoted in Malawi.

CSA practice	Region adoption rate	Predominant farm scale	Impact on CSA Pillars: Productivity	Resilience	Mitigation
Fodder shrubs	Dedza, Mulanje, Blantyre, Mzimba 30%–40%	Small & Medium	Improves yields and hence income	Controls soil erosion and soil loss, reduces incidences of vectors and diseases, and increases biodiversity	Increases biomass, and hence enhances carbon sinking
	Chikwawa and Nsanje <30%	Small, Medium & Large			

Source: CCAFS CSA Country Profile Tanzania

Pasture/rangeland management

Pastures and rangelands are likely to be heavily affected by climate change, especially in arid areas. Longer dry spells and warmer temperatures will reduce the productivity of grazing land with indirect, adverse effects on livestock production. These effects are further compounded by expanding populations and greater demands on 'common' resources, such as grazing land.

When making climate smart decisions on pasture/rangeland management it is important to understand the farming system, how livestock are currently managed within this system, and how different types of livestock are prioritised within the system. The first step is to understand the **carrying capacity** of the pasture/rangeland. When you know how many animals can be supported from a particular area of land, you will be in a better position to make an assessment of what might be done to increase the carrying capacity; or, if it has already been exceeded, to reduce stocking rates.

There are lots of climate smart activities that can be undertaken to increase carrying capacity:

- Increasing the numbers of fodder trees/shrubs
- Increase the palatability/acceptability of pasture by understanding which types/parts of plants each livestock type prefers, and manage accordingly
- Over-sowing with specific species (clovers or grass)
- Rotational grazing and (communal) grazing plans
- Cut and carry feed.

When making decisions with your farmers, it is vital to understand each individual farmer's context – as well as the broader community/watershed context. Grazing/pastureland is usually considered a communal resource, and will require **community-level decisions**. ILRI's **Feed Assessment Tool** is an excellent resource to help extension officers to work with their farmers to develop **Best Fit** options to improve rangeland/pasture improvements. Also the **Herding for Health** programme implemented by Conservation International and Peace Parks Foundation offers a range of suitable entry points for climate-smart livestock and rangeland management practices.

See **KP15** for more details on making climate smart decisions on pasture/rangeland management options for livestock. Table 4 illustrates the climate smart credentials of replacing cattle with goats as a pasture/rangeland management option. This was identified during CSA country profiling in Mozambique.

Table 4: Substituting goats for cattle was identified as a priority CSA intervention to be supported/promoted in order to reduce pressure on available natural resources in Mozambique.

CSA practice	Region adoption rate	Predominant farm scale	Impact on CSA Pillars: Productivity	Resilience	Mitigation
Diversification of livelihoods (keeping of smaller livestock, such as goats)	Maputo, Inhambane <30 %	Large	Increases total production. Rearing of different livestock species expands the sources of income and food security	Reduces exposure to adverse climatic conditions that affect pasture/rangeland Diversifies the production	Provides moderate reduction in GHG emissions per unit of output
	Gaza <30 %	Large			

Source: CCAFS CSA Country Profile Mozambique

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Manure management

Integrated Manure Management (IMM) is the optimal, site-specific handling of livestock manure from **collection**, through **treatment** and **storage**, up to application to crops (and aquaculture). Key facts to remember:

- The housing system determines the major manure characteristics
- Immediately after excretion, nutrients may begin dissipating.

The challenge is to prevent nutrient losses in the manure chain to the extent practically possible. Initially, dung and urine are the substances excreted by the animals. As soon as **dung** is mixed with other substances like urine, water, or bedding materials, it is called **manure**.

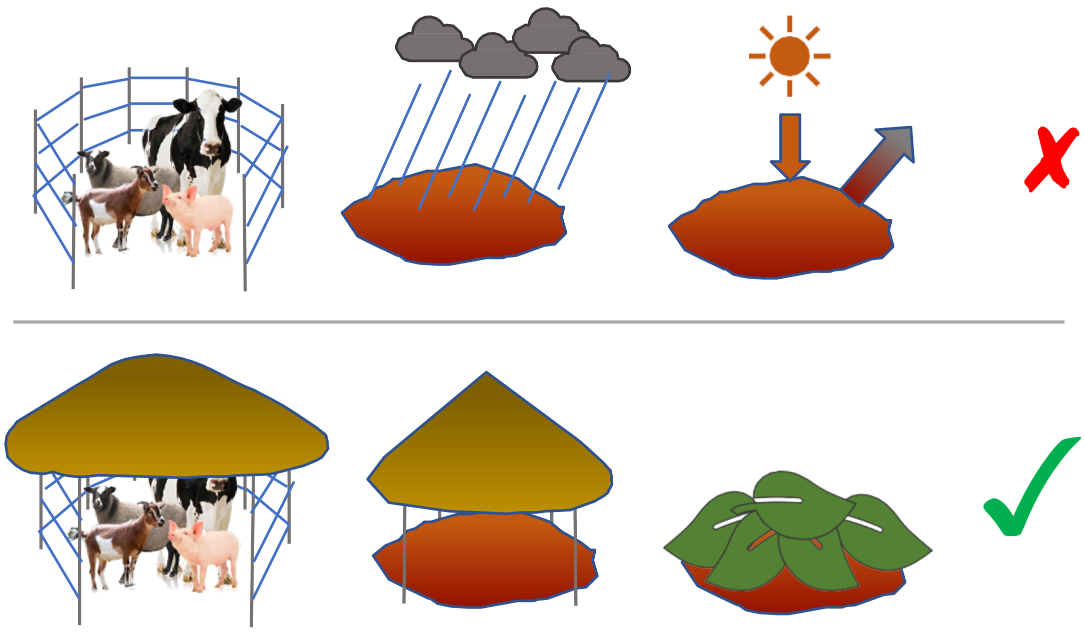
Manure is a valuable resource that can be used to make biogas. This can be used to power lights or to cook food. The leftover manure (digestate) from biogas production can still be used as a soil amendment. Treatment of manure is usually done for one of three reasons:

1. Reduce its volume
2. Increase its applicability (e.g., composting)
3. Increase its value.

Manure is applied as a soil amendment to improve soil fertility and increase moisture retention. It can also help stabilise pH and improve soil physical properties. To make climate smart decisions on manure management and have the best possible quality of manure to apply, it is necessary to understand the soil type (texture, slope, organic matter content, etc.) and climate-related factors such as rainfall timing, duration and intensity, and temperature/sunshine.

See **CCARDESA KP16** for more details on making climate smart decisions on manure management. Table 5 illustrates the climate smart credentials of improved housing for sheep/goats as a manure management option (with other co-benefits). This was identified during CSA country profiling in Zambia.

Figure 1: Covering manure prevents nitrogen loss trough leaching, run-off, and volatilisation.



Source: FAO, Manure management in the (sub) Tropics.

Table 5: Improved housing for sheep/goats was identified as a priority CSA intervention to be supported/promoted in order to improve manure management in Zambia.

CSA practice	Region adoption rate	Predominant farm scale	Impact on CSA Pillars		
			Productivity	Resilience	Mitigation
Diversification of livelihoods (keeping of smaller livestock such as goats)	Natural Region/AEZ 1; Southern and Eastern Province; and Natural Region 2b <30 %	Small, Medium & Large	Faster growth and higher feed conversion ratio due to proper housing	Reduces exposure to adverse climatic conditions, reducing animals' stresses (e.g., cold waves)	Allows better manure management, thereby reducing the related GHG emissions

Source: CCAFS CSA Country Profile Zambia

Genetic improvement

Genetics makes use of natural variation among animals. **Selecting preferred animals** as parents can yield **permanent** and **cumulative improvements** in the population. More efficient animals can greatly reduce feed costs, while decreasing greenhouse gas emissions. Breeding, including cross-breeding between indigenous and imported species, can also improve resilience to diseases and heat-stress, and increase reproductive performance. Some climate smart genetic improvement options for livestock are:

- **Hybridisation** – Cross breeding local breeds with introduced breeds with the aim of increasing milk/meat/egg production, etc.
- **Traditional breeds** – Selecting traditional breeds due to their adaptation to the local climate (heat tolerance, pest/disease resistance)
- **Assisted reproduction** – Artificial Insemination, embryo transfer/surrogacy, semen quality assessment, genetic marker assisted breeding
- Not generally a viable option for smallholders in the SADC region
- **Alternative breeds** – Introducing new breeds with desired traits to replace existing breeds
- **Species diversification** – Selecting different livestock species to minimise or diversify risk (e.g., switching from cattle to camels).

To improve the genetics of livestock takes time, especially for larger animals – as reproduction cycles are longer. It is vital that the farmer sets clear objectives for the genetic improvement of their animals, and understands that small incremental improvements in each generation will take many years to yield positive results.

Each farmer may have different breeding objectives for the same species. It is important that a one-size-fits-all approach is avoided. For example, several farmers may own goats; some may place more emphasis on milk production, because they see that as a key income source. Others may focus on the speed with which they can reach maturity and target weights for sale/slaughter. Understanding the farming context and the production system will enable you to make climate smart decisions on how best the farmer can address their breeding priorities.

See **CCARDESA KP17** for more details on making climate smart decisions on livestock genetic improvements. Table 6 illustrates the climate smart credentials of cross-breeding local and exotic varieties of chickens as a livestock management option. This was identified during CSA country profiling in Mozambique.

Table 6: Use of improved breeds of pigs was identified as a priority CSA intervention to be supported/promoted in order to improve livestock productivity in Mozambique.

CSA practice	Region adoption rate	Predominant farm scale	Impact on CSA Pillars		
			Productivity	Adaptation	Mitigation
Cross-breeding (using local and exotic varieties of chickens)	Natural Region /AEZ 1; Natural Region 2a <30%	Small	Increases quality and stability of the food production. Reduces production costs	Local breeds can present greater resistance to diseases and heat stress	Reduced inputs can reduce GHG emissions per unit of produce

Source: CCAFS CSA Country Profile Zambia

Pest and disease management options

Pests and disease cause massive losses in livestock production across Southern Africa. Climate smart practices that target improvements in pest and disease control can:

- Reduce mortality rates
- Reduced morbidity (sick) rates
- Increase animal growth rates
- Increase milk/egg/meat production
- Reduce age at first calving/lambing/foaling/farrowing, etc.
- Increase fertility rates
- Increase incomes.

Being able to identify which pest/disease is affecting your livestock is the first step in being able to control it. Each pest/disease has its own life cycle. To select the most climate smart management option, you need to understand the pest lifecycle. Some pests/diseases occur regularly at certain times of year and/or are triggered by temperature/rainfall.

Incidence of Rift Valley Fever generally increases after the rainy season. Livestock may not be well nourished during the dry season, and so may be more susceptible to infections – especially if many herds are using the same drinking/ feeding spots. Spending time discussing with your farmers when diseases are more prevalent, weather conditions at that time and what management practices are being used, will help to make decisions on which climate smart pest/ disease management option(s) will best fit your farmers.

Some options include:

- **Biological control of vectors** – Using non-chemical means to control the vectors
  - Some diseases move from one host to another through vectors. The most common vectors are small biting insects (mosquitos/fleas) and ticks
  - Ducks, wildlife and even people can also be vectors of diseases
- **Resistant breeds**
  - Local breeds are usually more resistant/tolerant to endemic pests/diseases than exotic breeds
  - Exotic breeds may be more productive, but generally require more intensive management
  - Crossing local breeds with exotic breeds may give increased production, along with pest/disease tolerance
- **Vaccination campaigns**
  - These can be a cost-effective means of preventing infections. They require detailed planning and clear communication with farmers to be successful.

Some pests/diseases cause huge losses across the region, and/or can be transmitted to humans. These are required to be reported whenever an outbreak is observed. The outbreaks or spread may be directly or indirectly due to climatic changes. Accurate reporting helps to track the spread of disease/pests. This enables better decision-making on prevention methods, such as vaccination campaigns.

See **CCARDESA KP18** for more details on making climate smart decisions on pest and disease management options for livestock. Table 7 illustrates the climate smart credentials of integrated pest and disease management as an option in cattle production. This was identified during CSA country profiling in Zambia.

Table 7: Integrated pest and disease management was identified as a priority CSA intervention to be supported/ promoted in order to improve cattle productivity in Zambia.

CSA practice	Region adoption rate	Predominant farm scale	Impact on CSA Pillars		
			Productivity	Resilience	Mitigation
Integrated pest and disease management (cattle)	Natural Region 2b 30%–60 % Natural Region 1 <30%	Small, Medium and Large	Ensures crop quality, hence income potential increases	Reduces crop losses from pests and diseases, even when cops are under moisture-stress conditions	Reduces GHG emissions by reducing use of synthetic pesticides

Source: CCAFS CSA Country Profile Zambia.

HOW TO CHOOSE THE BEST BET CLIMATE SMART OPTIONS FOR YOUR FARMER(S)

Once you have worked with your farmer(s) to determine if the proposed climate smart solutions are feasible, you will have a list of viable options. The next step is to pick which option is best suited to meeting the demands of the farmer(s).

Trials should be established with the farmers to test feasible solutions to see which are the most effective. These can be done with individual farmers, with lead farmers, or through **farmer field schools (FFS)**.

Where possible, **gross margins** should always be calculated to assess the return on investment. This will result in the most profitable option emerging. Cost of own labour must be included in any gross margin analysis, along with all other inputs. A decision on a practice/technology might have positive or negative effects on labour/input requirements, later in the animal's life cycle.

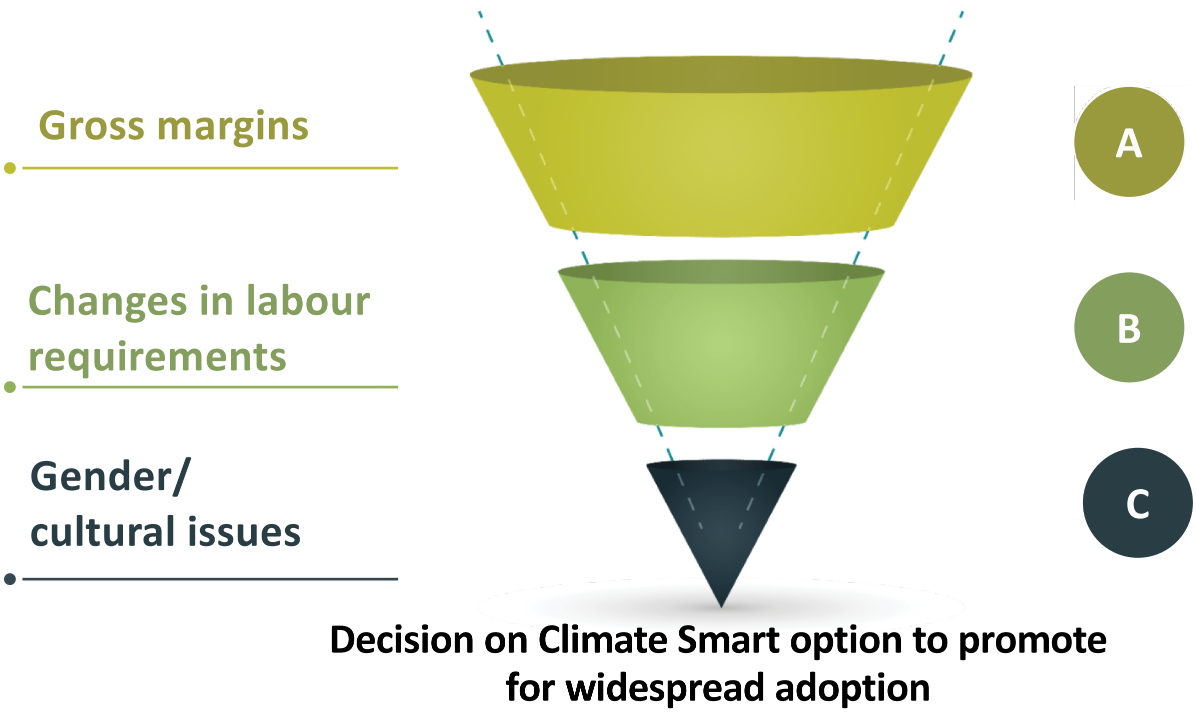
It is important to understand who does what and when within the whole lifecycle and to assess input costs over a whole production cycle. This may be several years for livestock such as cattle.

Gross margins, labour requirements, gender and cultural issues as well as multiple other context specific issues need to be understood and trade-offs made when deciding which CSA practice/technology is the best fit for a particular farmer (Figure 2).

TIP

Remember, when establishing farmer trials, to keep all other variables – except the one that you are testing (breed, housing, grazing, feed type and quantity or access to water, etc.) – the exact same.

Figure 2: A deep understanding of the context and the interplay between multiple social, environmental, and agronomic issues is required to make climate smart decisions.



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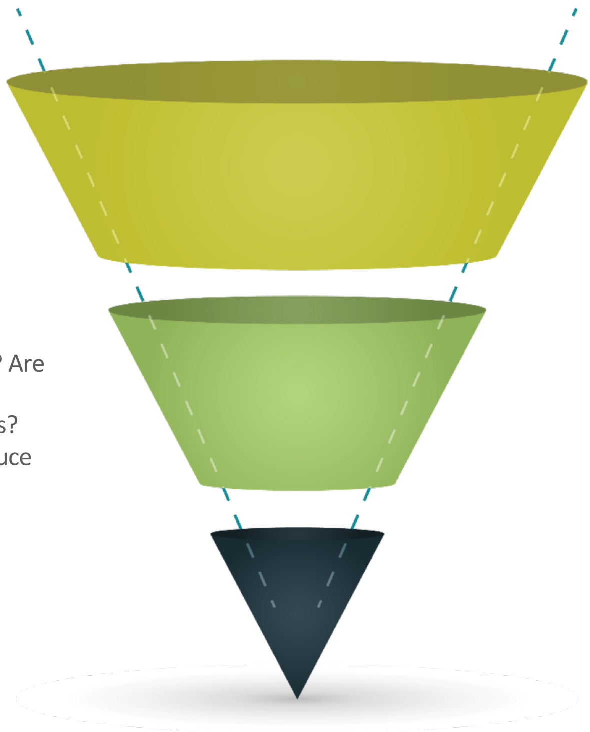
TO SUMMARISE



STEP 1: Identify options

- What is the current situation
- What happens if nothing is done?
- What is the potential if climate smart options are introduced?

STEP 2: Analyse feasibility

- What is being demanded by farmers? What are their requirements? Are the requirements of men and women the same?
- Is the technology/practice, available/accessible to the target farmers?
- Will the proposed climate smart practice/technology increase or reduce labour requirements?

STEP 3: Select option

- Test different options with farmers
- Assess cost effectiveness using gross margins analysis
- Assess any gender/cultural constraints.

ILRI, Mann, 2008

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. Translations of this Knowledge Product to French and Portuguese was achieved using machine translation tools, and the results were checked by an accredited translator.

- **The CCARDESA Knowledge Hub** – KPs 14, 15, 16, 17 and 18
- **Access Agriculture** – Various videos on animal health, feeding, breeding, etc.
  - A very useful resource to show to farmers. Available in multiple languages. If you sign up (free), you can get access to downloadable technical guides and much more besides. A good resource to return to on any topic. Not all are climate smart
- **African Union** – Inter-African Bureau for Animal Resources (AU-IBAR): **http://www.au-ibar.org/**
  - The Transboundary Animal Diseases and Zoonoses Compendium for Africa – is quite scientific and lacks images – but is a useful resource
- **Australian Centre for International Agricultural Research (ACIAR)** – Controlling Newcastle Disease in Village Chickens: A Field Manual
  - An excellent resource for anyone planning a vaccination campaign (not just for chickens)
- **AU-IBAR** – A field manual on Animal Diseases by Syndromes: With emphasis on transboundary diseases
  - A simple illustrated guide to the main transboundary diseases in the region. Highly recommended
- **CCAFS** – CSA Country Profiles
- **CCAFS** – The CSA Guide (**https://csa.guide/**)
- **FAO** – The Climate Smart Agriculture Sourcebook
- **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
  - Good background information. Not a technical guide
- **FAO** – A Manual for the Primary Animal Health Care Worker: **http://www.fao.org/docrep/t0690e/t0690e00.htm#Contents**
  - A detailed resource, useful for all extension officers
- **FAO** – Manure Management in the (Sub-)Tropics: Training Manual for Extension Workers, Report 919 Wageningen UR Livestock Research Rome/ Wageningen, October 2015
  - A very practical resource for extension staff
- **GACSA** – Improved Ruminant Genetics
  - A good overview of the climate smart credentials of genetic improvements in livestock
- **GACSA** – Manure Helps Feed the World
  - A good overview of the climate smart credentials and components of manure management
- **ILRI – FEAST: https://www.ilri.org/feast**
  - This is a useful tool to help make decisions on livestock interventions
- **ILRI** – Smallholder dairy farmer training manual. ILRI Manual 24, 2016
  - This is a useful resource for assessing body condition, heat detection, key performance indicators (traits), etc.
- **Small-scale Livestock and Livelihoods Program, Malawi (SSLLP)** – Training Notes for Community Animal Health Workers on Dairy Cattle, Pig Production, Village Poultry, Goats and Sheep
  - These are excellent resources targeted at community animal health workers, but perfectly usable for all extension staff working with livestock. They include descriptions of pests/diseases common in each species, as well as control measures and general production guidelines. Focus on Malawi, but very useful in other contexts
- **Shamba Shape Up**
  - Various videos and leaflets available. May take some time to find the ones you are looking for, but well worth it.

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