Climate Change Adaptation in Agriculture in SADC

Climate resilient agriculture in a changing world

Workshop on
Dryland Management for Livestock
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Gaborone, Botswana
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Climate change and agriculture

Climate Change effects in the SADC region
Situation analysis
SADC region

- The SADC region is extremely vulnerable to the effects of climate change.
- Agriculture sector most affected, whereby 70% of the region’s population depend on agriculture for food, income and employment.
- Extreme weather events like floods and droughts are increasing as well as the average temperatures.
- Already low yields are decreasing, heavily impacting on regional food security.
Situation analysis – SADC region II

- Regional drought disaster declared in July 2016.
- Climate induced crop failures: cereal deficit: 9.3 Million tons
- 643,000 cattle perished in the drought
- Food insecure population increased by 31% since 2015
- 40 Million people in SADC are food insecure (2016-2017 marketing year) and will need humanitarian assistance.
Data from the SADC region – 2016

* All data from SADC regional update on El Nino induced drought, Report 1, May 2016

- **2015** cropping season was the **driest** in the SADC region in **35 years**.
- **13 out of 15 countries** in the SADC region **declared national drought disaster**.

**Angola**: up to 75% crop losses in the southern part

**Botswana**: 50% increase in livestock feeds

**Lesotho**: 80% harvest losses

**Madagascar**: 80% of the population in the 7 most affected districts food insecure

**Malawi**: 2.8 Mio people food insecure, expected maize deficit 2016: 1.07 tonnes

**Mozambique**: 1.5 Mio people food insecure in southern and central regions, 64% reduction in maize harvest.
Data from the SADC region – 2016

**Namibia:** 370.000 people at risk of food insecurity

**South Africa:** Maize harvest 25 % reduced (compared to 2015, 40% compared to 5 year average), cereal deficits in maize and wheat,

**Swaziland:** 64 % reduction in maize harvest (2016), 320.000 people in need of food assistance, 64.000 cattle perished

**Tanzania:** some flooding events, not affecting the performance of the country agriculture in general

**Zambia:** Good harvest, agricultural production not negatively affected

**Zimbabwe:** Extensive crop failure and food insecurity, 2.8 Mio people food insecure
and 2016/2017 ????

- Extraordinary rainfalls (e.g. Gabs dam first time filled since 2001)
- Excess of water, floods, fields washed away, damages in agriculture through too much water
- Increased emerging of pests and diseases (army worm, locust, leaf diseases and other)

→ Climatic conditions are getting harsher and more unpredictable
→ Extreme weather events are increasing
→ Climate Change has come to stay, its not going to disappear
→ Agriculture needs to react, take strategic decisions and build resilience
Climate change and agriculture

Agriculture - Victim and Culprit?

Effects of Climate Change on Agriculture and Contributions through Agriculture to Climate Change
Climate Change Effects

- Extreme precipitation
- Rising sea level
- Extreme heat waves
- Decreasing agricultural production
- Flooding & Inundation
- Acidification of oceans
- Increase of drought
- Land losses
- Ice melting

• different magnitudes in different regions (warming above sea level 2-10 degrees Celsius)

• developing countries more affected, also because of lack of resilience
Agriculture suffers from climate change

- Unsecure cropping conditions and crop failures
- Displacement of **optimal growing regions**
- Changes in **pest** exposition, **invading species** and genetic losses
- Overall **yield** losses but with considerable regional differences
- $\Rightarrow$ Major implications for **food security**
Impact of climate change on agriculture

Map 1 Climate change will depress agricultural yields in most countries in 2050, given current agricultural practices and crop varieties.

Example: Coffee cultivation in Ethiopia

Source: Ruegsegger 2008
Alarming rates of land degradation

Philippe Rekacewicz, UNEP/GRID-Arendal
Already by 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, and two thirds of the world population could live under water stress conditions. (UN Water, 2013)
Nitrogen – Environmental and atmospheric impact

Nitrogen environmental and atmospheric impacts:

- Global warming.
- Nitrogen deposition leads to eutrophication of natural ecosystems.

Agricultural emissions in (MT CO₂ eq)

Source: Bellarby et al 2008
Agriculture contributes to climate change

GHG emissions per economic sector

Agriculture contributes 10%; Forestry and Other Land Use contribute 14%

### Sources of agriculture

<table>
<thead>
<tr>
<th>Source</th>
<th>Million tonnes CO₂-eq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrous oxide from soils</td>
<td>2128</td>
</tr>
<tr>
<td>Methane from cattle enteric fermentation</td>
<td>1792</td>
</tr>
<tr>
<td>Biomass burning</td>
<td>672</td>
</tr>
<tr>
<td>Rice production</td>
<td>616</td>
</tr>
<tr>
<td>Manure</td>
<td>413</td>
</tr>
<tr>
<td>Fertiliser production</td>
<td>410</td>
</tr>
<tr>
<td>Irrigation</td>
<td>369</td>
</tr>
<tr>
<td>Farm machinery (seeding, tilling, spraying, harvest)</td>
<td>158</td>
</tr>
<tr>
<td>Pesticide production</td>
<td>72</td>
</tr>
<tr>
<td>Land conversion to agriculture</td>
<td>5900</td>
</tr>
</tbody>
</table>

Source: Bellaraby et al. 2008
The Livestock – Climate Change Dynamic

With GHG emissions along livestock supply chains estimated at 7.1 giga-tons CO$_2$ equivalent per annum, representing 14.5% of all anthropogenic emissions. The livestock sector plays an important role in climate change.

Sources of sector emissions:

- Processing and enteric fermentation 45%
- Feed production 39%
- Manure storage and processing 10%
- Processing and transportation of animal products 6%

Source: FAO. 2013. Tackling Climate Change through Livestock.
GHG emissions from global livestock supply chains, by production activities and products

The Livestock – Climate Change Dynamic

Relationship: total greenhouse gas emissions and milk output

A case for sustainable intensification?
Importance of Livestock for Food Security, Poverty Reduction and Resilience

Approx. 80% of the world’s 1.3 billion poor people live in rural areas. 2/3 of them keep livestock; 70% of them are women.

Contributes to:

- Multiple benefit (milk, meat, eggs, labour, manure, wool, hides and skins…)
- (Regular) income generation
- Human nutrition
- Use of marginal landscapes / weed control
- Transfer of plants into food
- Financial security
- Socio-cultural importance
The Livestock – SLM* Dynamic

- Land used for livestock production, including grazing land and cropland dedicated to the production of feed, represents approximately 70 percent of all agricultural land in the world.
- Overgrazing is the greatest cause of degradation of grasslands.
- 35% of total world cereal use is fed to livestock and more than 90% of the global soybean production is used as animal feed.

*= Sustainable Land Management

FAO 2013. Climate Change and Integrated Crop Livestock Systems.
The Challenge for the agricultural sector:

Food production needs to increase by 60% by 2050 to satisfy the demand of a population of more than 9 billion people.

Source: FAO, Coping with Water Scarcity, 2012

“by 2050, we need to…

• Double world food production on ~ the same amount of land

• Make farms, fields and landscapes more resistant to extreme weather, while…

• … massively reducing GHG emissions.”
Climate Smart Agriculture (CSA)

How to adapt to a changing climate and get more resilient?
“Agriculture that sustainably increases productivity, resilience (adaptation), reduces/removes GHGs (mitigation), and enhances achievement of national food security and development goals”

CSA Concepts and Technologies
Climate-smart agriculture (CSA)

• An approach for transforming and reorienting agricultural systems to support food security under the new realities of climate change.

• Climate change threats can be reduced by increasing the adaptive capacity of farmers, increasing resilience and resource use efficiency.

• Climate Smart Agriculture is not just about new technologies, and it is combining traditional indigenous knowledge, common agricultural practices and appropriate new technological developments for agriculture to increase sustainably the efficiency in the agricultural production – to ensure food security for future generations.

• Knowledge and relevant information is available but a giant task still remains: Closing the gap between Science/Research and Application on farm level and for policy and decision making – knowledge translation for different user groups.
Livestock and climate change in Southern Africa

- SADC estimates: 64 m cattle, 39 m sheep, 38 m goats, 7 m pigs, 380 m poultry
- ¾ of livestock population in smallholder farming systems
- Drought vulnerability: 643,000 cattle died during 2015-2016

**Climate change impacts**

**Increasing temperatures** -> heat stress
- > 30°C: cattle, sheep, goats, pigs, chickens reduce food intake by 3-5% for each 1°C increase

**Changes in rainfall** -> crop and pasture growth, water, pests and diseases
- Changes in feed resources will occur (pasture, crop residue, suppl. feed)

**Highest impact on dryland grazing systems**
- Subsistence, small-scale commercial farming systems are at high risk due to their dependency on rain-fed natural pastures and limited access to capital resources and management technologies
Impacts of climate change on livestock systems

<table>
<thead>
<tr>
<th>Grazing systems</th>
<th>Non-grazing systems</th>
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<tbody>
<tr>
<td></td>
<td>Direct impacts</td>
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<tr>
<td></td>
<td>• extreme weather events</td>
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<td></td>
<td>• drought and floods</td>
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<td>• productivity losses (physiological stress): reduced foraging time and feed intake, growth, carcass quality, reproduction</td>
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<td>• water availability</td>
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<td>• water availability</td>
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<td>• extreme weather events</td>
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<td>Indirect impacts</td>
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<td></td>
<td>• fodder quantity and quality</td>
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<td></td>
<td>• Pest and disease epidemics (spread and severity)</td>
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<td>• host–pathogen interactions and incidence of emerging diseases</td>
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<td></td>
<td>• increased resource prices, e.g. feed and energy</td>
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<td></td>
<td>• disease epidemics</td>
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<td></td>
<td>• increased cost of animal housing, e.g. cooling systems</td>
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• Projected changes in Aboveground Net Primary Productivity (ANPP) in Africa’s rangelands

• ANPP is a good indicator for livestock productivity

Spatial distribution of percentage change in ANPP production by 2050s and RCP8.5 (high-end emissions) in relation to the mean value of 1971-1980.
Effects of temperature on probability of choice of species (Rust and Rust 2013).
Climate smart options

• **Improve resource use efficiency** – any practice that improves productivity or efficient use of scarce resources is climate-smart even if not directly countering climate change
  • Higher water productivity/feed efficiency, improved manure/fertiliser management, better feed-food conversion
• **Climate resilient livestock development** requires that increased production is met by increased efficiency, not increased numbers -> stock fewer but more productive animals
• **Pasture management**
  • Sow improved grasses/legumes – productivity, drought tolerance, digestibility (Blue Buffalo Grass, Napier, Lablab)
  • Tackle bush encroachment (e.g. controlled burning, removal or goats) after overuse
  • Fertilisation, cutting regimes, irrigation – productivity, animal performance, pasture quality, soil carbon
Climate smart options for livestock

• **Grazing management**

  • Controlled grazing: manage stocking rates to allow rejuvenation of grasses, ensure surface cover, increase fodder productivity
  • Optimise grazing pressures – with choice animals select nutritious forage
  • Rotational grazing: match livestock needs with pasture availability
    • Maintain forage at early growth stage with higher quality/digestibility – but more intensive management and investment
Climate smart options

• **Improved feeding**
  • Agroforestry:
    • Integrate trees & shrubs with animals - reduced heat stress, improved supply and quality of forage to help manage overgrazing, improved resilience (e.g. *Acacia*, *Albizia*, pigeon pea)
    • Supplement diets with better quality green fodder (e.g. feeding 1kg of *Leucaena leucocephala* leaves per animal per day can nearly triple milk yields and live-weight gains)
  • Nutritious diet supplements
    • Fodder conservation (e.g. silage, hay) – don’t ignore the good seasons!
    • Higher-digestibility crop residues (e.g. treat straw with urea)
    • Small areas of planted legumes (“fodder banks”)
    • Supplementation with grain

• **Herd management**
  • Management herd size and age structure
  • Better nutrition, improved husbandry – reduce mortality, improve reproduction, reduce slaughter age
  • Manage disease risk
  • Maintain herd health: veterinary services, vaccines
Climate smart options

- **Switch breeds**
  - Strengthen local breeds: well adapted, heat/drought tolerant, disease/parasite resistant, utilize poor quality forage – e.g. Nguni and Tswana cattle (but low productivity and high emissions per kg)
    - Select for desired traits within the indigenous breeds (e.g. fast growing)
  - Improve local genetics through crossbreeding: when coupled with better diets
    - Increase adaptability, productivity, heat tolerance, disease resistance, fitness, reproductive traits
    - Crossbred beef can produce more than double the amount of milk and meat
  - Uptake results in fewer but larger, more productive animals -> but investment in feed and water, impacts on land/labour resources and increased risk under climate variability
- Positive consequences for incomes, methane production and land use
Climate Smart options for livestock

Switch species

- Diverse species portfolio to spread risk
- Goats are more hardy than cattle and sheep (low feed/water requirements, exploit low quality forage, disease resistant, heat tolerant, require less space, easier to handle/sell)
- Pork and chicken: growing demand, but intensive systems require investment (supplementary feeding)
Climate smart options

- **Diversify your system**
  - Change mix of products: include crops and livestock, introduce heat tolerant breeds, be opportunistic in investing in crops/livestock depending on season
  - Crop-livestock or crop-livestock-tree systems (e.g. combination of leguminous fodder shrubs and herbaceous legumes grown together with food crops to improve crop productivity and provide)

- **Early warning systems and livestock insurance**
  - Use weather information to manage risk – but this is difficult for livestock management
  - Weather indexed insurance – but limits in vulnerable populations with covariate risks
Dry season management

- Periods of reduced forage availability are likely to increase under climate change
- Limits to what is possible through livestock management in terms of increasing resilience
- Mixed systems can deliver multiple benefits and spread risk
- Make use of different feeds to cover the gap
  - Crop residue
  - Small areas of planted legumes (fodder banks)
  - Opportunistic feeds cut, Storage
  - Plant tree species (e.g. *Leucaena*, Saltbush) that are nutritious, increase milk and meat yield, reduce emissions per kg of product
What are SADC, CCARDESA and GIZ doing to support Climate Change Adaptation in the agricultural sector?

SADC programme „Climate Change Adaptation in Rural Areas in Southern Africa“ - ACCRA, implemented by CCARDESA with support through GIZ.

Focus on:

1) Regional knowledge dissemination on Climate Change Adaptation in Agriculture and Climate Smart Agriculture

- Trainings, Conferences and Exchange visits (e.g. CCAA/CSA, Accessing Finance, Proposal Writing)
- Internet based information and knowledge platform for all 15 SADC countries, access free of charge, possibility for all MS to up- and download information.
- Information material and knowledge products: Guidelines, leaflets, factsheets, videos, training materials and more as free downloads.
What are SADC, CCARDESA and GIZ doing to support Climate Change Adaptation in the agricultural sector?

2) Climate proofing of priority agricultural value chains

- **Vulnerability analysis** for value chains.
- **Recommendations for CSA technologies and best practices** to reduce or mitigate Climate risks (Climate Proofing).
- **Piloting of selected technologies**.
- **Feasibility studies** to document evidence for the benefits and impacts of CSA-practices and technologies.
- Support to institutions in the SADC member states for writing *investment proposals* for up-scaling and disseminating CSA.
- Support for *mobilizing financing*. 
Thank you for your attention !!!!