CCARDESA
Centre for Coordination of Agricultural Research & Development for Southern Africa
Centre De Coordination De La Recherche Et Du Développement Agricole De L'afrique Australe
Centro para a Coordenação da Investigação e Desenvolvimento Agrário na África Austral

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Climate Change Adaptation in Agriculture in SADC

Climate resilient agriculture in a changing world

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Workshop on
Dryland Management for Livestock
09.-10.03.2017
Gaborone, Botswana

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SADC
SOUTHERN AFRICAN DEVELOPMENT COMMUNITY
TOWARDS A COMMON FUTURE

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

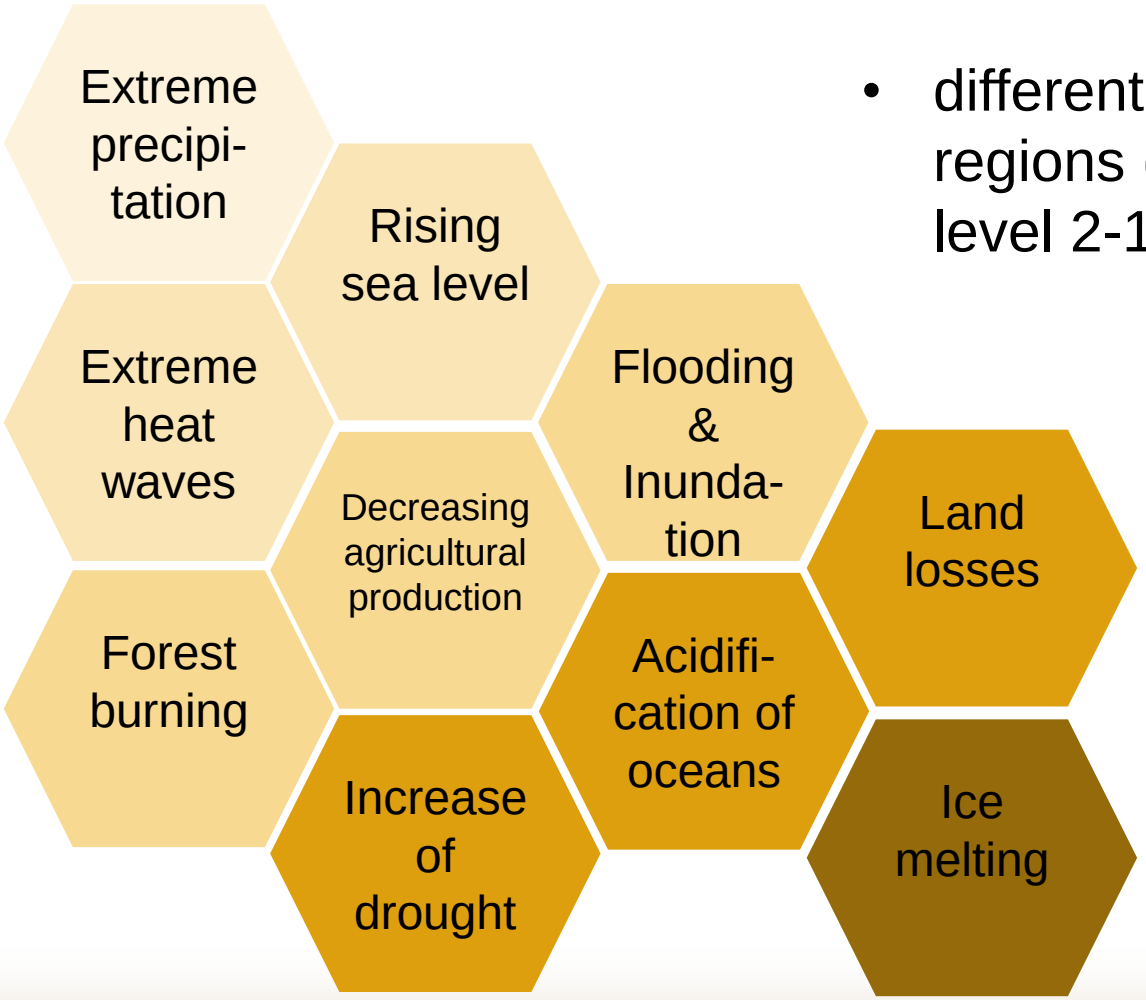
→ Agriculture needs to react, take strategic decisions and build resilience

Climate change and agriculture

Agriculture - Victim and Culprit ?

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

Climate Change Effects



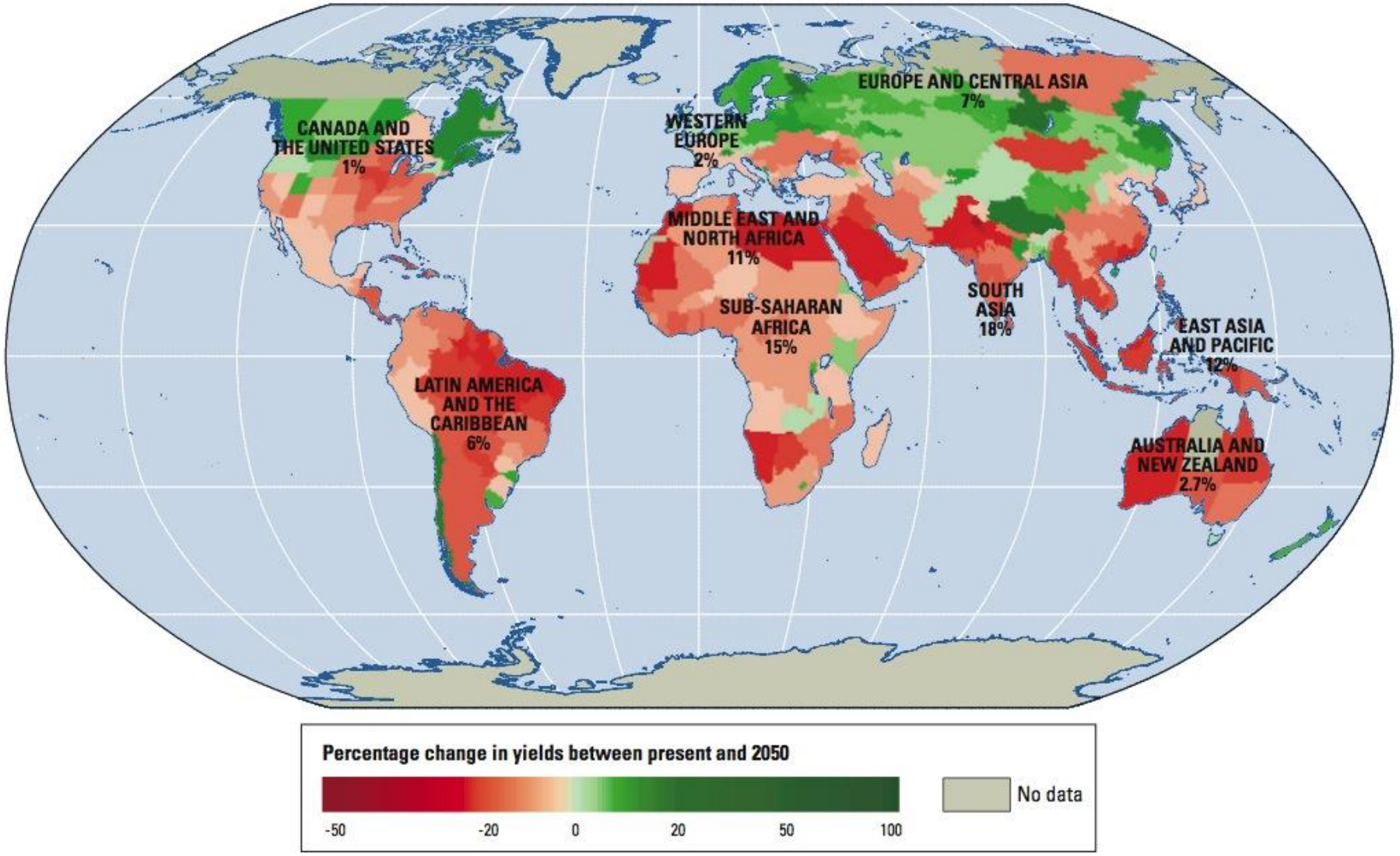
- different magnitudes in different regions (warming above sea level 2-10 degrees Celsius)
  - developing countries more affected, also because of lack of resilience

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
- ⇨ Major implications for **food security**

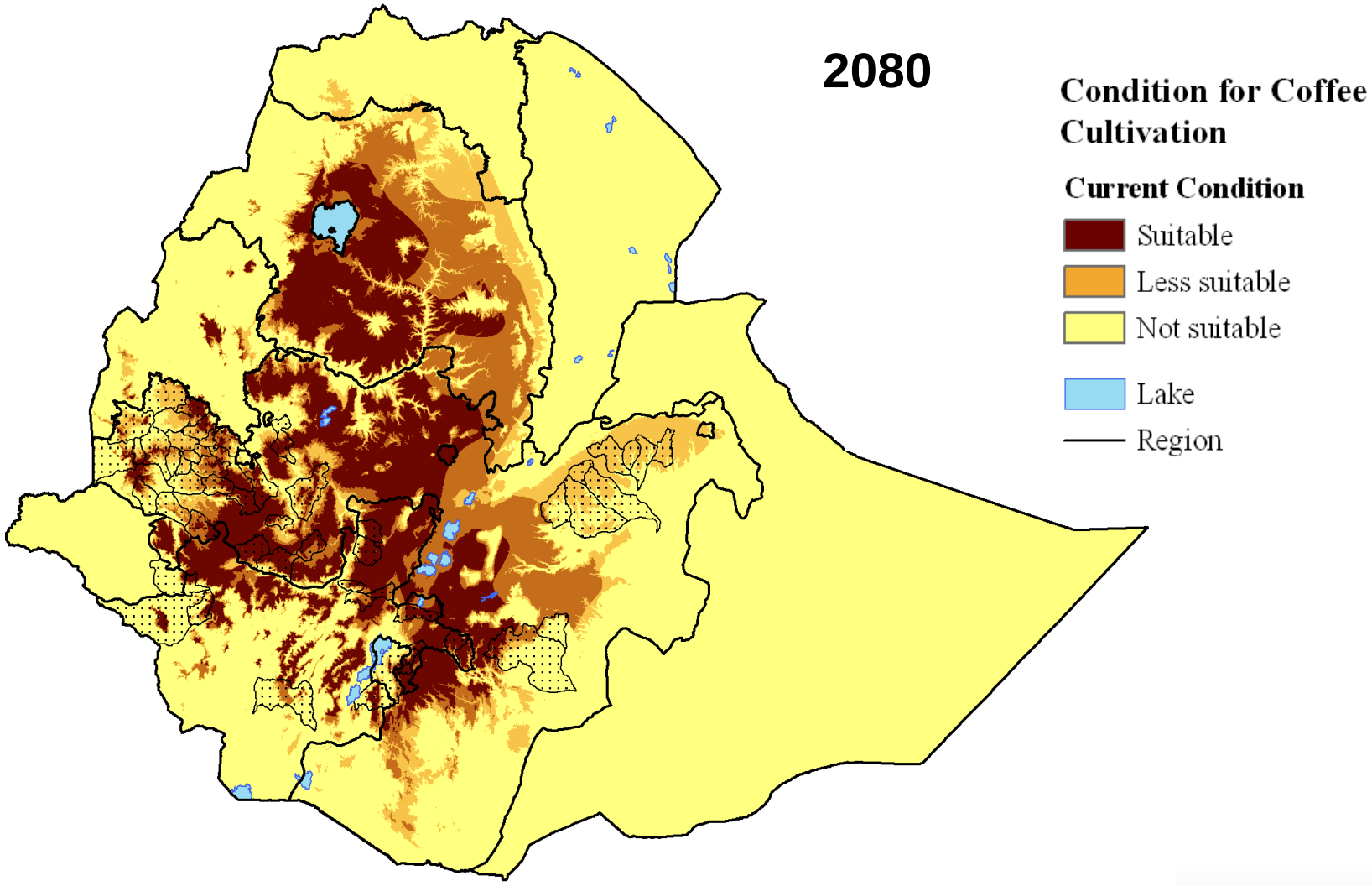
Impact of climate change on agriculture

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



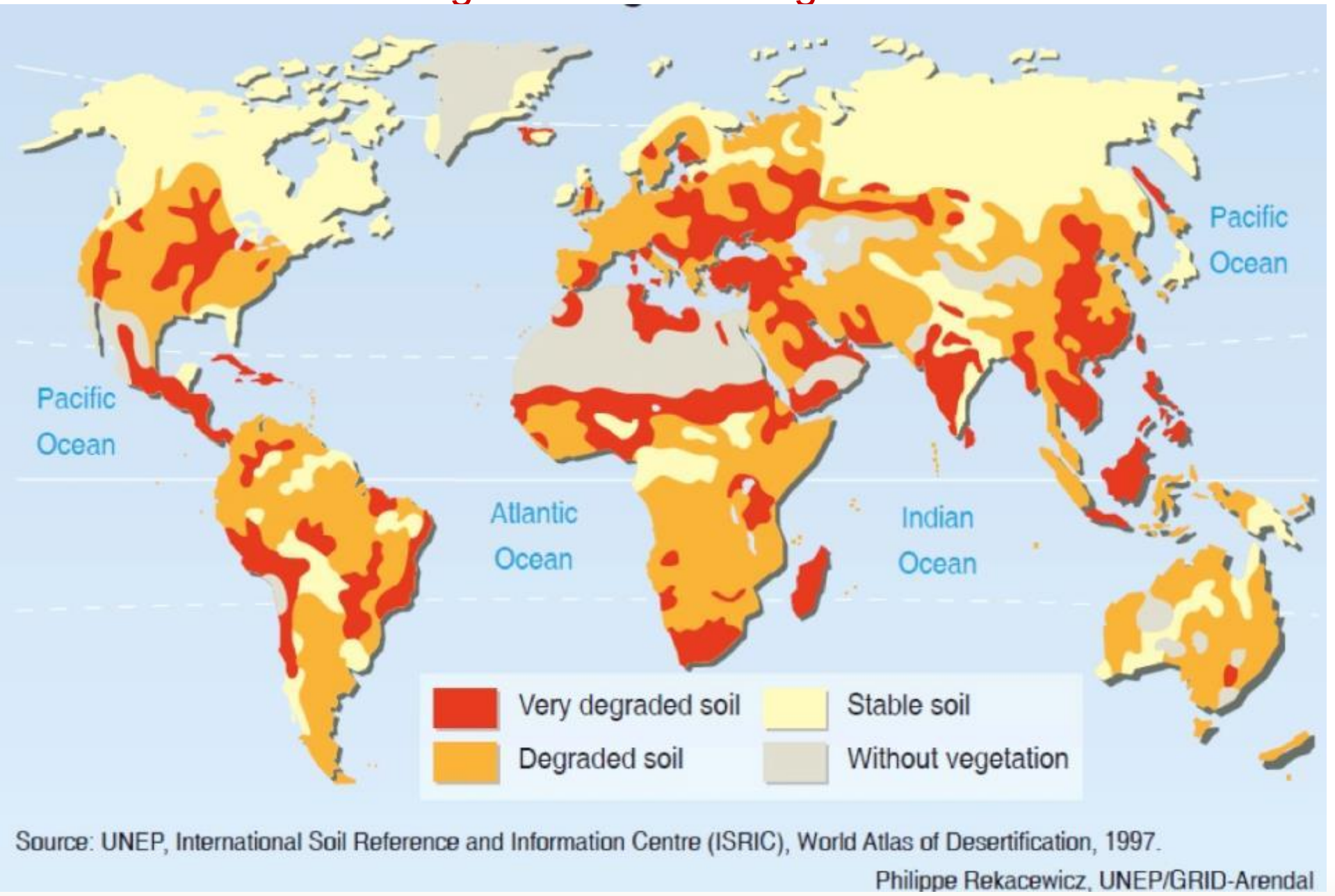
Source: http://www.fao.org/fileadmin/templates/cpesap/C-RESAP_Info_package/Links/Module_1/reduction_yields_wb.pdf

Example: Coffee cultivation in Ethiopia



Source: Ruegsegger 2008

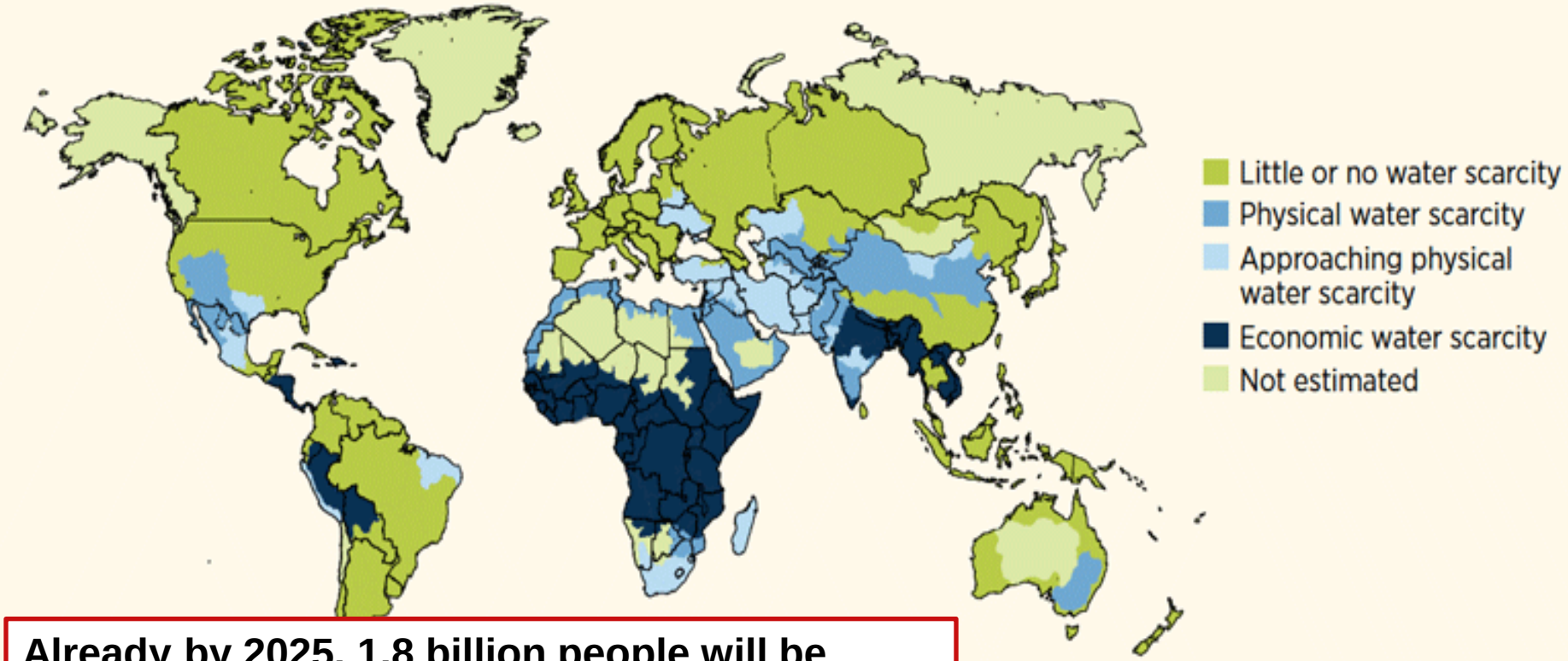
Alarming rates of land degradation



Source: UNEP, International Soil Reference and Information Centre (ISRIC), World Atlas of Desertification, 1997.

Philippe Rekacewicz, UNEP/GRID-Arendal

Global physical and economic water scarcity



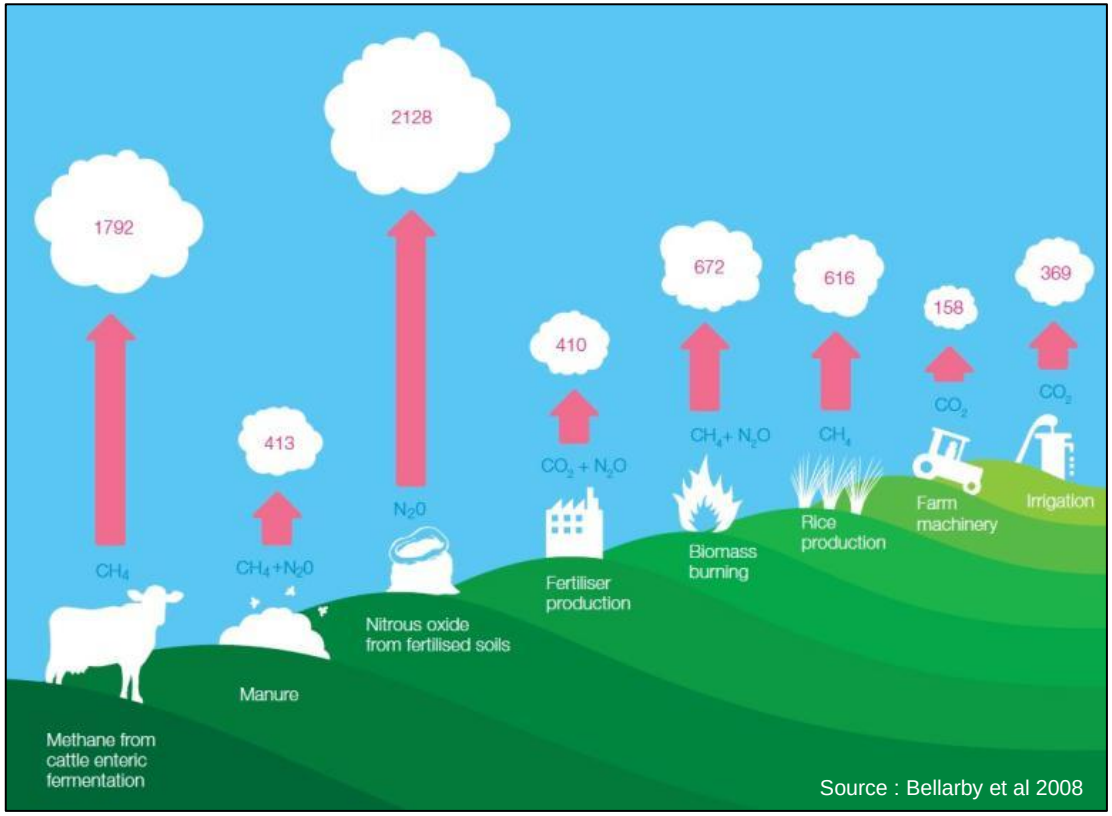
Already by 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, and two thirds of the world population could live under water stress conditions. **(UN Water, 2013)**

Source: World Water Development Report 4, World Water Assessment Programme (WWAP), March 2012

Nitrogen – Environmental and atmospheric impact

Nitrogen environmental and atmospheric impacts:

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

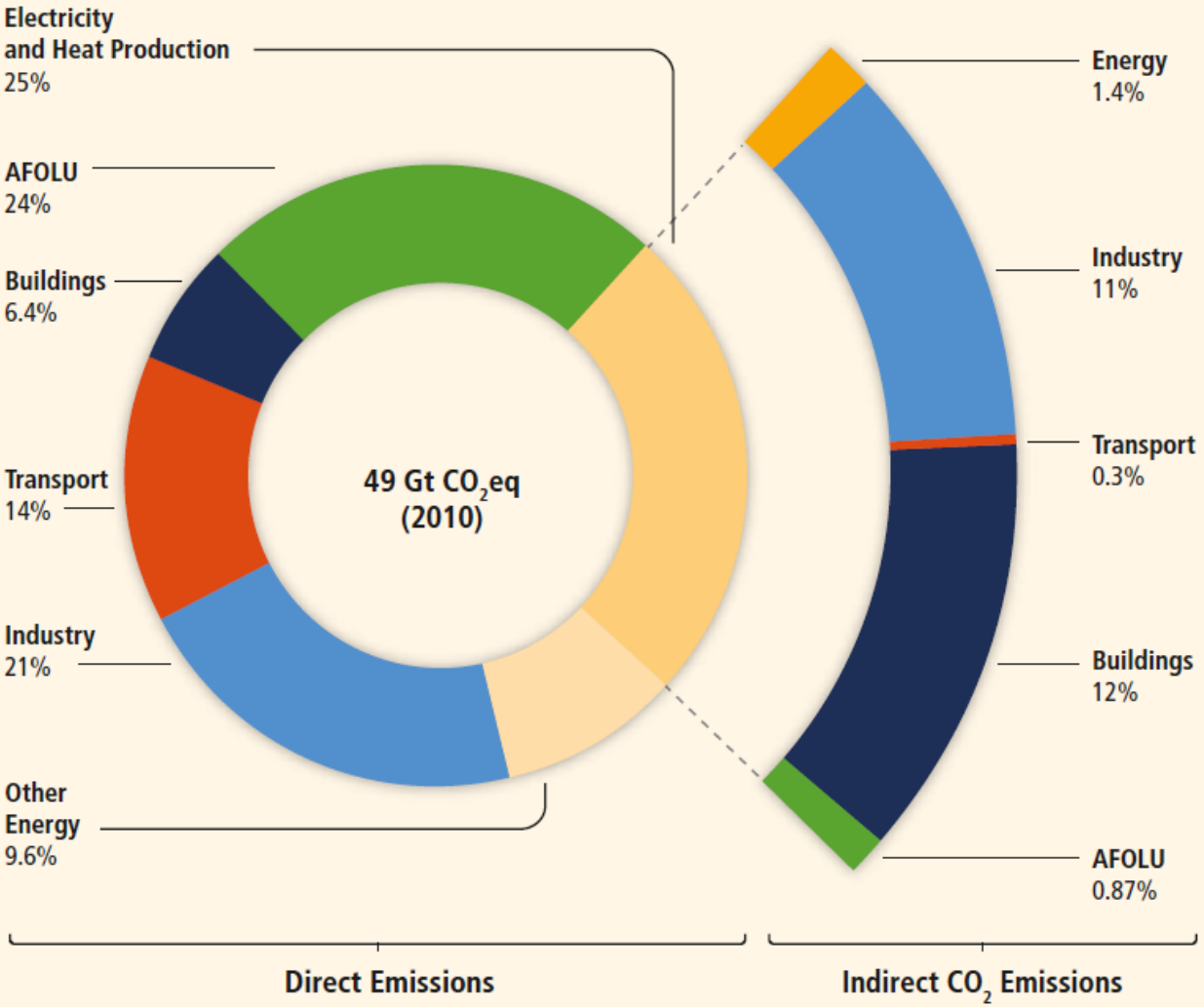


Agricultural emissions in (MT CO_2 eq)

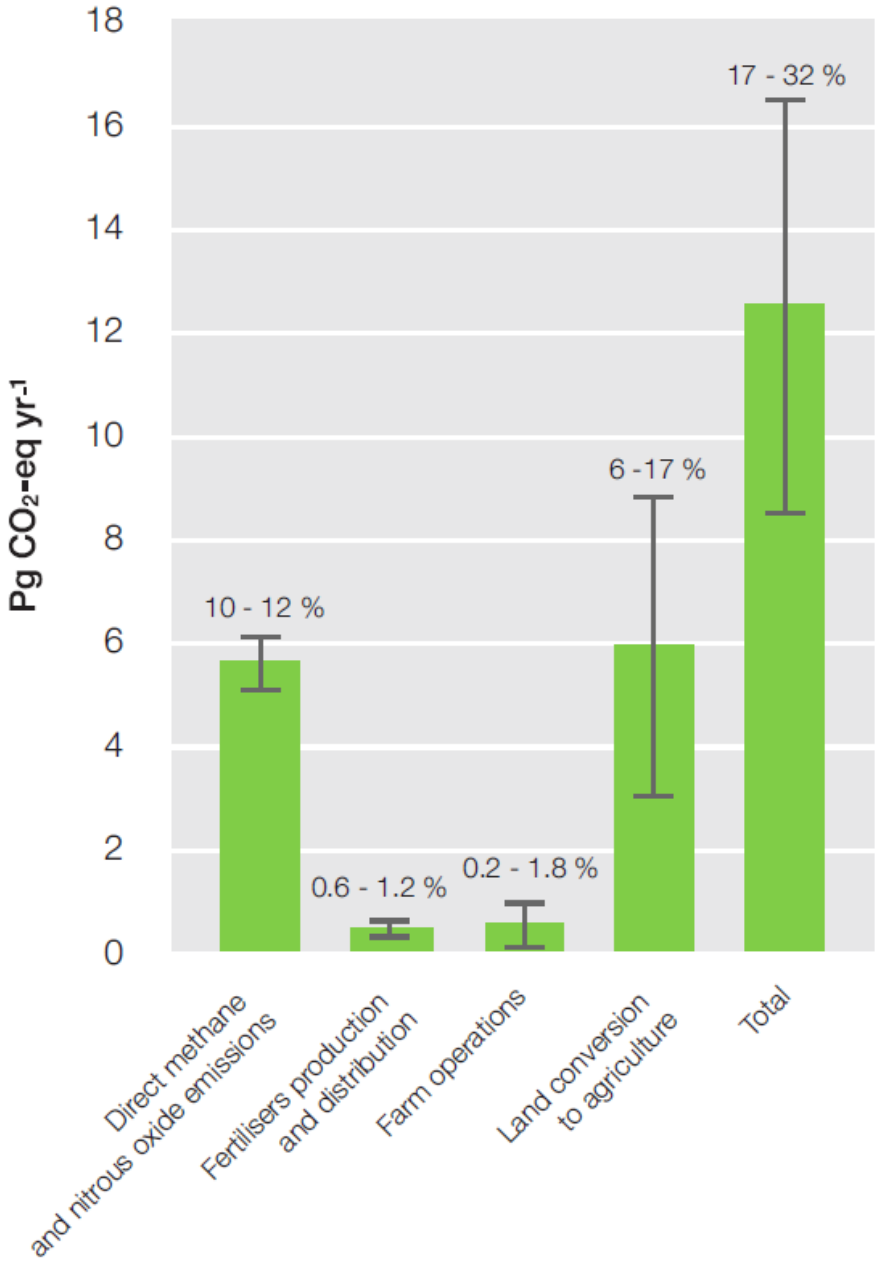
Agriculture contributes to climate change

GHG emissions per economic sector

Agriculture , ontributes 10%; Forestry and Other Land Use contribute 14%



Source: IPCC, 2014: Climate Change 2014: Mitigation of Climate Change.



Sources of agriculture GHG	Million tonnes CO_2-eq
Nitrous oxide from soils	2128
Methane from cattle enteric fermentation	1792
Biomass burning	672
Rice production	616
Manure	413
Fertiliser production	410
Irrigation	369
Farm machinery (seeding, tilling, spraying, harvest)	158
Pesticide production	72
Land conversion to agriculture	5900

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 %

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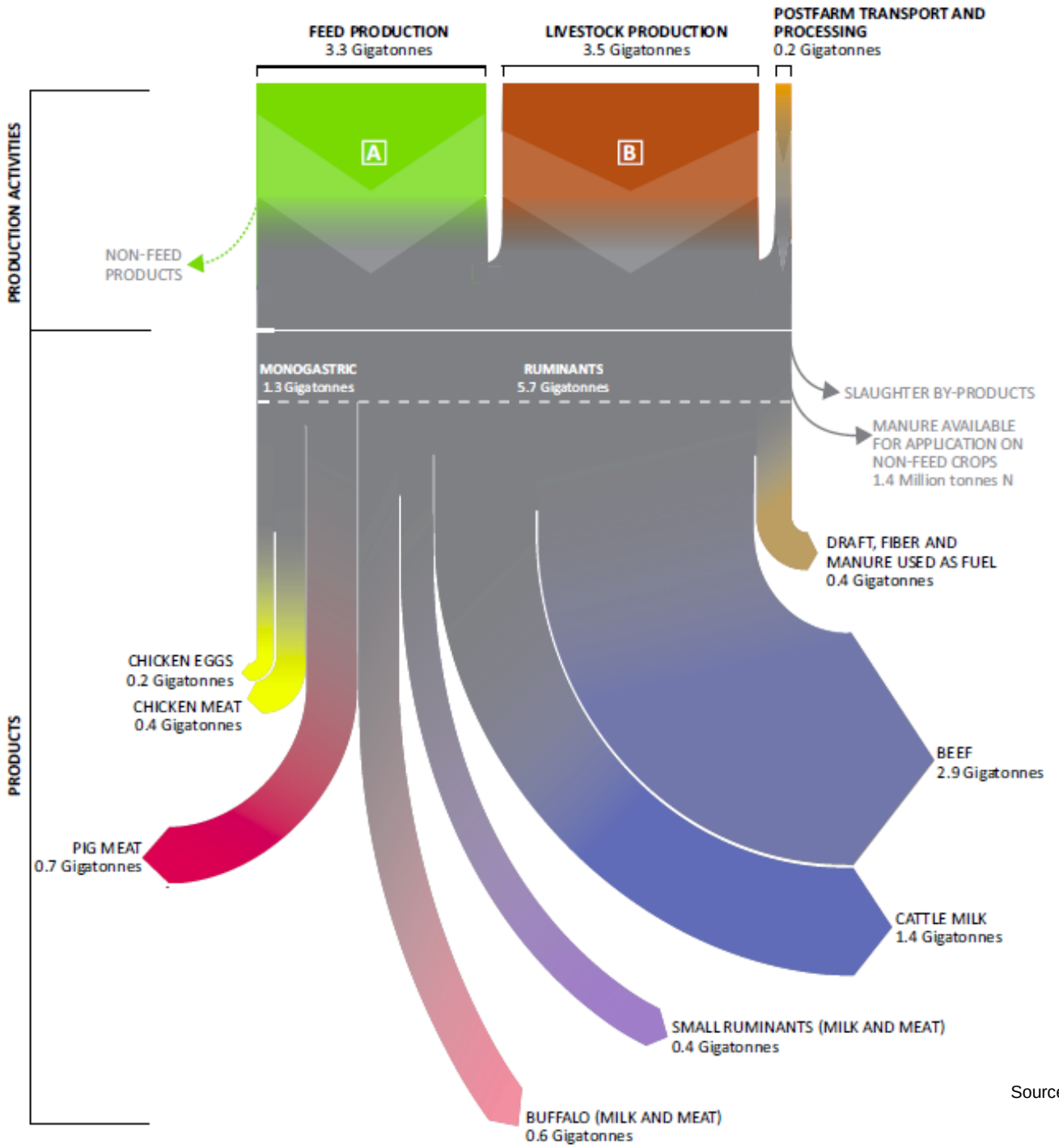
Source: FAO. 2013. Tackling Climate Change though Livestock.

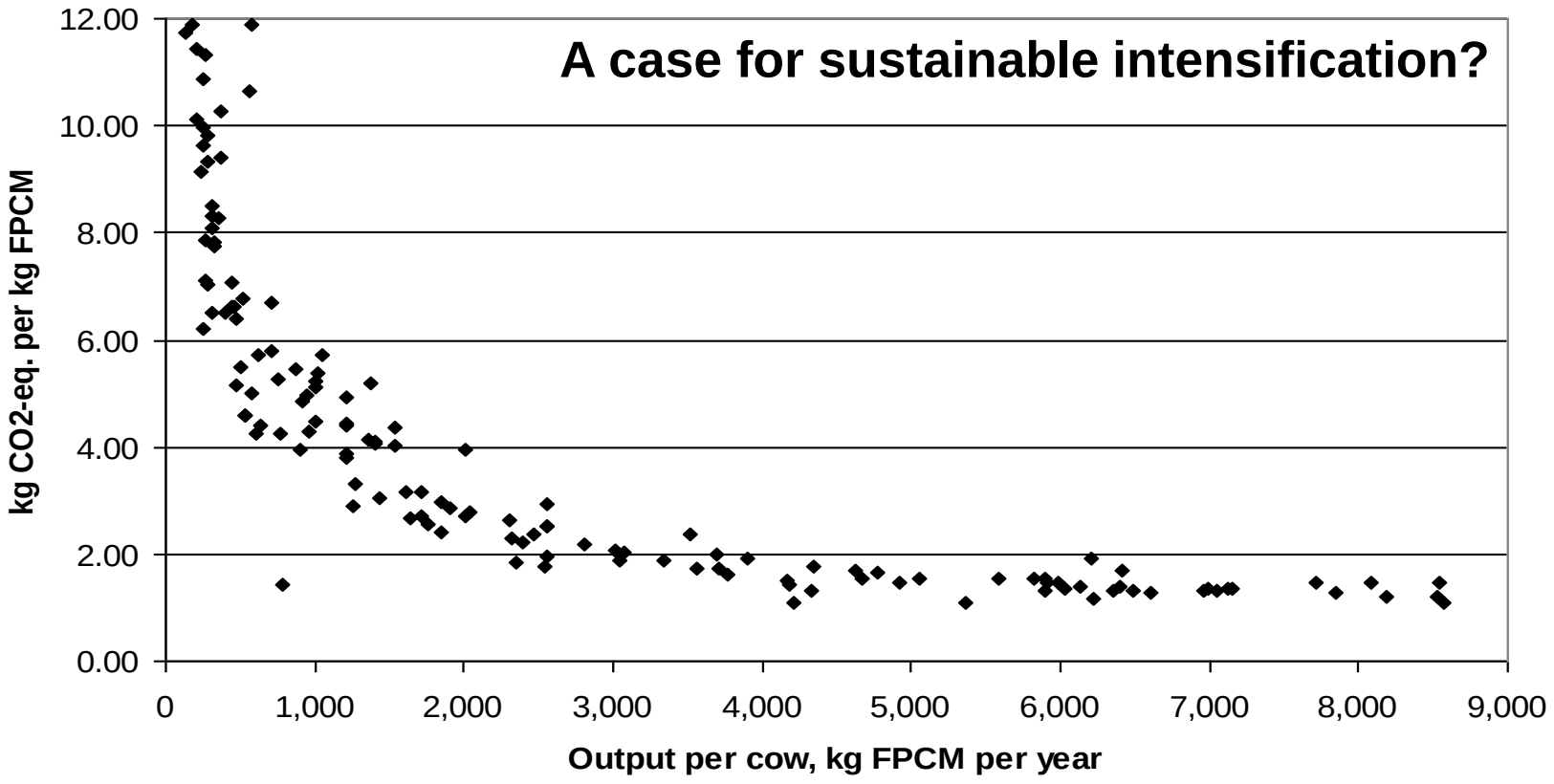


GHG emissions from global livestock supply chains, by production activities and products

Source: FAO. 2013. Tackling Climate Change though Livestock.

The Livestock – Climate Change Dynamic

Relationship: total greenhouse gas emissions and milk output



Steinfeld. 2010. Livestock's Emergence from the Long Shadow.

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

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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.

© Hoeggel.

***= 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."*

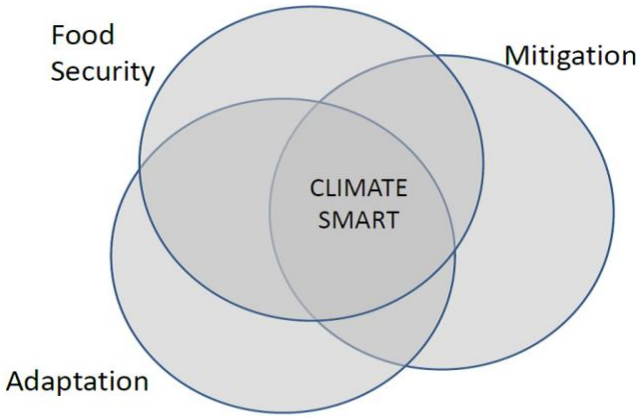
Climate Smart Agriculture (CSA)

How to adapt to a changing climate and get more resilient?

Climate-Smart Agriculture

Source: http://www.fao.org/climatechange/climatesmart/en/

*„Agriculture that sustainably increases **productivity**, **resilience** (adaptation), **reduces/removes GHGs** (mitigation), and enhances achievement of national **food security and development goals**“*

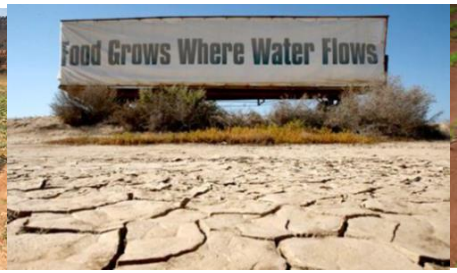


FAO, 2010: „Climate-Smart“ Agriculture - Policies, Practices and Financing for Food Security, Adaptation and Mitigation.

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

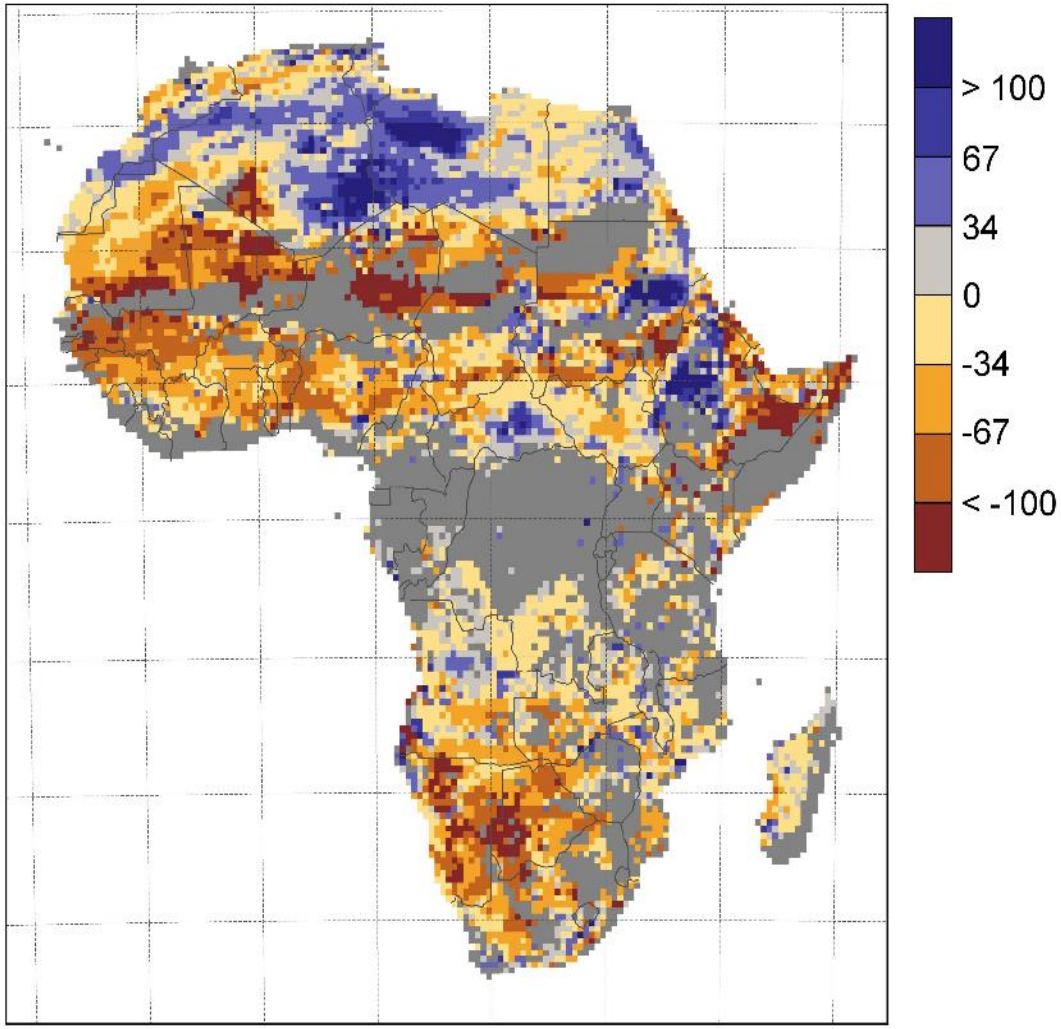
- Changes in feed resources will occur (pasture, crop residue, suppl. feed)

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

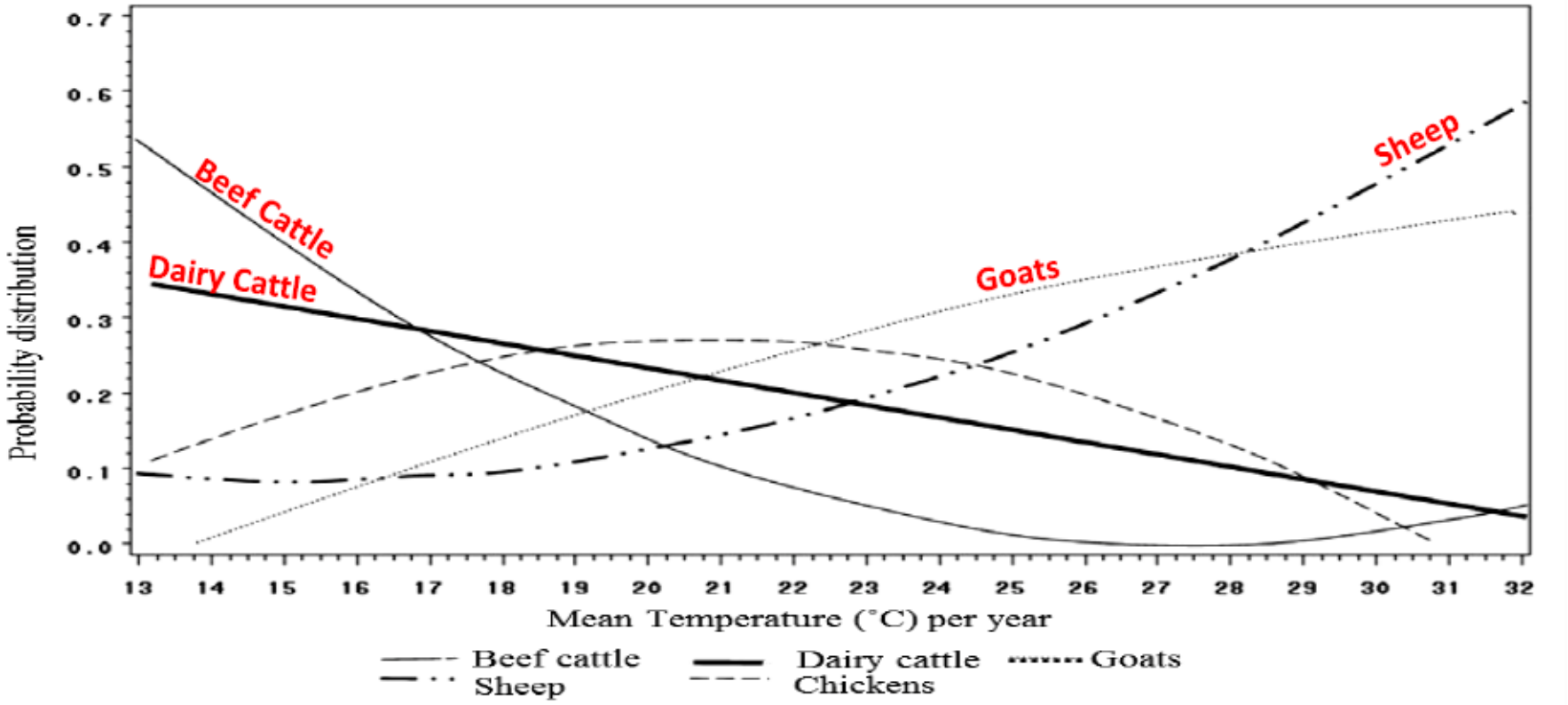
Grazing systems	Non-grazing systems
Direct impacts	
• extreme weather events • drought and floods • productivity losses (physiological stress): reduced foraging time and feed intake, growth, carcass quality, reproduction • water availability	• water availability • extreme weather events
Indirect impacts	
• fodder quantity and quality • Pest and disease epidemics (spread and severity) • host–pathogen interactions and incidence of emerging diseases	• increased resource prices, e.g. feed and energy • disease epidemics • increased cost of animal housing, e.g. cooling systems



- 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) tha 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 !!!!