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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Livestock in Smallholder Adaptation and CSA

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DEUTSCHE ZUSAMMENARBEIT

SADC
SOUTHERN AFRICAN DEVELOPMENT COMMUNITY
TOWARDS A COMMON FUTURE

Outline

- The Livestock – Climate Change Dynamic
- Livestock and Climate Change in Southern Africa
- Livestock and Health
- Livestock in Climate-Smart Agriculture

The Livestock – Climate Change Dynamic

The Livestock – Climate Change Dynamic

GHG emissions along livestock supply chains estimated at 7.1 giga-tons CO2 equivalent per year, 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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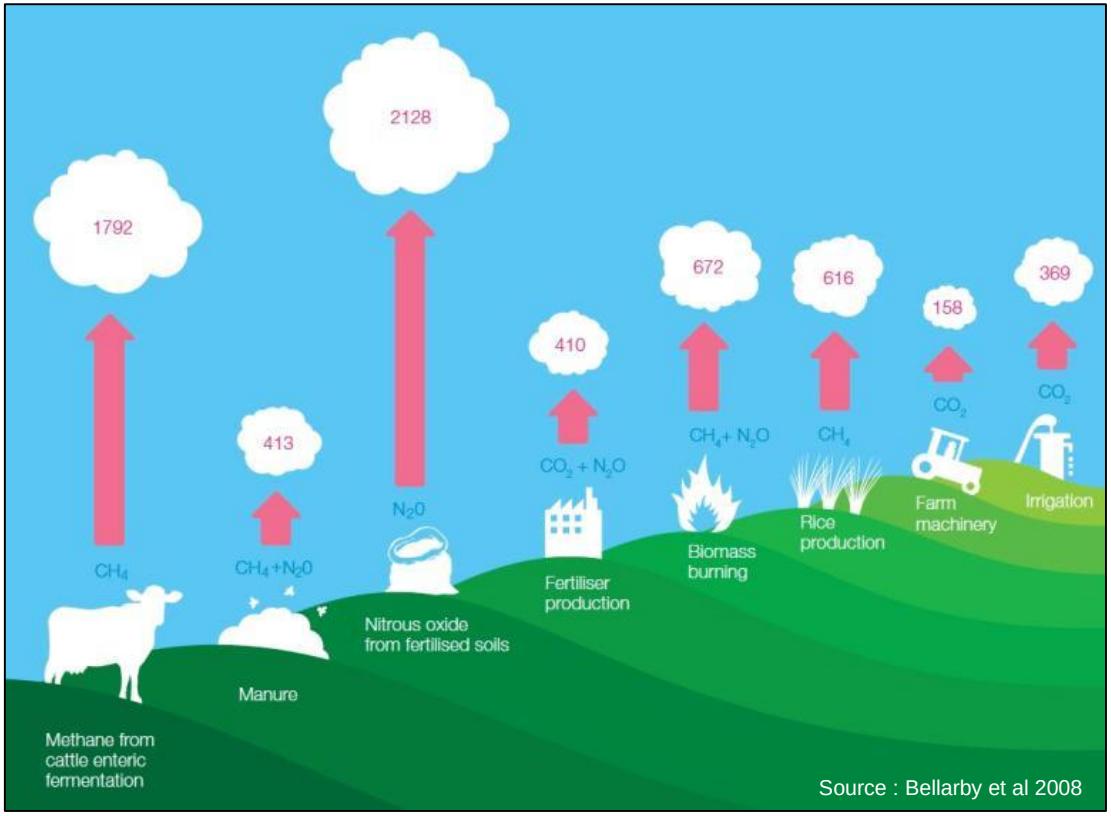
Source: FAO. 2013. Tackling Climate Change though Livestock.

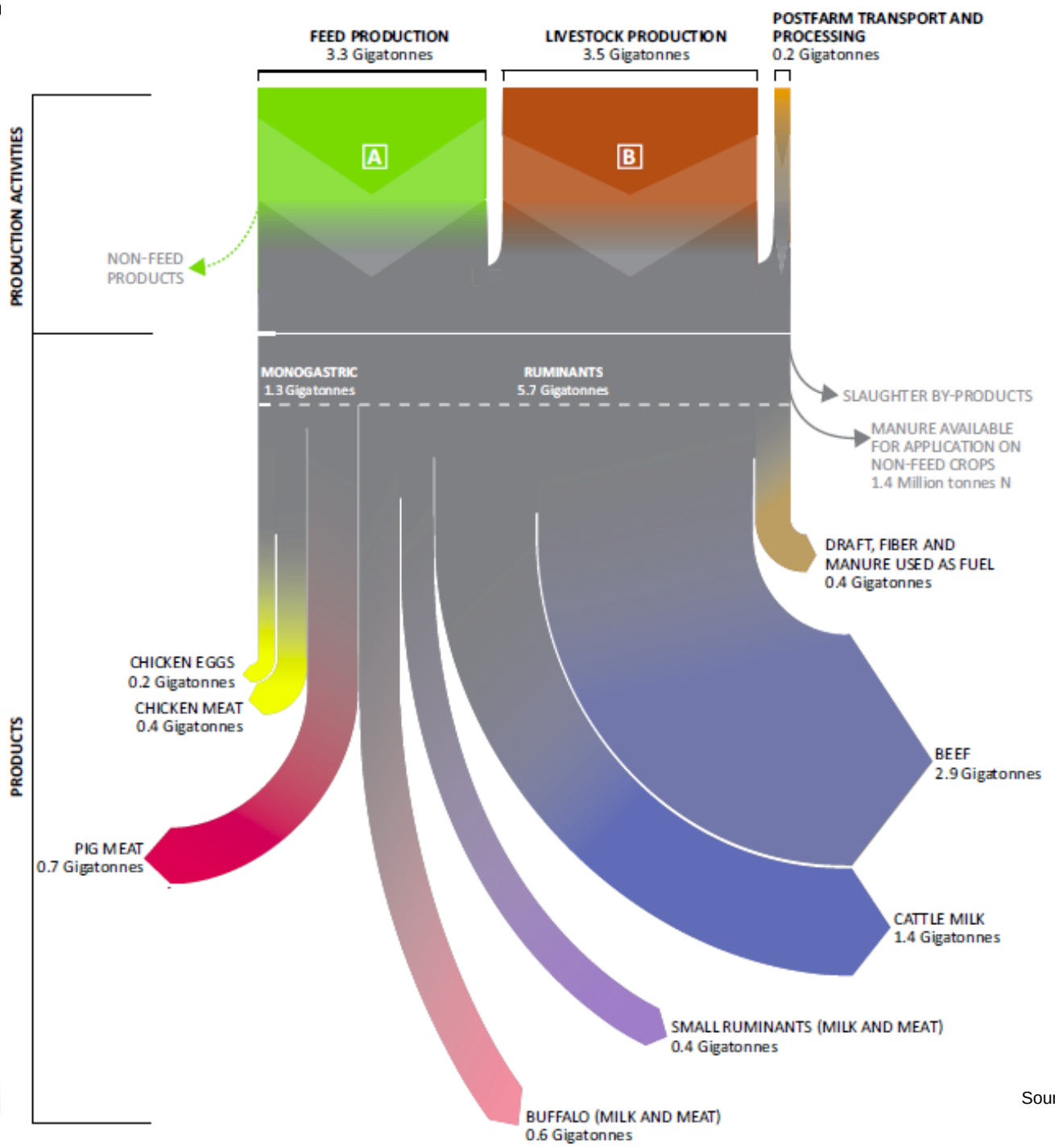
Nitrogen – Environmental and atmospheric impact

Nitrogen environmental and atmospheric impacts:

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



Agricultural emissions in (MT CO_2 eq)

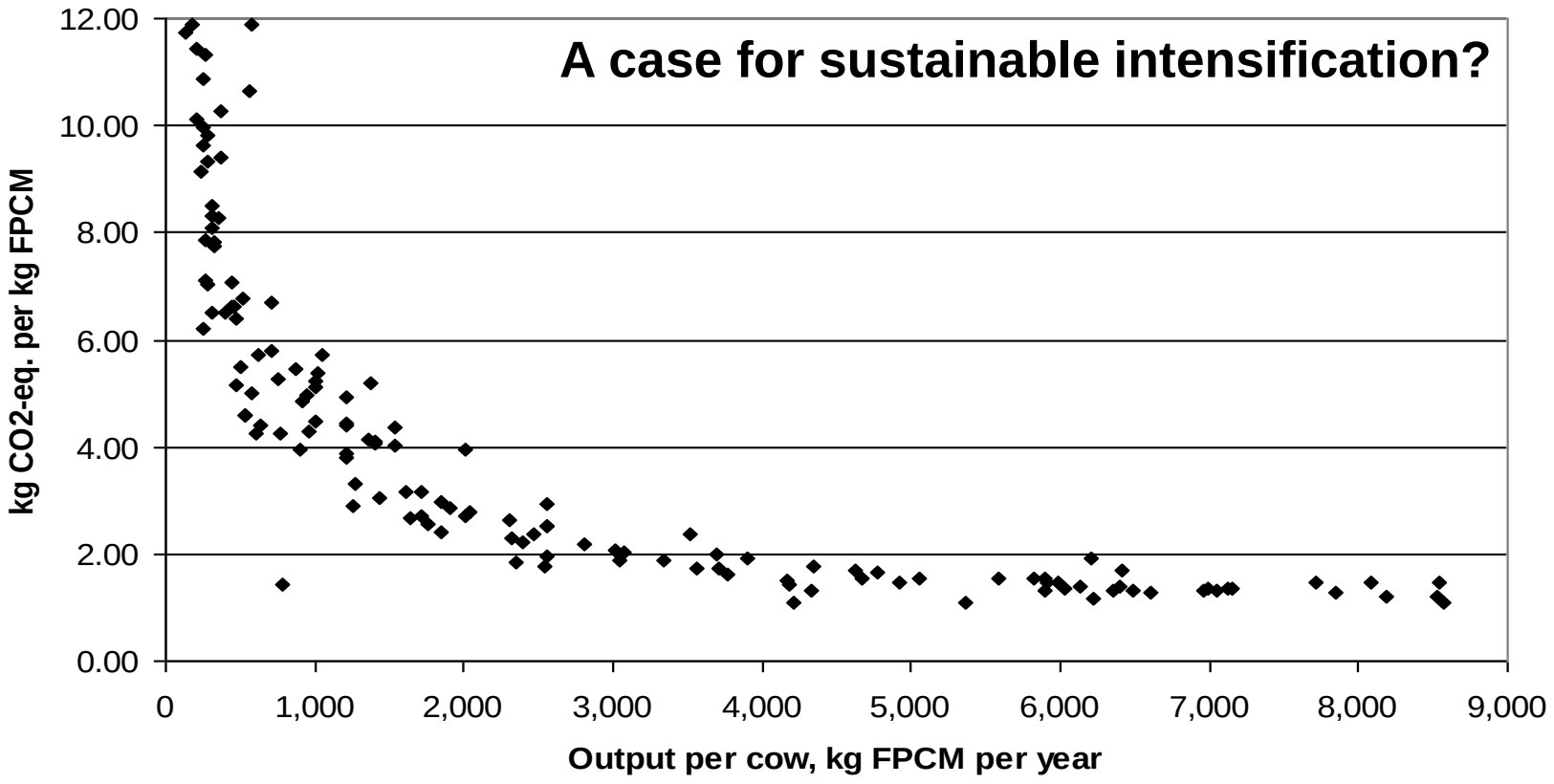


GHG emissions from global livestock supply chains, by production activities and products

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, 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 feed production) represents approx. 70% of all agricultural land globally
- Overgrazing as greatest cause of grassland degradation
- 35% of total world cereal use is fed to livestock and over 90% of 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."*

Livestock and Climate Change in Southern Africa

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

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

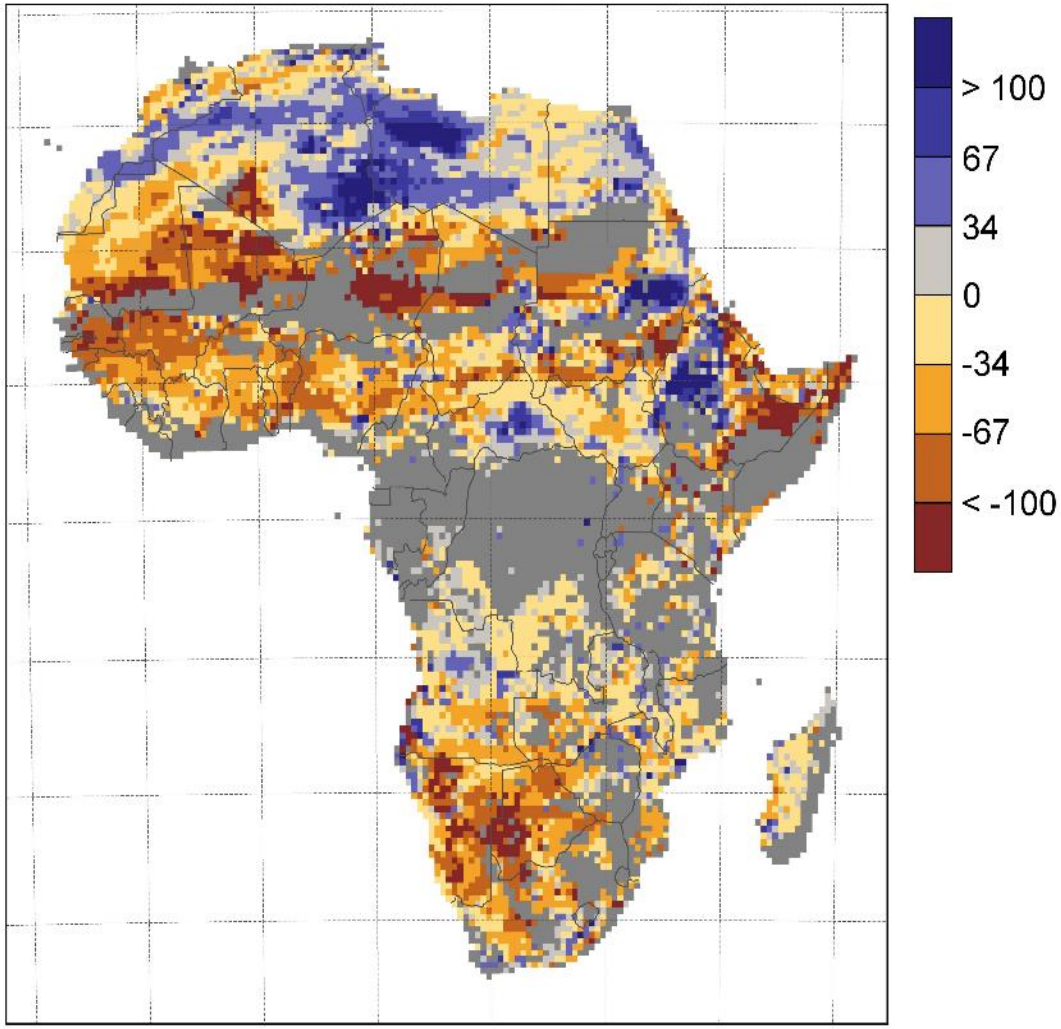
- Changes in feed resources will occur (pasture, crop residue, suppl. feed)

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

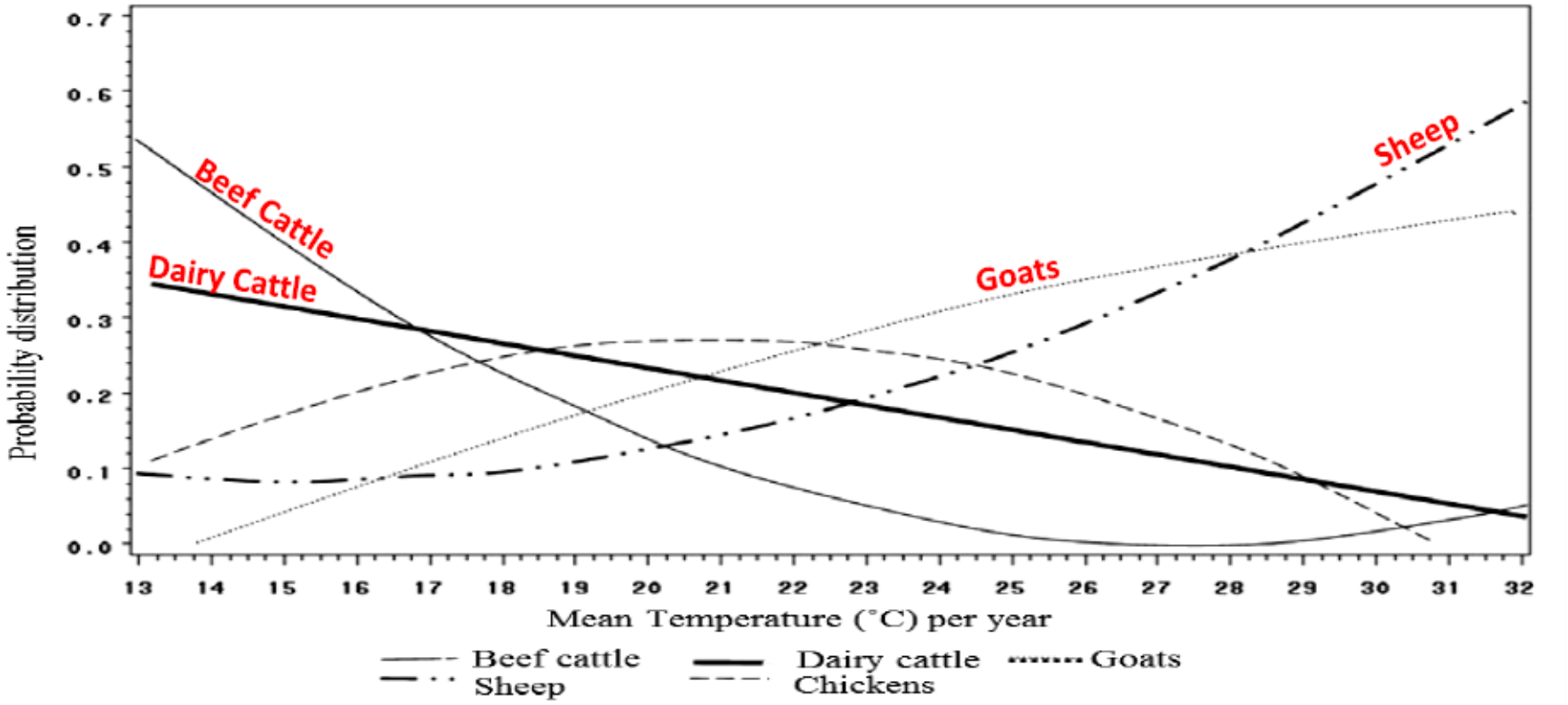
Grazing systems	Non-grazing systems
Direct impacts	
• extreme weather events • drought and floods • productivity losses (physiological stress): reduced foraging time and feed intake, growth, carcass quality, reproduction • water availability	• water availability • extreme weather events
Indirect impacts	
• 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).

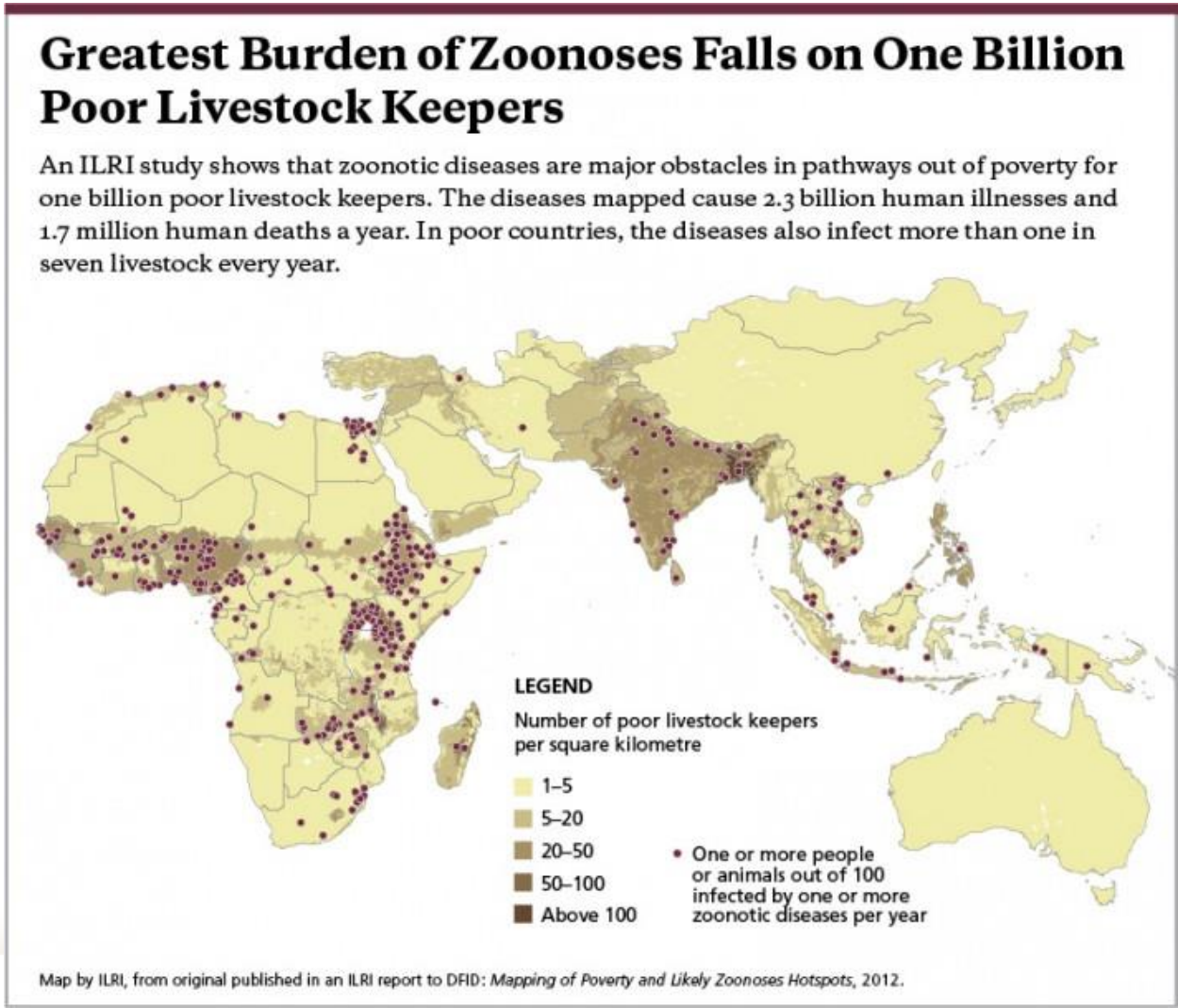


Livestock and health

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

Livestock, diseases and human health under climate change

- High burden of animal disease in SSA
  - Livestock disease probably kills 20% of ruminants, over 50% of poultry each year
  - Causing a loss of approximately USD 300 billion per year
  - Most diseases, animal and human, occur in areas that are hot, wet, and poor



Livestock, diseases and human health und climate change

- Impacts on human health
  - Over 60% of human pathogens are zoonotic (transmissible from animals)
  - Cause billions of cases of illness each year
  - Zoonoses acquired by direct contact or food include bovine tuberculosis, brucellosis and leptospirosis
  - Other zoonoses are emerging (though human infection is currently rare, because pathogen is poorly adapted to humans (e.g. avian influenza) or occasions of transmission are infrequent)
  - But as pathogens evolve, they may become better adapted to humans
  - In low-income countries, zoonoses make up 26% of infectious disease burden and 10 % of total disease burden

Climate change can exacerbate disease in livestock, some diseases are especially sensitive to climate change

- 58% of animal diseases important to poor livestock keepers are climate sensitive – likely to have greatest impact
- Climate change could affect distribution of vector-borne diseases: ticks, mosquitoes, flies - East Coast fever, babesiosis, anaplasmosis, trypanosomiasis
- Direct effects likely to be most pronounced for diseases that are vector-borne, soil associated, water or flood associated, rodent associated, or air temperature/humidity associated
- Most prominent: food-and-water borne zoonoses with high human health burden
  - 94 million cases of gastroenteritis due to Salmonella species occur globally each year, with 155,000 deaths
  - Campylobacter infection has even higher burden (than Salmonella)
  - Parasitic diseases that impose a high burden on productivity, water-transmitted leptospirosis and soil associated anthrax, tuberculosis, rabies, leishmaniasis, brucellosis, hepatitis E, etc.

Example 1: Trypanosomosis

- Caused by a blood-borne parasite, transmitted by tsetse fly
- Cattle are especially affected: annual losses of some US$ 5 billion
- Tsetse occur currently only in Africa, distribution highly dependent on climate, land cover and demography
- Climate change impact: changed distributional potential of tsetse but anthropogenic changes resulting from population expansion are key
- Estimated reduction of tsetse distribution by some 15% may occur by 2030, though some areas may become more suitable
- Model-based and not very high confidence (cannot predict land use change well), but more agricultural development makes many areas less suitable for tsetse to survive

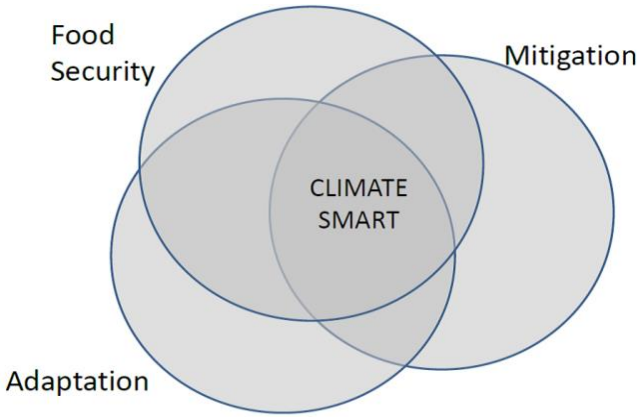
Livestock in Climate Smart Agriculture (CSA)

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

Climate-Smart Agriculture

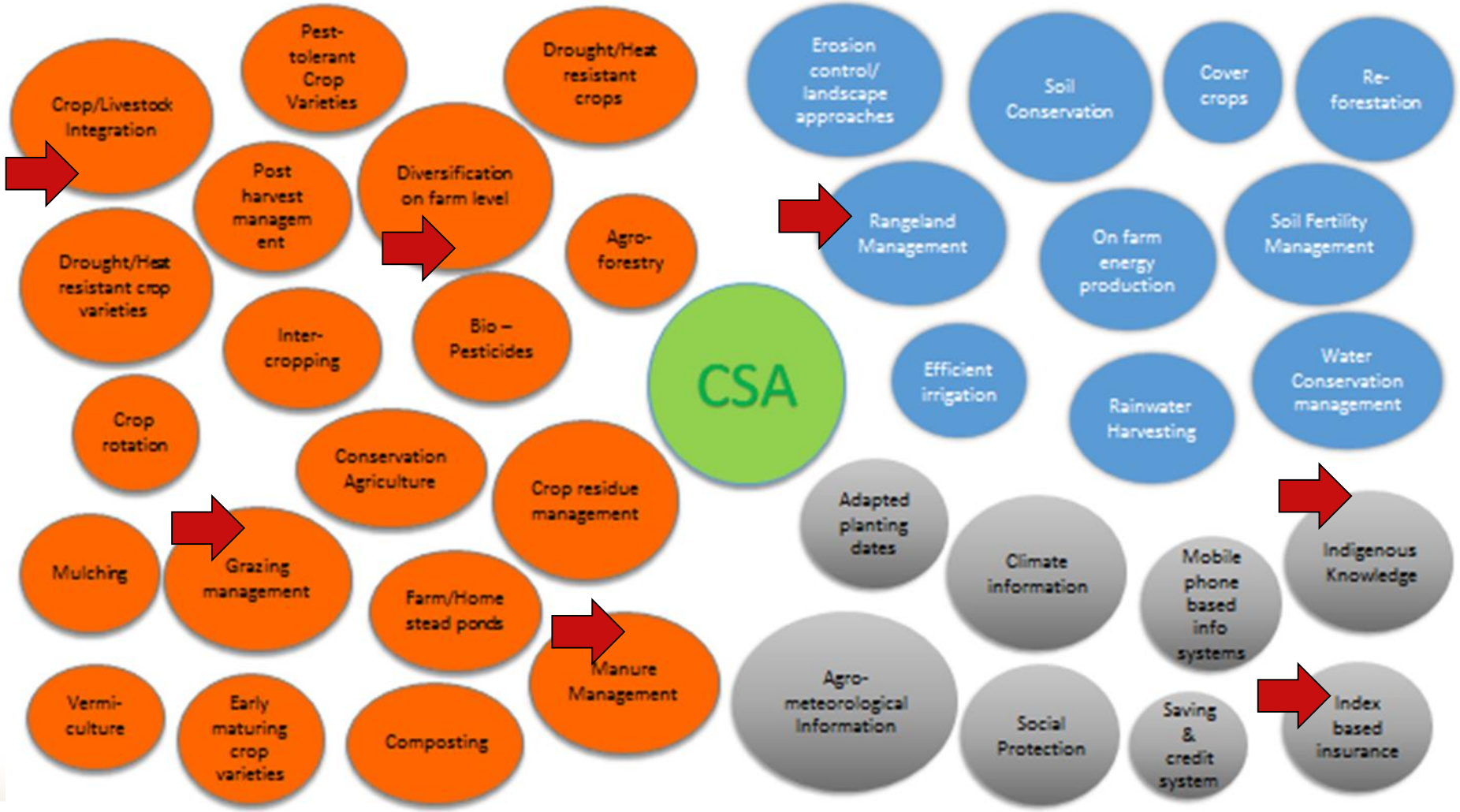
Source: http://www.fao.org/climatechange/climatesmart/en/

*„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 options for livestock

- **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

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Climate smart options for livestock

- **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

Climate smart options for livestock

- **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, animal health
  - Livestock housing (against weather elements)
- **Manure management**
  - Improve handling to ensure recovery and recycling of nutrients and energy contained in manure, storage and application techniques
  - Biogas production (anaerobic digestion of manure)

Climate smart options for livestock

- **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/water, impacts on land/labour resources, increased risk under climate variability

  -> Positive consequences for incomes, methane production and land use

Adapted breeds offer resilience

- Almost 100 breeds have gone extinct between 2000 and 2014 and 17% of farm animal breeds are at risk of extinction (FAO, 2016).
  - Majority of indigenous breeds are unimproved and therefore viewed as inefficient
  - Indigenous breeds are in the kept by resource poor farmers

- Indiscriminate cross-breeding while neglecting environmental adaptation is a threat to livestock diversity.

- Other threats include (i) introduction of non-native breeds, weak policies and institutions, the lack of profitability and competitiveness of traditional breeds, production system intensification, and poor disease management.

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 for livestock

- **Diversify your system**
  - Change mix of products: crops and livestock, heat tolerant breeds, be opportunistic in investing in crops/livestock depending on season
  - Crop-livestock or crop-livestock-tree systems (e.g. combine leguminous fodder shrubs and herbaceous legumes with food crops to improve crop productivity, fodder)
  - Production shifts (from cattle to more small ruminants, intensification to chickens, pigs)
- **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

Practices with mitigation co-benefits

- Technologies that improve productivity, such as feeding additives, vaccines and genetic selection have potential to reduce emissions
- Feed quality improvements that enhance digestibility (urea treatment, drying, grinding and pelleting) and use of improved forages such as mixes including legumes
- Improving pastures and reducing land degradation
- Agroforestry
- Biodigesters
- Changing consumption behavior as effective way of cutting GHG from animal production
- Supportive policies, adequate institutional and incentive frameworks and more pro-active governance are needed to fulfil the sector's mitigation potential (FAO, 2013)

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

Conclusion

- Livestock offer options for land use in marginal areas and offer resilience in arid areas – already key for poor smallholders
- Adaptation and mitigation potentials
- Provide efficient feeds/ diets and manage manure
- Improving productivity of breeds and efficiency of use of feed resources provides mitigation options
- Breed productive and adapted animals
- Improve management of grazing and over sow pastures with improved varieties & agroforestry spp
- Enabling environment needed to for smallholders to adopt efficient approaches and technologies.

Thank you for your attention !!!!