

# Climate Smart Crop Production

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# What is Climate Smart Agriculture?

## **How do we apply it to crop production?**

# Key messages

- Need for stronger linkages between research and extension (& education??), and appreciating the value of local innovations
- Drought-tolerant and high-yielding crop varieties, together with crop diversification will play a pivotal role in reducing the food-security risks associated with climate change
- The identification and development of agricultural clusters and incentive schemes for climate resilient products will help accelerate the adoption of CSA innovations in Zimbabwe
- Incorporation of CSA into the curricula of institutions of higher learning will greatly improve farmers' access to climate-resilient technologies and practices, knowledge and information

# CSA practices

- Conservation agriculture, mulching, dry planting, no-tillage and minimum tillage, crop rotations, green manuring, cover crops, broad bed furrows
- Development and promotion of drought tolerant crops including small grains
- Promotion of short season varieties
- Rainwater harvesting techniques
- Beneficial crop combinations and succession planting
- Early dry planting of short season varieties of maize

# Conservation Agriculture



Ground cover through Crop residues

# Cover crops as CA



Fodder radish



Lab lab



Black Sunnhemp



Cowpea



Velvet bean



Sunnhemp



Jack bean

# Mulching

Mulching at Makoholi  
Research Station



# Small grains promotion



Sorghum production at Matopos, Nkayi, Chiredzi, Buhera, Muzarabani and Tsholotsho

Sorghum crop at Nkayi 2017

# Small grain promotion



Sorghum, pearl millet, finger millet

# Rainwater harvesting



Pot holing done in Chiredzi, Matopos, Masvingo, Chivi, Buhera

# Intercropping



Intercropping of cowpea and pearl millet at Matopos

# Knowledge Sharing



Farmer Trainings through field days,  
IPs, Shows, FFSs, Seed Fairs,  
Participatory Variety selection

# Innovation Platforms



Established at Hwedza, Mutasa for wheat and Manunure, Gudyanga, and Nyanyadzi for beans.

# Farmer Field Schools

- Partnerships groundnuts, small grains, drought tolerant maize, cowpea across the country with:
  - Community Technology Development Organisation
  - Practical Action
  - SAFIRE
  - SNV



# Germplasm Technology

- Conventional plant breeding for drought tolerance, pest and disease resistance has seen an increase in availability of better hybrids to farmers
- DR&SS has collaborated with CIMMYT and Institute of Tropical Agriculture (IITA)'s Drought Tolerant Maize for Africa (DTMA) and Stress Tolerant Maize for Africa (STMA) as well CIAT and ICARDA.

# Stress Tolerant Maize for Africa



Multiple stresses on the maize crop



Drought tolerant maize crop

- Zimbabwe and sub-Saharan Africa – 35 Million Ha under maize production (Fischer et al., 2014).
- Multiple production stresses occur concurrently in the field (CIMMYT, 2016).
- Stress tolerant maize is needed to maintain productive maize production in the face of climatic change and growing stresses in the production environment (Cairns et al., 2013).

**Over the last 20 years, maize production in Zim has never reached the self sufficiency level of 1.8 Mil tons (Ruzivo Trust, 2013)**

# Drought tolerant -- varieties by DR&SS

- ZS 263, ZS269,ZS265, ZS271, ZS273,ZS275 under Drought Tolerant Maize for Africa
- ZS 244, ZS242, ZS246, ZS255, ZS255 under Stress Tolerant Maize for Africa
- Drought tolerant Bean varieties such as Sweet Williams were also bred. NUA 45 bean variety is an early maturing varieties

# DT Varieties: Cowpeas

- Seven elite advanced mutant lines have been disseminated to various communal farming communities in Zimbabwe through on-farm evaluations.
- Mutation induction has generated a huge genetic base for cowpea improvement with elite material combining superior traits in drought tolerance, earliness and increased yields. Selected lines are in M2, M3, M4 and M5 generations.
- The mutation breeding project is contributing to food and nutrition security in Zimbabwe through availing elite cowpea genotypes to the farmers.

# Selected mutants at Harare Research Station



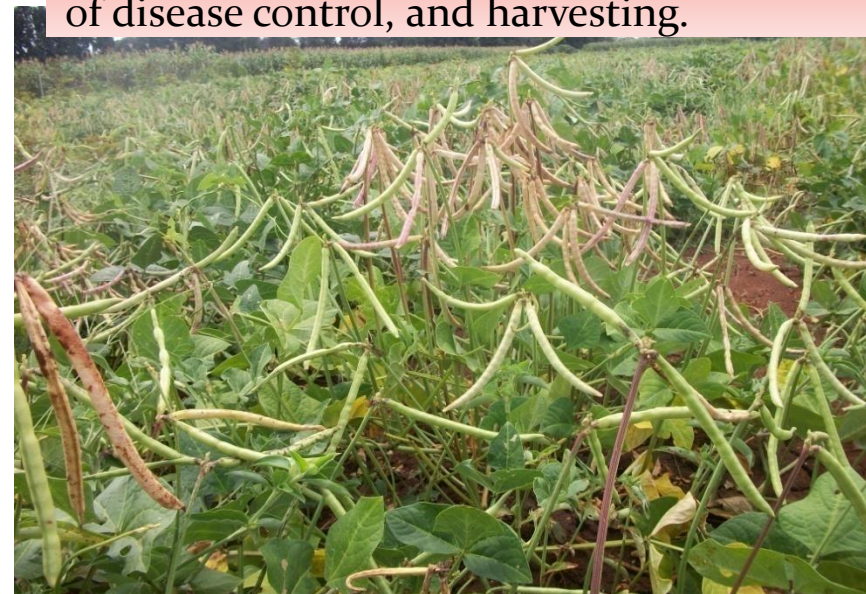
Early maturing cowpea mutants



Mutants with pods above the canopy – easy of disease control, and harvesting.



High fodder and grain yield potential



# Other smart practices

- Crop diversification
- Irrigation
- Early dry planting

# Challenges

- Inadequate seed for drought tolerant varieties developed but still on the shelf
- Poor promotion of new innovations
- Poor linkages with agriculture colleges
- Inadequate finance

# Way forward

- Institutionalisation of Innovation Platform approach
- Upscaling of basic seed production through community-based seed production
- Suitability maps for different crops and varieties
- Appropriate crop diversification mix

**THANK YOU FOR LISTENING!!**



# Climate-Smart Agriculture Manual

for Agriculture Education in Zimbabwe

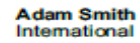


# Climate-Smart Agriculture Manual

for Agriculture Education in Zimbabwe

Edited By  
Todd Ngara  
UNEP DTU Partnership

Special thanks to the following organisations for their support:



  
**SUSTAINABLE  
DEVELOPMENT  
GOALS**

**1** NO  
POVERTY



**2** ZERO  
HUNGER



**3** GOOD HEALTH  
AND WELL-BEING



**4** QUALITY  
EDUCATION



**5** GENDER  
EQUALITY



**6** CLEAN WATER  
AND SANITATION



**7** AFFORDABLE AND  
CLEAN ENERGY



**8** DECENT WORK AND  
ECONOMIC GROWTH



**9** INDUSTRY, INNOVATION  
AND INFRASTRUCTURE



**10** REDUCED  
INEQUALITIES



**11** SUSTAINABLE CITIES  
AND COMMUNITIES



**12** RESPONSIBLE  
CONSUMPTION  
AND PRODUCTION



**13** CLIMATE  
ACTION



**14** LIFE  
BELOW WATER



**15** LIFE  
ON LAND



**16** PEACE, JUSTICE  
AND STRONG  
INSTITUTIONS



**17** PARTNERSHIPS  
FOR THE GOALS



**Africa** will have a **larger percentage** of  
the world's population to **feed.**

Demographic Projections, the Environment and Food Security in Sub-Saharan Africa, Working Paper, UNDP, Regional Bureau for Africa,  
Tukufu Zuberi and Kevin J.A Thomas, 2012

**65%** of the world's population will be  
living in urban areas by 2030

United Nations Sustainable Energy for All: A Global Action Agenda; *Pathways for Concerted Action toward Sustainable Energy for All*, 2012

In Zimbabwe, the **majority of the population**,

**67%** lives in rural areas and mostly

depends on agriculture-based livelihoods

Zimbabwe Population Census 2012, National Report, Population Census Office.

In many African countries, **yields from rain-fed agriculture could be reduced** by up to

**50%.**

Fact Sheet: Climate Change in Africa – What is at stake? Excerpts from IPCC reports, the Convention, and BAP. Compiled by AMCEN Secretariat.  
2007

The African continent has warmed by about **0.5°C** over the last century, and average annual temperatures are expected to continue to rise—by about **3-4°C** by 2080, greater than the global average.

Identifying opportunities for investments in Climate-Smart Agriculture in Africa: Giacomo Branca, Timm Tennigkeit, Wendy Mann , Leslie Lipper, FAO, Rome, April 2012.

Zimbabwe is experiencing **more hot and fewer cold days than before** as a result of climate change and variability. The country's annual mean surface temperature has warmed by

about **0.4°C** from 1900 to 2000. The period

from 1980 to date has been the warmest since Zimbabwe started recording its temperature

National Climate Change Response Strategy: Government of Zimbabwe, Ministry of Environment, Water and Climate

**80%** of Africa's agriculture still depends on  
rain not irrigation.

Africa Progress Panel; By Caroline Kende-Robb, 29 November, 2013.

Agriculture uses most of Zimbabwe's water,

**81%** for irrigation, fish farming and  
livestock watering.

National Climate Change Response Strategy: Government of Zimbabwe, Ministry of Environment, Water and Climate

**The last 30 years** have shown a trend towards **reduced rainfall or heavy rainfall and drought** occurring back to back in the same season. The frequency and length of **dry spells** during the rainy season have increased while the frequency of **rain days** has declined.

National Climate Change Response Strategy: Government of Zimbabwe, Ministry of Environment, Water and Climate

**Global technical mitigation potential** from agriculture could reach the equivalent of 5 500-6 000 tonnes of CO<sub>2</sub> per year by 2030. This is grossly equivalent to the sector's emissions in 2030 (around 8 200

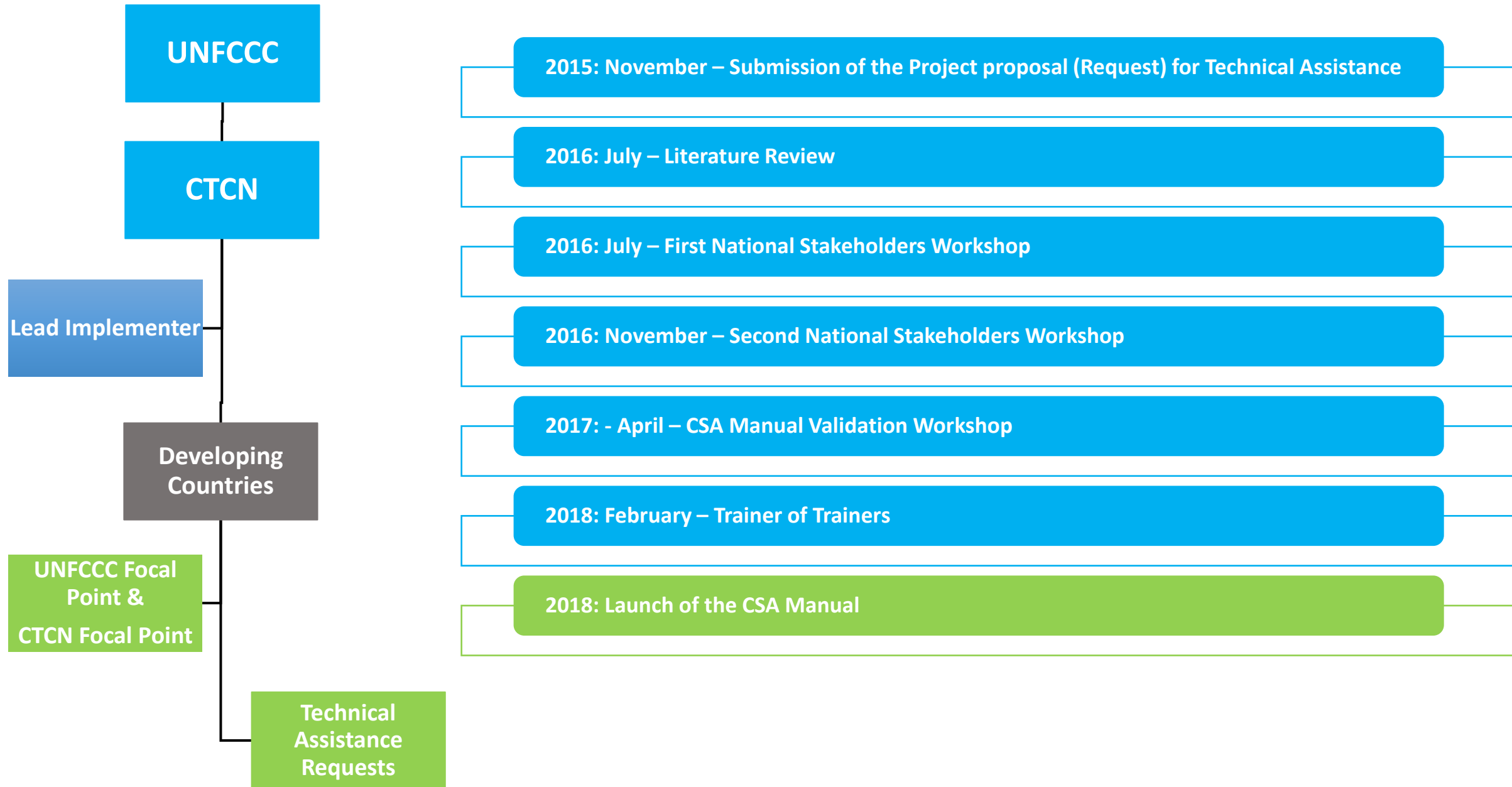
tonnes of CO<sub>2</sub>.) About **70%** of this identified potential lies in developing countries.

Intergovernmental Panel on Climate Change (IPCC). 2007. Climate Change 2007: Mitigation of climate change, B. Mertz, O.R. Davidson, P.R. Bosch, R. Dave and L.A Meyer, eds. Contribution of Working Group III to the Fourth Assessment Report of the IPCC Cambridge, UK and New York, USA, Cambridge University Press.

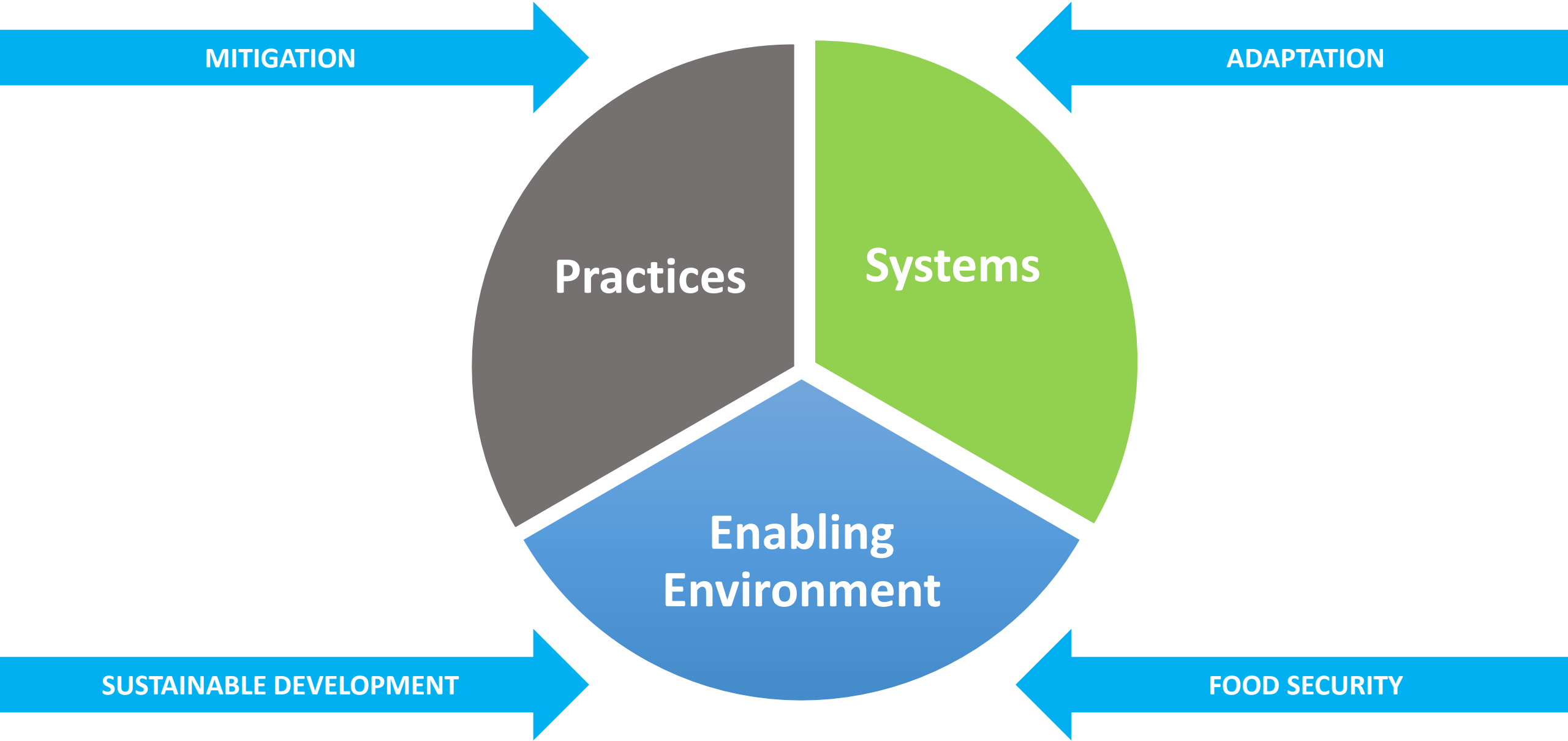
**Africa** is the world's youngest continent. If it invests in education and training to develop the potential in its youth, Africa could become one of the most dynamic and productive economies.

Africa in 50 Years' Time: The Road Towards Inclusive Growth, Africa Development Bank, Tunis, Tunisia, September 2011.

# UNFCCC CTCN Technical Assistance Roadmap



# WAY FORWARD: PUTTING CSA KNOWLEDGE INTO PRACTICE



MITIGATION

ADAPTATION

Practices

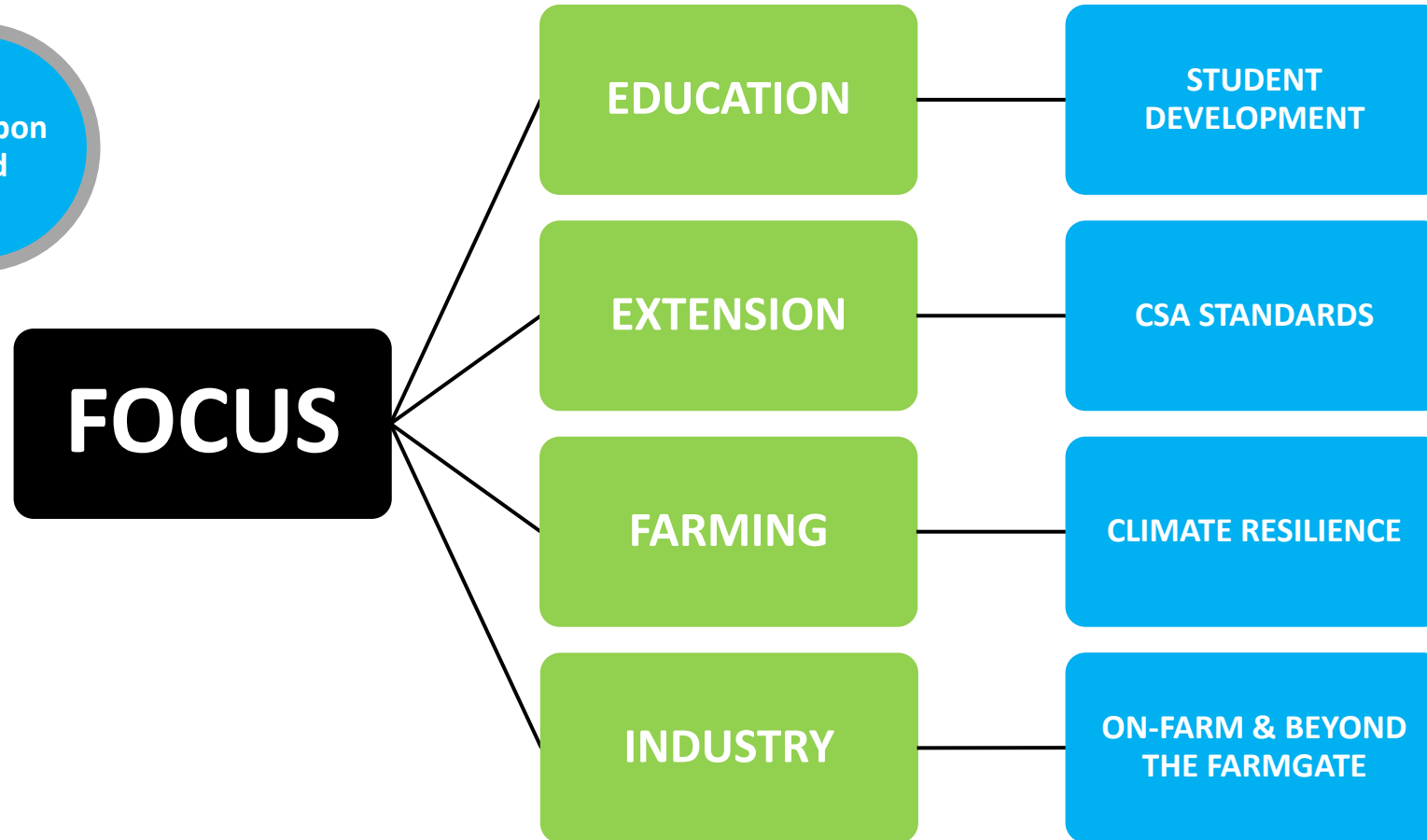
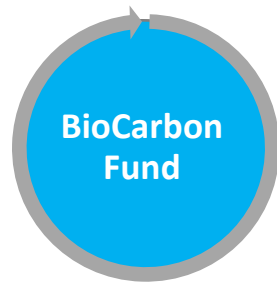
Systems

Enabling Environment

SUSTAINABLE DEVELOPMENT

FOOD SECURITY

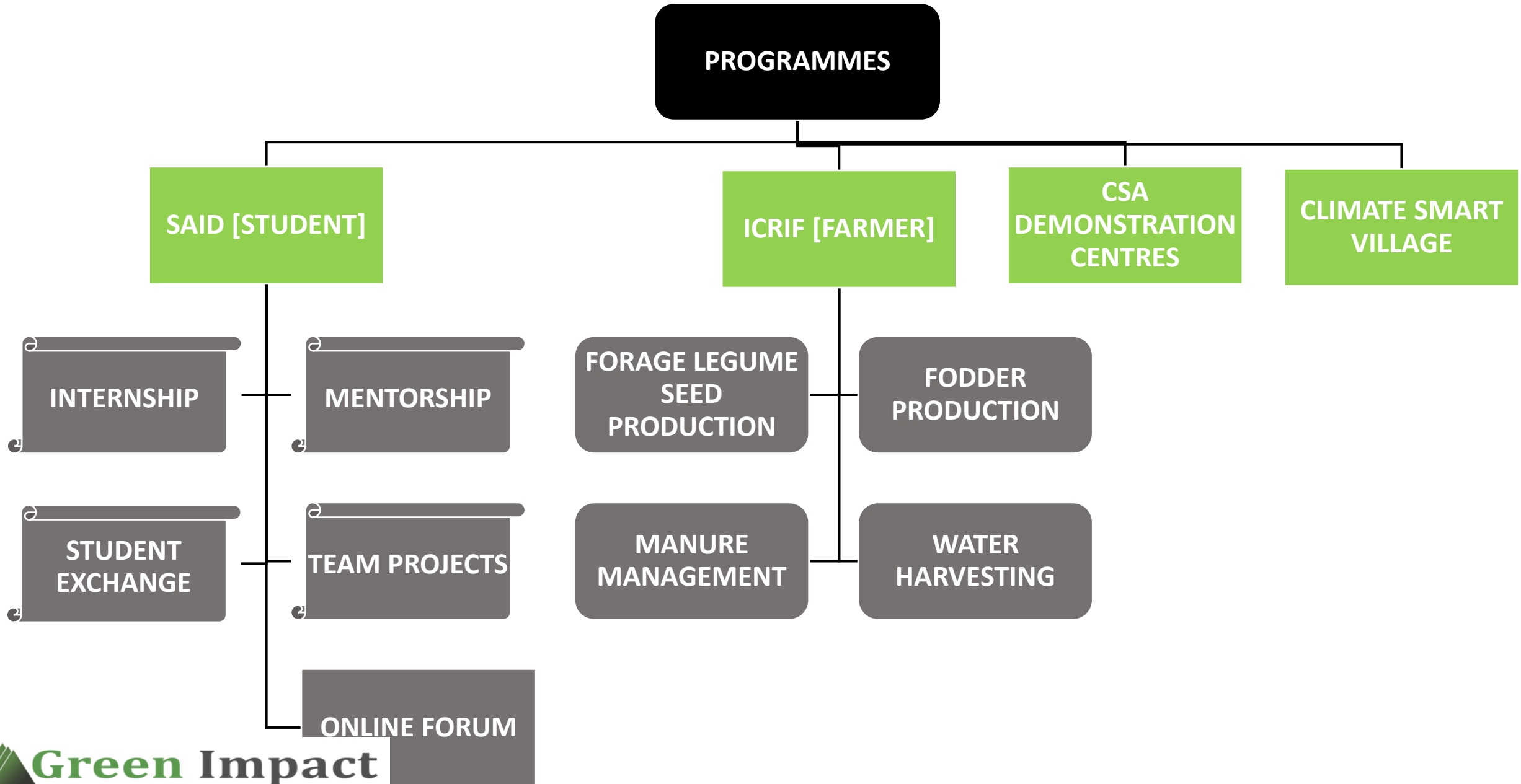
# FOCUS OF THE CSA MANUAL



## OTHER FOCUS AREAS ACCORDING TO THE UNFCCC CTCN TA RESPONSE PLAN

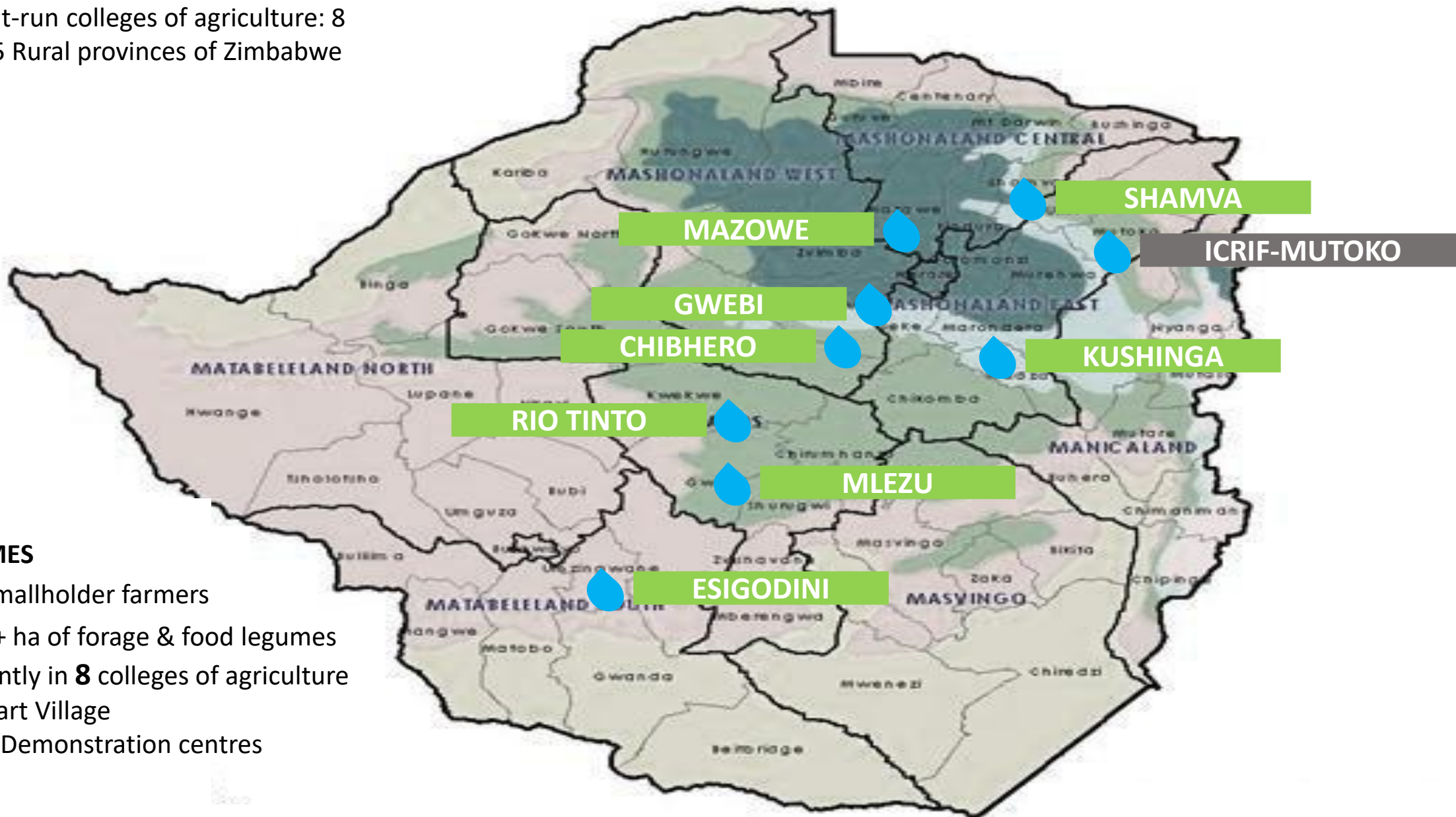
1. CSA Framework/Strategy
2. Green Impact Trust Student Exchange programme (North-South & South-South)
3. Awareness of CSA across the value chain
4. CSA Demonstration Centres in colleges of agriculture
5. CSA Villages in rural communities

# PROGRAMMES



## OVERVIEW

- Government-run colleges of agriculture: 8
- Located in 5 Rural provinces of Zimbabwe



## PROGRAMMES

- ICRIF: **96** smallholder farmers
- ICRIF: **100+** ha of forage & food legumes
- SAID: Currently in **8** colleges of agriculture
- Climate Smart Village
- Agriculture Demonstration centres

# STUDENTS AGRICULTURAL INNOVATION AND DEVELOPMENT (SAID) WORKPLAN

ACTIVITY	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Team Recruitment and Selection	Green											
Teams and Patrons Training workshops		Olive										
Project Identification and Formulation		Red										
Project Implementation			Blue	Blue	Blue	Blue	Blue	Blue	Blue		Blue	Blue
Monitoring, Reporting and Verification			Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow		Yellow	Yellow
Judges Recruitment and Orientation								Green	Green			
Annual Projects Competition										Olive		
Team Mentors Recruitment & Selection		Red										
Team Mentors Training Workshop			Blue									
Team Mentors Review Workshop											Yellow	
Internship Placements											Green	Green
Internship Monitoring visits							Olive	Olive				
Online Forum	Red					Red			Red			
Student Exchange visit												Blue
Harare Agricultural Show												Yellow



**THANK YOU**

# Climate Smart Agriculture Institutional and Policy Engagement



**Dr. Easter Chigumira**

**9 February 2018**

**Management Training Bureau,  
Harare**

# Defining Policy and Institutions

## **WHAT IS POLICY?**

- Systematically defined course of action
- Selected from alternatives
- Guides and determine present and future decisions on a particular issue e.g the environment, climate, agriculture
- Intention is to achieve stated objective(s)
- It guides decision making and programmatic implementation

# Environmental Policy

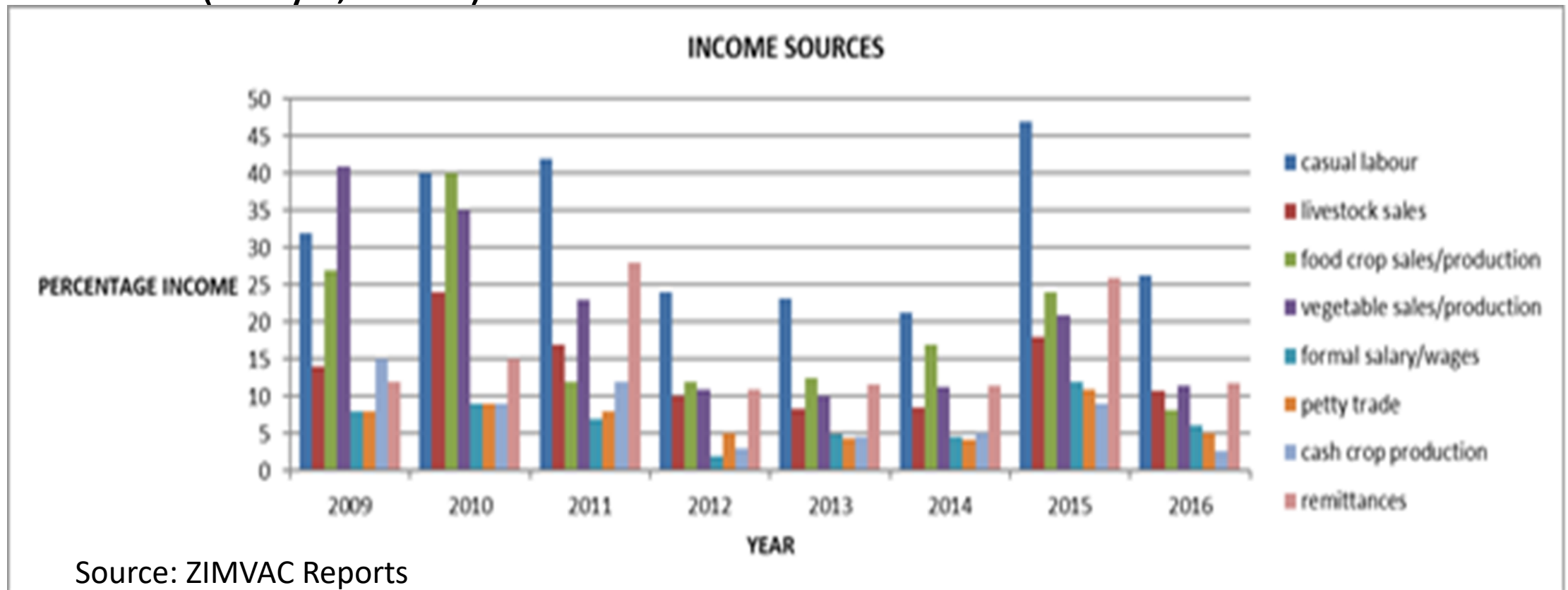
- Defines how environmental concerns are approached from a governmental or organizational perspective, often with the goal of addressing and solving environmental problems.

## Climate Policy

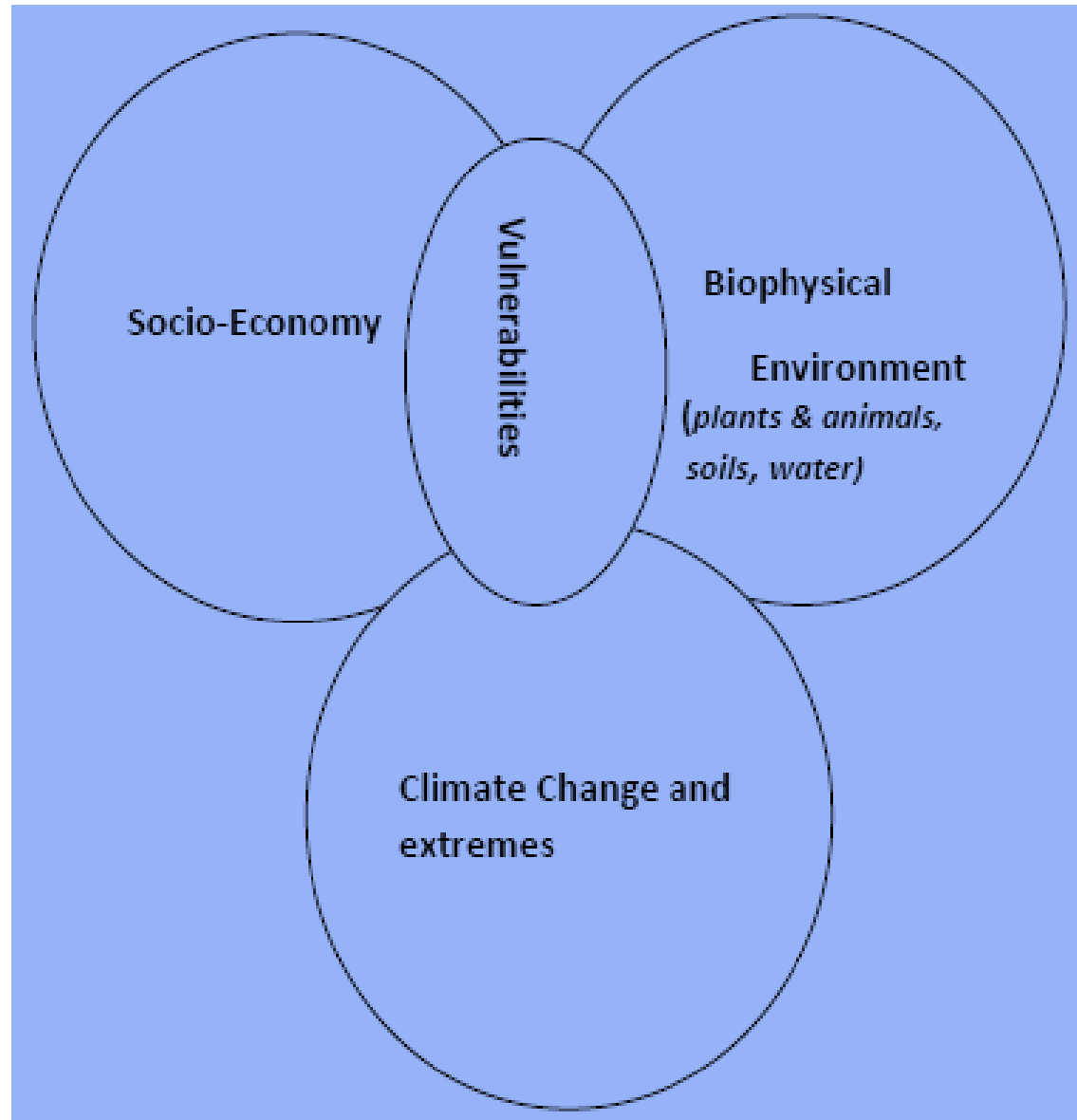
- Seeks to create a pathway towards a climate resilient and low carbon development economy in which the people have enough adaptive capacity and continue to develop in harmony with the environment.

# Framing Policy Environment

- Majority of population dependent on climate sensitive livelihoods
- Rainfed crop and livestock production practiced by 89% of smallholder farmers (Moyo, 2011)



# Rural Vulnerabilities



# Policy Framework

## Policies that Climate Smart Agriculture

ZIMASSET

Environment  
Policy and  
Strategies (2009)

National Gender  
Policy

Transport Policy

National Water  
Policy

National Energy  
Policy

Draft Renewable  
Energy Policy

Draft National  
Forestry Policy

Draft National  
Climate Policy

Draft Biofuels  
Policy

Draft Agriculture  
Policy

Nationally  
Determined  
Contributions

Food and  
Nutrition Security  
Policy

Draft Drought  
Management Policy  
and Strategy

National Policy and  
Programme on  
Drought Mitigation

Technology &  
Innovation  
Policy

# Legislative Framework

## Legislation that supports Climate Smart Agriculture

Constitution  
Sections 48  
73, 76 & 77

Environment  
Management Act

Water Act

Parks and Wildlife  
Act

Forestry Act

Communal Land  
Produce Act

Rural District  
Councils Act

Regional Town  
and Country Act

Public Health Act

Electricity Act

Rural Electricity  
Act

Small to Medium  
Enterprises Act

# Legislative Framework

- **LEGISLATIVE FRAMEWORK**

(SENDAI Framework to disaster risk reduction 2015-2030)

- Civil Protection Act of 1989,
- Water Act of 2002
- Meteorological Services Act of 1990
- **The National Climate Change Response Strategy, the proposed National Framework for Climate Services and the Draft Disaster Risk Management (DRM) Bill of 2012.**

## Social and Economic Frameworks that supports Climate Smart Agriculture

Zimbabwe Agenda  
for Sustainable  
Social and  
Economic  
Transformation  
(ZIMASSET)

Zimbabwe  
Reconstruction  
Fund (ZimRef)

Zimbabwe United  
Nations  
Development  
Assistance  
Framework  
(ZUNDAF)

# Who are the Institutions and what is their role????

- Organisations
- Customs and Norms

# Mainstreaming CSA Policies and Programmes

- Coordination and Clear Sectoral Responsibilities
- Technology and Innovation
- Participatory models
- Institutional Strengthening



# Weather Index Insurance

Todd Ngara

Training of Trainers Workshop, Harare,  
Zimbabwe.  
8th - 9th February 2018

Definitions of WII

CSA and WII

Characteristics of WII

Role of Govts and Donors

Case Study - Malawi

Lessons learnt

Zimbabwe experience

Three ways in which index insurance might help build adaptive capacity:

1. As a risk transfer mechanism within a comprehensive strategy for managing climate risk in the face of climate change;
2. As a mechanism to help people access the resources needed to escape climate-related poverty; and
3. As a mechanism to incentivize risk reduction.

## Preamble(cont'd)

Debate centred on three questions:

1. Can index insurance contribute to adaptation strategies in developing countries?
2. Can it play a role in managing the uncertainty associated with climate change?
3. Does climate change challenge the viability of index-based insurance products?

## Definitions

- **WII for development:** a tool to bring about agricultural and rural development by helping households and input suppliers cope with low-to-medium episodes of risks, for example, drought or excessive rainfall.
- **WII for disaster reduction:** provides an alternative method of financing disaster reduction assistance or relief programmes.

**Productivity:** Index insurance, especially when associated with access to credit, allows farmers to take additional risks by investing in improved practices that increase productivity and food security, even in situations of adverse weather conditions.

### **Adaptation through short-term climate risk management:**

In most developing countries, rainfall varies in both seasonal totals and spatial distribution. Under these conditions, index insurance is designed to contain such risks, thus making a significant contribution to farmers' resilience.

**Mitigation.** This will depend on the degree to which insured farmers are able to invest in improved production practices (e.g., agro-forestry) that either enhance carbon sequestration or reduce greenhouse gas emissions.

The usual features of a WII contract are:

- A specific functional meteorological station is taken as the reference.
- A trigger weather measurement is determined, e.g., the cumulative amount of rainfall in a specified period at which disbursements are triggered in accordance with the contract.
- A lump sum or incremental payment is determined, e.g., a specific amount of money per specified rainfall amount above or below the trigger.
- A limit to the measured parameter is set at which a maximum payment will be made

## Disadvantages of WII

### 1. Basis Risk:

The lack of a **direct link** between on-farm losses and pay-outs is one of the greatest challenges involving index insurance.

**Example:** a weather index does not insure a farmer's loss directly, and multiple farmers, who will typically have somewhat different losses, must be covered by the same index formula and data source. Farmers may receive a pay-out even when their crops survive, or they may experience losses when a pay-out is not triggered.

**2. Technical capacity and expertise.** It is imperative to have technical capacity and expertise, especially during the initial design phase for new products in agro-meteorology and in the operationalisation of the process.

**3. Scarcity of credible weather data.** WII is a function of its availability, spatial coverage and temporal distribution, as well as quality of the weather data. These aspects can vary considerably both within and between countries, especially developing countries.

For long-term sustainability of WII, the role of donors is important to facilitate the development of insurance products.

### Examples:

- Improvements in data systems and data collection.
- Improvements in the legal and regulatory environment.
- Capacity-building programmes on the use and advantages of weather insurance.

### Govt Premium Subsidies

**Drawback** - countries provide a single flat-rate premium subsidy, typically 50% of the full commercial price of insurance for all farmers, all crop types, and all regions at risk. These undifferentiated premium subsidies disproportionately benefit the larger farmers to the detriment of the small and marginal farmers, and they actively encourage farmers in the highest risk rated regions to grow unsuitable high-risk crops.

## Case Studies - Malawi

In Malawi, credit to the rural sector, has been limited. Index insurance can support such farmers as they become more market-oriented and take on higher levels of risk by buying improved seeds and fertilizers.

World Bank, the pro-poor international insurance group MicroEnsure piloted such a project.

.

## Malawi Case Study

First Year: 892 farmers located within 20 km of four weather stations purchased the insurance, which was bundled with a loan for groundnut production inputs. The groundnut sector was chosen for this pilot operation because

- (i) the crop is relatively drought sensitive,
- (ii) farmers had been unable to invest in new groundnut varieties due to their high cost, and
- (iii) the farmers' union had established a new marketing system for the crop, which envisaged loan recovery at the point of sale.

## Lessons learnt

The groundnut pilot revealed that problems related to production, marketing and sales can undermine credit repayment and hence the effectiveness of the insurance policy. To make insurance viable for this sector, complementary investments are necessary to strengthen contractual relationships. The conclusion for Malawi, therefore, is that insurance should be closely linked to more formal and better coordinated supply chains.

## Malawi Experience

The low density of automated rainfall stations in the country is a limitation to scaling up in Malawi. For example, an estimated 110,000 smallholder tobacco growers cultivate close to a reliable weather station. If 53 new rain gauges are installed, an additional 200,000 farmers could be included in the program. A government program supported by the World Bank and Norway, the Agricultural Development Project – Support Program (ADP-SP), is currently investing in new weather stations and infrastructure

## Lessons learnt continued

The development of capacity and technical expertise in insurance will be critical for continued growth of the sector. Specifically, national players will need to take a larger role in contract design and underwriting.

### **How have farmers responded to this insurance?**

Some farmers are aware of it but we still need to popularise the concept. Farmers need to understand that insurance is not a gamble but a fall-back plan. Its principles need to be understood by farmers, farmers' organisations and other actors in the agriculture value chain.

### **Why are farmers not using a tool that can help them?**

Most programmes have been pilots and not commercialised. For those that have gone commercial, they have done so in specific regions with the assistance of donor organisations, and not all farmers have been exposed to them.

### **What is needed to overcome the current lack of awareness and uptake?**

A demand-driven approach to insurance is required where farmers' groups and organisations come together and understand that insurance is for their benefit. They need to push the weather insurance agenda. Once there is demand, insurers, re-insurers and other partners will come together and offer products that will benefit the whole agricultural value chain.

### **1. Holistic approaches**

Case studies have shown that it is imperative to collaborate with smallholders, policymakers, scientists and agricultural practitioners. This scenario is ideal for the common appreciation of derived products, tradeoffs, disadvantages and limitations on solutions.

### **2. Farmer-driven design**

Index insurance studies have shown that substantial benefits are realised when smallholders are consulted during the design process. This is important because farmers need to understand the operations of the insurance programme so as to build trust and common understanding, as well as to minimise misunderstandings.

### **3. Building trust and capacity**

Education and capacity-building have proved to be essential aspects of successful case studies. Basically, insurance is a commitment to pay later for a premium paid now. Farmers' buy-in to the insurance process is vital for ensuring success.

### **4. Credible Science**



# **ENERGY MANAGEMENT IN AGRICULTURE**

# PRESENTATION OUTLINE

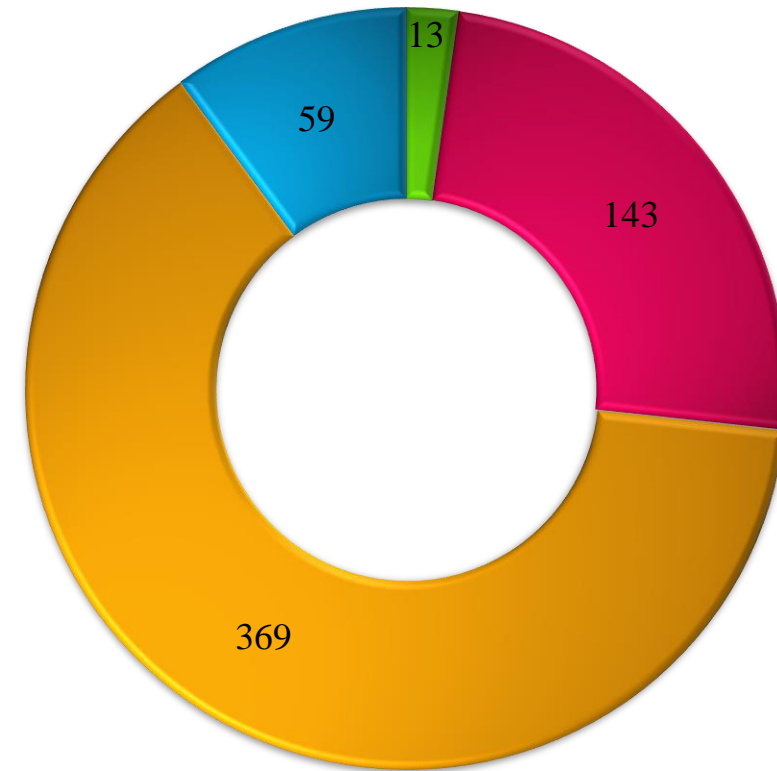
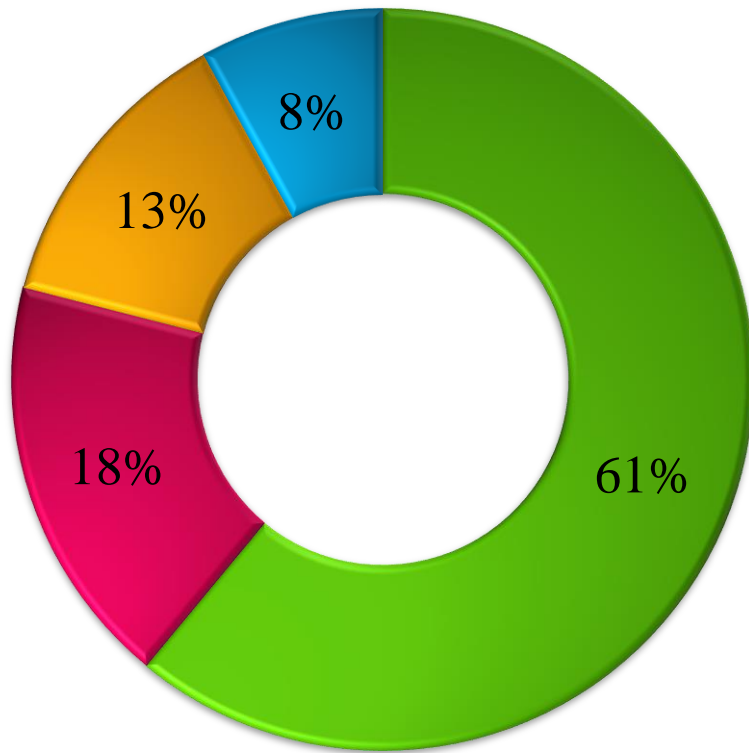
- Energy Situation in Zimbabwe
- Energy consumption in Agriculture
- Energy sources in agricultural production in Zimbabwe
- GHG emissions from agriculture
- Sustainable Energy use in Agriculture
- Contribution of EE and RE to CSA
- Energy Management Opportunities in Agriculture
- Importance of Energy management in CSA
- EM Implementation Barriers and Strategies to Overcome
- Policy instruments and financing
- Recommendations
- Conclusion

# ENERGY SITUATION IN ZIMBABWE

1/2

**Main sources of energy (NEP, 2012)**

**Energy use in Agriculture in Zimbabwe in ktoe (IEA, 2015)**



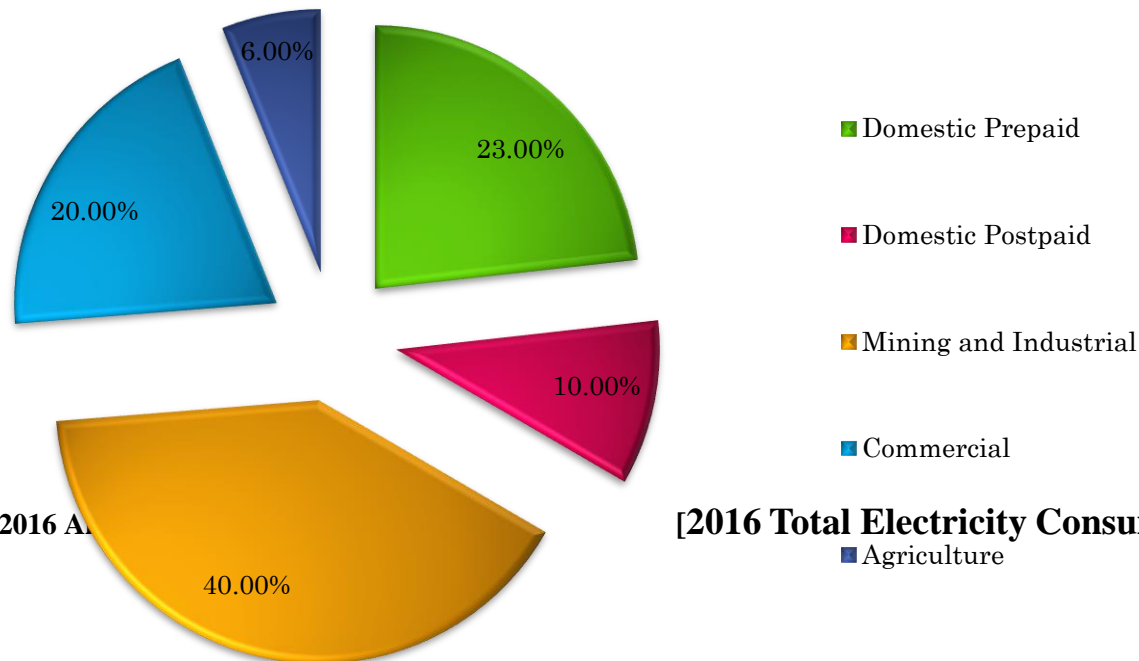
■ Wood fuel ■ Liquid fuels ■ Electricity ■ Coal

■ Coal ■ Liquid fuels ■ Wood fuel ■ Electricity

# ENERGY SITUATION IN ZIMBABWE

2/2

- Clean energies (small hydro, biomass and forestry waste) supply 5% of national needs (*MoEPD, 2016a*)
- National electrification rate is about 40%
- Little penetration of other forms of energy such as LPG, gel, charcoal, and solar (PV and thermal), biogas, wind and small hydro power
- **Demand** (1400MW) for electricity is **greater** than supply (6,948.2 GWh)



Source :ZERA 2016 A

[2016 Total Electricity Consumption 7,318GWh]

■ Agriculture

# ENERGY CONSUMPTION IN AGRICULTURE

- High dependence on fossil fuels worldwide
- Fossil fuels used by small to large scale commercial farming systems
- Subsistence farming and small family farming units utilise animal drawn and human labour
- Agriculture sector consumed 439 GWh of electricity (6%) directly in 2016 (*ZERA, 2016*)
- Agriculture sector has potential to save 12% (58.75GWh/year) through energy efficiency and energy conservation measures (*ZERA, 2015*)
- **Energy is used directly and indirectly**

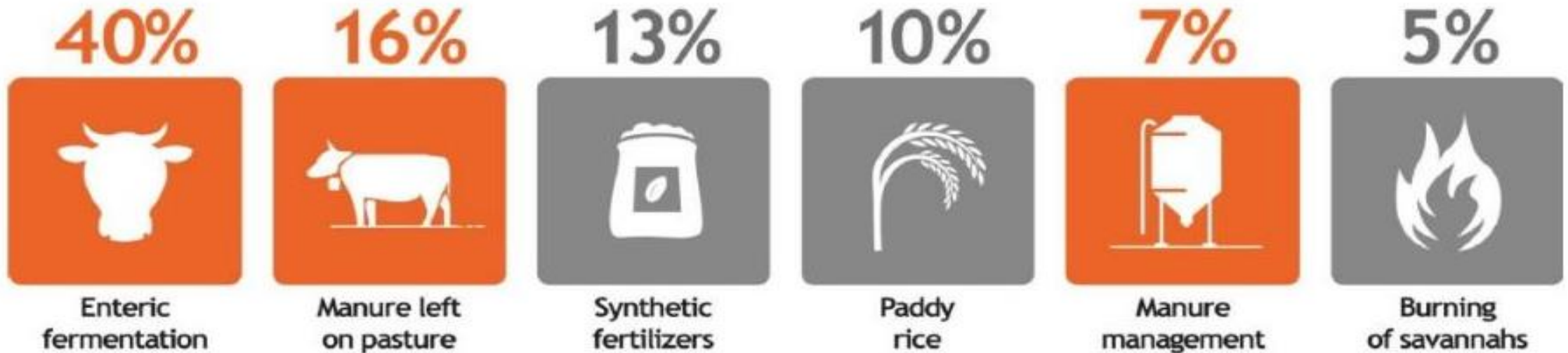
## ENERGY SOURCES IN AGRICULTURAL PRODUCTION IN ZIMBABWE

Direct Use of Energy	Energy Sources
Operating heavy farm machinery and large trucks	Diesel
Operating small vehicles	Diesel, Petrol
Operating small equipment:	Diesel, Petrol, Coal, LPG, Electricity, Wood, Solar, Human, Animal
General farm overhead	Electricity, Paraffin
Marketing	Diesel, Petrol, Human, Animal
Value addition processes	Diesel, Coal, LPG, Electricity, Wood
Indirect Use of Energy	Energy Sources
Fertilizers, Pesticides, Insecticides, Herbicides, Manufacture of farm equipment	Electricity, coal

# GHG EMISSIONS FROM AGRICULTURE

Agriculture alone contributes 10–12 percent of global GHG emissions (IPCC, 2014a).

Below is breakdown of agriculture emissions globally by sector:



Source *MICCA, 2015*

# GHG EMISSIONS FROM AGRICULTURE

## Global perspective

- Agriculture contribute significantly to GHG emissions
- Contribute 5.0-5.8 tCO<sub>2</sub>eq/year, corresponding to 10-12% of total anthropogenic GHG emissions (*Smith et.al, 2014*).
- Contribution range from 19% and 29% of global GHG emissions if pre-and post-process emissions are included (*Vermeulen et al., 2012*).

## Country perspective

- Agriculture is second emitter of GHG emissions
- Contributes 44% of total national emissions (22,019.566 Gg CO<sub>2</sub>eq)
- Energy use emissions in Agriculture contributed 6.76% (1, 475.280 Gg CO<sub>2</sub>eq) in 2006 (*MEWC, 2016*)

## TERMS IN ENERGY MANAGEMENT 1/2

- **Energy management**

- in agriculture context refers to managing all forms of energy used at the farm and beyond the farm gate, as well as optimising operations and processes of value chain addition to reduce energy usage and costs by implementing an Energy Management System (EMS)

- **Energy efficiency**

- is the ratio of useful outputs to energy inputs for a system where the latter may be an individual energy conversion device (e.g., a boiler), a building, an industrial process, a firm, a sector or an entire economy. UNIDO (2011).

## TERMS IN ENERGY MANAGEMENT 2/2

- **Energy conservation**

- involves activities which reduce the wasteful use of energy usage through appropriate behavioural aspects (i.e., if you do not need, switch it off).

- **Renewable energy**

- is any energy source that is naturally replenished, that is, from a source that is not depleted when used, such as solar, wind, geothermal, biomass or hydroelectric generation.

## DISCUSSION OF TERMS

1. A farmer buys feedstock daily with a 7ton truck, pumps water using a diesel generator, monitors fuel usage on a 1ton pick up truck which occasionally picks up small items from town, for he suspects that the guys do own errands when they have the small car. Comment on the farmers approach to EM.
2. A farmer decides to retrofit a gen set with wind pump, for water extraction for a beef herd. This is energy efficiency/energy conservation/sustainable energy use /renewable energy use.
3. Farmer Jangano measures water used for irrigation on daily basis, sums up this to give monthly usages. He does the same for all fuels used by vehicles and the electricity from the meter. He has a file of the recordings dating back a few years. Is this energy management?
4. At Energy farm, the farm owner measures water used for irrigation on daily basis, sums up this to give monthly usages. She does the same for all fuels used by vehicles and the electricity from the meter. She has a file of the recordings dating back a few years. She makes comparisons and questions any discrepancies against her farm produce. Is she practicing energy management?
5. Mr Ndhlovu has a hybrid water pumping system. He switches of the gen set when there is enough solar for water pumping. A tank level float system is used to automatically switch off pumping to avoid tank overflow. Is this a case of RE, EE or EC?
6. Farmer Mado has decided to replace his horticulture water sprinkler system with a drip irrigation system. This is because he wants to conserve energy/ energy efficiency/ resource efficient. His neighbour has discovered that a 265HP MF tractor can handle exactly the same activities as his 390HP MF tractor which he has been using. He decides to sell the 390MF and buys the 265 Hp MF. Is this wise?
7. In the value chain process at BFP, workers switch off the production line conveyors and other pieces of equipment when they go for lunch and some sections during tea breaks. They waste time and production due to restarting the processes from lunch or tea breaks. Comment on this practice.

# ENERGY SUSTAINABILITY IN AGRICULTURE

## Energy Management

### Energy conservation

- Behavioural issue
- Gain control of energy usage

### Energy efficiency

- Invest in more efficient appliance/equipment
- Maintain control over energy usage

### Energy management standard

- ISO 50001 EnMS
- Continual energy improvement

## Renewable Energy

### RE potentials from IRENA:

- Solar PV: 109 GW (at 230 W/m<sup>2</sup>),
- CSP: 39.5 GW (at 270 W/m<sup>2</sup>)
- Wind power: of 39.3 GW (at 200W/m<sup>2</sup>)

### Potentials from national sources:

- Solar resource:- 16-20MJ/m<sup>2</sup> (4,4–5,5 MW/m<sup>2</sup>) and annual sun-hours of 3000 hours (*NEP 2012*)
- Average wind speed of 3m/s (*NEP 2012*)
- Biomass power resources of 1000MW (*Draft Renewable Energy Policy, 2016*)
- Small installed capacity is 24.6MW (*ZERA 2015*)
- Small hydro potential of 120MW (*SE4LL AA for Zimbabwe, 2016*)

# ISO 50001 ENERGY MANAGEMENT MODEL

## The benefits of implementing ISO 50001 are:

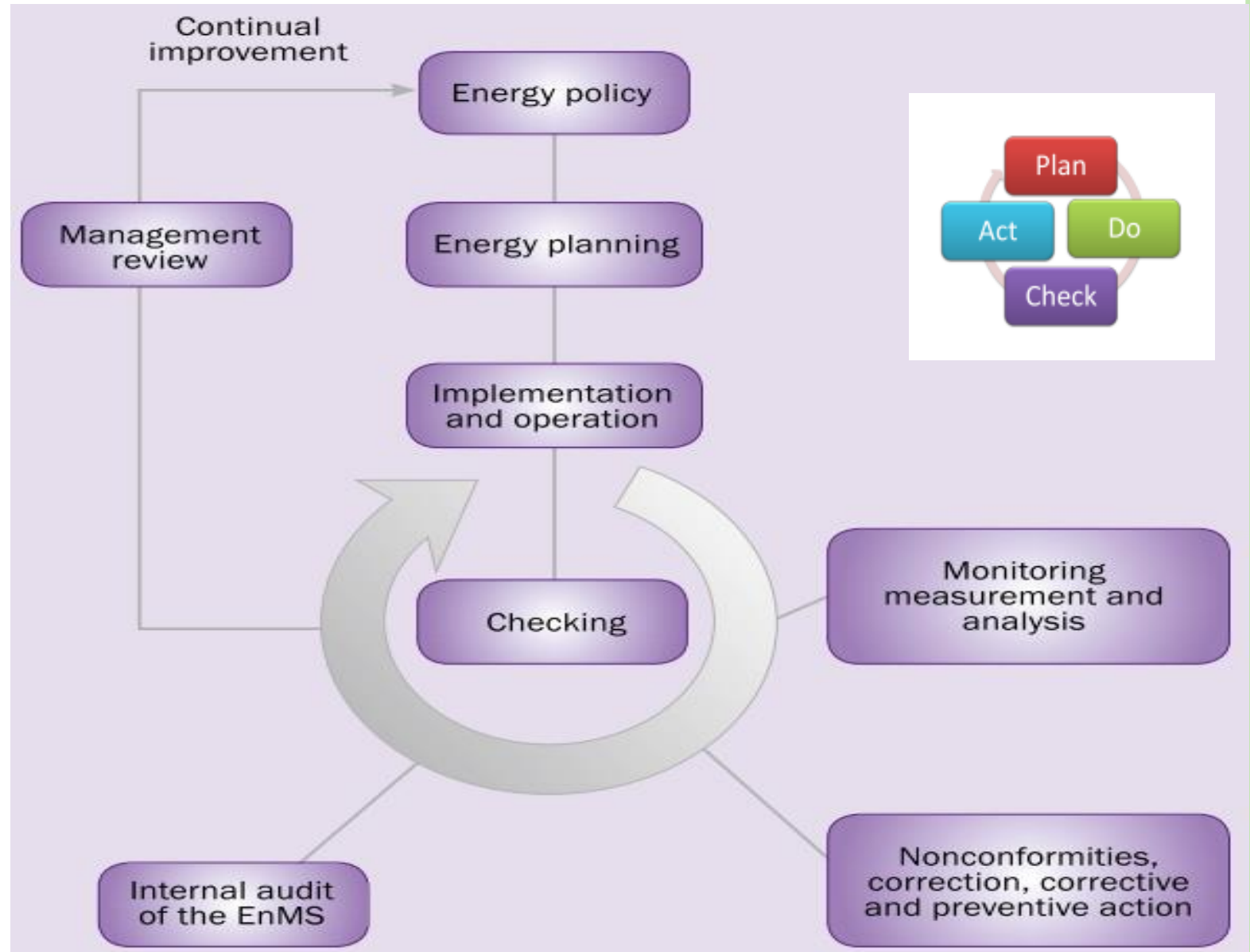
- Save money and reduce costs through energy efficiencies
- Comply with legislation and meet stakeholder expectations
- Support sustainable development policies
- Enhance the reputation of your business and win more customers

## Basic Principle and Philosophy of EnMS:

- Systematic management approach;
- PDCA Model (Plan—Do—Check—Act);
- Process approach;
- Coordination and harmonization;
- All processes control and all staff involvement; Continual improvement

## The requirements of ISO 50001 are:

- Appropriate energy policy;
- Energy plans;
- Identification of the significant energy uses;
- Identification of applicable regulations and laws;
- Set priorities, objectives, targets;
- Create a structure and programme(s);
- Planning, control, monitoring, preventative and corrective actions, auditing and review activities.



## CONTRIBUTION OF EE AND RE TO CSA

- Climate change threatens the stability and productivity of Zimbabwe agricultural systems
- Agriculture is second major GHG emitting sector after Energy
- Zimbabwe focuses more on adaptation than mitigation

### EE and RE contribution to the three pillars of CSA:

- Sustainably increase agricultural **productivity** and incomes;
- Strengthen **resilience** in agriculture (adaptation to climate change);
- Reduce agriculture's contribution to climate change (**mitigation**, i.e. reduction of GHG emissions)

# ADAPTATION MEASURES IN AGRICULTURE

Adaptation measure	Climate Smart Agriculture Pillar		
	Productivity	Resilience	Mitigation
Conservation agriculture	✓	✓	✓
Improved seed and crop varieties	✓	✓	
Improved livestock breeds	✓	✓	
Strengthening management of water resources and irrigation	✓	✓	✓
Private insurance		✓	

# GHG MITIGATION MEASURES IN AGRICULTURE

## Main GHG Mitigation Options in Agriculture

- Increasing carbon dioxide storage in soils and biomass
- Reducing emissions during agricultural production
- Indirectly, reducing the required volume of agricultural production

## Possible Indicators for Energy Management in CSA

- Household income increase and related social impacts through energy management in CSA
- GHG emission reductions from mitigation measures and adaptation (core benefits)
- Number of farmers investing in energy management/RE application in CSA through ICTs

# GHG MITIGATION MEASURES IN AGRICULTURE

Mitigation measure	Climate Smart Agriculture Pillar		
	Productivity	Resilience	Mitigation
Energy efficiency	✓	✓	✓
Use of renewables	✓	✓	✓
Nutrient management	✓	✓	✓
Strengthening afforestation programmes	✓	✓	✓
Improved agronomic practices	✓	✓	✓
Improve livestock management	✓	✓	✓
Waste reduction	✓		✓

# ENERGY MANAGEMENT OPPORTUNITIES IN AGRICULTURE

- Discuss energy management opportunities in agriculture.
  - Crop production (CA, system optimisation, fertilizer application, water use, crop drying)
  - Livestock production (feedstock, manure mgt, energy system optimisation)
  - Fisheries (energy system optimisation)
  - Processing and Distribution (transport system, energy system optimisation , Decentralisation)
  - Retailing, preparation and cooking (Building energy envelope)
- What are the barriers to implementing the opportunities?

## BARRIERS TO IMPLEMENTATION OF EM AND RE

- Lack of enabling policy and regulatory framework for EM and RE;
- Lack of awareness of the benefits of EE;
- Limited or lack of technical expertise in energy systems, e.g., energy auditing;
- Focus is on yield (output) instead of on energy efficiency and energy conservation;
- Component approach instead of systems approach in energy systems
- Lack of incentives for energy efficiency;
- Limited/lack of financial resources; and
- Poor information and record keeping of energy use.

*Rank the above barriers, starting with the most significant*

## STRATEGIES TO OVERCOME BARRIERS

- Government should enact enabling policies and policy instruments that promote EE and EC through relevant institutions;
- Training of experts on EM, RE and energy auditing, including measurement, monitoring and verification;
- Documenting and sharing the achievement of annual energy goals and targets;
- Promote research, uptake and deployment of RE and EE through favourable financing mechanisms; and
- **Behavioural change.**

# IMPORTANCE OF ENERGY MANAGEMENT IN CSA

## 1/2

- Link between SDG 7 and other SDGs e.g. 1, 2, 3, 8, 9, 11,12, 13, 15
- Role of tertiary and research institutions
  - Capacity building for agriculture extension workers
  - Conduct adaptive capacity or vulnerability assessments
  - Design curriculum on Energy Management for CSA

# IMPORTANCE OF ENERGY MANAGEMENT IN CSA

## 2/2

- Relevance to extension officers
  - Knowledge on energy trends, cost and energy efficient technologies
  - Knowledge on how to disseminate effectively using appropriate ICTs energy information to key stakeholders in the agro value chain
- Behaviour change

## POLICY RECOMMENDATIONS

- ❑ Strengthen institutions that produce, share technical knowledge, provide financial services
- ❑ Renewable uptake through incentives, voluntary and regulations and standards
- ❑ Renewable Energy competitive bidding

# FINANCING SUSTAINABLE ENERGY USE IN AGRICULTURE

## Local/Regional

- Public finance
- Development banks IDBZ, DBSA, AfDB
- Bilateral public finance channels
- PPP
- Private sector
- Innovative business models e.g. ESCOs

## International

- UNFCCC (e.g. GEF)
- UN e.g. UN REDD, UNEP REED programme
- Clean Technology Fund
- Multilateral Development banks; World Bank
- Bilateral public finance channels
- Carbon markets
- IRENA

# CASE STUDIES

# INTERCROPPING

- BFP



**Drip solar irrigation**



**Border Timbers Biomass plant**



**Gwanda solar mini grid**



**Chipendeke mini hydro**



**Biodigester**



**Kutsaga tobacco ban**



# RECOMMENDATIONS

- ❖ Large scale agro- commercial enterprises, should appoint an energy champion for energy management activities.
- ❖ Smallholders should be capacitated to measure, monitor and track their energy use.
- ❖ Capacity building of extension workers in the areas of energy management
- ❖ Readily avail energy information on efficiency measures and alternative sources of energy to both large scale and small scale farmers.
- ❖ Close the information gap on financing mechanisms, causes of global warming and climate change impacts
- ❖ Strengthen policy and policy instruments addressing energy management

# CONCLUSION

To increase food productivity at competitive prices,  
the country should adopt CSA embracing energy management.

END OF PRESENTATION



THANK YOU FOR YOUR ATTENTION

# Fisheries and aquaculture in Zimbabwe

Mzime Ndebele-Murisa (CUT), Maxwell Barson (UZ) and Nyasha Mabika  
(UZ)

Climate-smart Training of Trainers Workshop 9 February, 2018, Management Bureau  
Training Center, Msasa, Harare

# Key messages

- i. Fisheries production from natural fish stocks has been declining globally, regionally and nationally (Zimbabwe) due to overfishing and climate change impacts, among other factors;
- ii. Over the last two decades, the demand for fish has increased worldwide, including Africa;
- iii. The fisheries and aquaculture sectors in Africa, including Zimbabwe, have increased in dimension and can make a significant contribution towards filling the demand gap of over 260% by 2020;
- iv. Relevant CSA fisheries and aquaculture systems for Zimbabwe would include research and innovation in technologies for affordable fish feed, breeding (hatchery) equipment and techniques, good quality fish fingerlings, more effective feeding mechanisms, efficient post-harvest techniques and value addition

# Introduction

- Aquaculture -fastest growing food producing sector in the world, 10% per annum in Africa
- The development of aquaculture fits well into the CSA narrative, particularly when practiced in smaller and intensive units in the tropics as opposed to its extensive use in the oceans which has been associated with environmental destruction and degradation
- Currently, over 26 species of fish are utilised in aquaculture production in Africa, of which Tilapia, Catfish, and the Common carp are more predominant. Molluscs as well as oysters are also bred in the coastal zones
- Fish most common produce among other aquatic organisms such as crabs, crocodiles, crayfish, freshwater shrimp, and algae
- ~114 indigenous fish species; 30 exotic species are exploited; but only utilize a few species (about six) for aquaculture production (FAO, 2016):
  - Nile Tilapia 'bream' (*Oreochromis niloticus*)
  - Freshwater Tanganyika sardine, commonly known as 'Kapenta' (*Limnothrissa miodon*)
  - Rainbow trout (*Onchorhynchus mykiss*) Eastern Highlands, generally for the urban up-markets and for recreational fishing

# Fish species in pictures



# Fisheries, aquaculture and CSA

- Fish-farming -untapped aquaculture sector in Zimbabwe which has great potential to improve food security as a diversified livelihood strategy under changing climatic conditions (Gumbo, 2015)
- Diversifying small holder farming systems through the combination of several production components that include fisheries and aquaculture decreases the risk element associated with small-scale farming especially in view of climate change
- Pond water will not only yield fish, an edible and tradable commodity, providing one if not the main source of cash income but can be used to irrigate crops and water livestock in the dry season, thereby increasing the viability of year-round production
- Furthermore, through several linkages, fish farming has effects on other sectors of the economy. There are production links in terms of inputs and services (construction materials, fertilizers, storage, transport etc) as well as consumption links as fishers become self-employed and can spend their money on other goods and services within the economy (FAO 2002, Béné, 2006)
- There is also an important gender dimension to fish farming on small holder farms as women are the main actors when it comes to processing and trading the fish
- Integrating aquaculture with other practices, such as agro-aquaculture, multi-trophic aquaculture and culture-based fisheries, recycles nutrients and uses energy and water much more efficiently

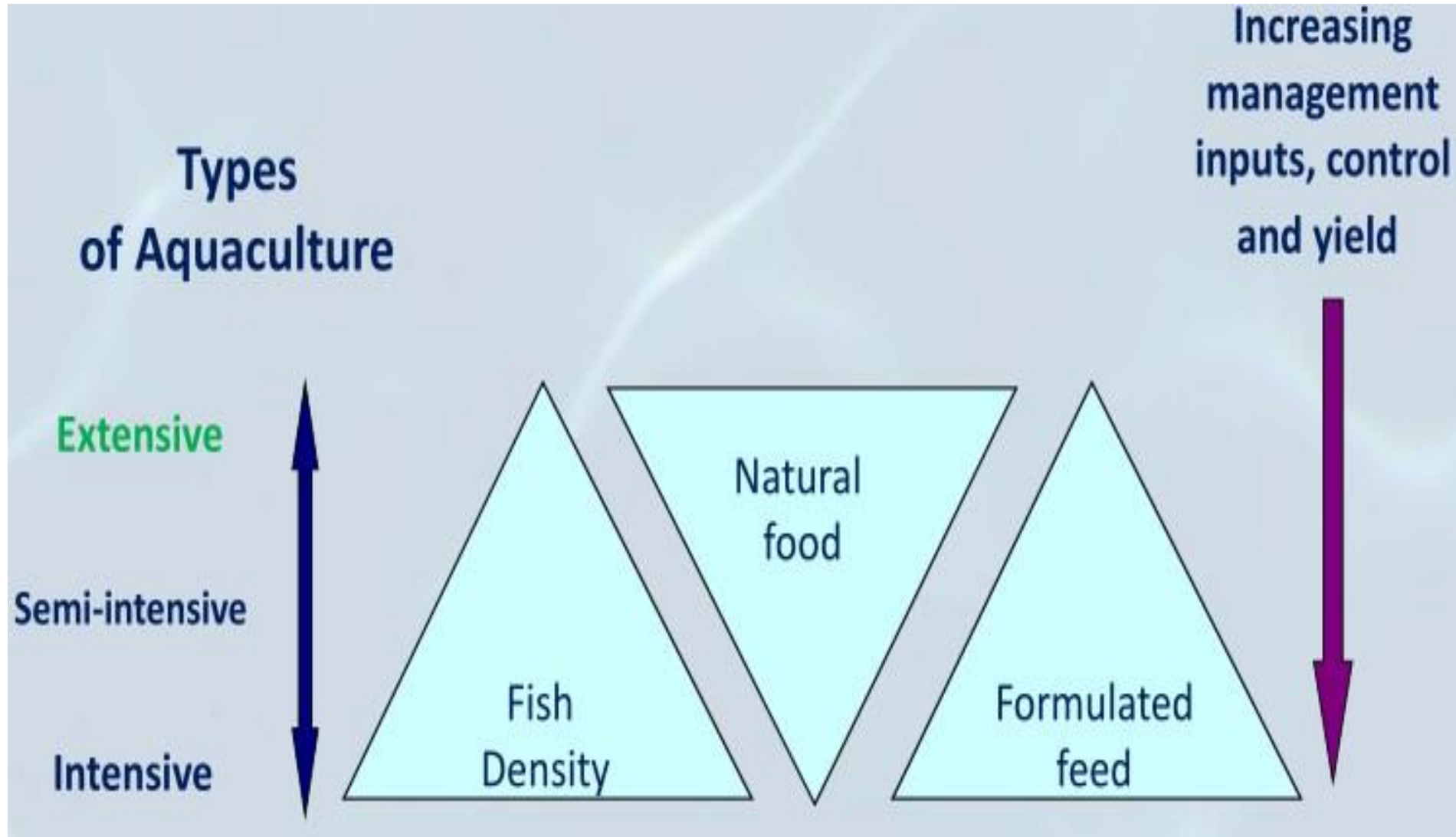
# CSA Cont...

- Given the historical trends of increasing temperatures and more erratic rainfall patterns across the country - especially in Natural regions III to IV (Mugandani et al., 2012; Ndebele-Murisa and Mubaya, 2015; Brazier, 2015, 2017), aquaculture works well as a strategy for coping with and adopting to climate change and variability, and consequent increased aridity as it requires less water for fish production as compared to the production of crops and livestock.
- In addition, fisheries and aquaculture can be practised concurrently with other farming activities and integrates very well with them

# Types of aquaculture

- Aquaculture can be broadly categorised into extensive, intensive and semi-intensive
- Extensive aquaculture is a low skilled practice that involves the use of large stagnant ponds that only allows a limited number of stock receiving no supplementary feed, and minimal attention. E.g. Chivero, Kariba, Mazvikadei and Mutirikwi; deriving secondary functions of commercial fisheries
- Semi-intensive aquaculture requires a certain level of managerial skills and a much greater extent of intervention through supplementary feed or water quality and air circulation systems. It also tends to bear higher costs in setting up as well as operations, with higher risks of mortalities because of diseases, poor management, and/or *force majeure*
- Semi-intensive aquaculture systems have intermediary conditions between extensive and intensive aquaculture

# Types of aquaculture – EXTENSIVE TO SUPER-INTENSIVE



# Types of fish feed and the respective amounts of protein in different aquaculture settings

<b>Ingredient</b>	<b>Semi-intensive ponds (26% protein)</b>	<b>Intensive ponds (32% protein)</b>	<b>Intensive tanks (36% protein)</b>
<b>Corn</b>	<b>50.8</b>	<b>22.6</b>	<b>16.5</b>
<b>Dicalcium phosphate</b>	<b>1.0</b>	<b>1.0</b>	<b>0.8</b>
<b>Fish meal</b>	<b>4.0</b>	<b>6.0</b>	<b>12.0</b>
<b>Mineral mix</b>	<b>0.2</b>	<b>0.2</b>	<b>0.2</b>
<b>Soybean meal</b>	<b>38.3</b>	<b>48.5</b>	<b>50.8</b>
<b>Vegetable oil</b>	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>
<b>Vitamin mix</b>	<b>0.2</b>	<b>0.2</b>	<b>0.2</b>
<b>Wheat middlings</b>	<b>4.0</b>	<b>20.0</b>	<b>18.0</b>

# Current aquaculture systems in Zimbabwe

- Pond culture
- Tanks
- Pens
- Cages
- Raceways
- Recirculating Aquaculture Systems (RAS)
- Integrated aquaculture
- Aquaponics
- Breeding and hatchery technology
- Farm equipment and feed

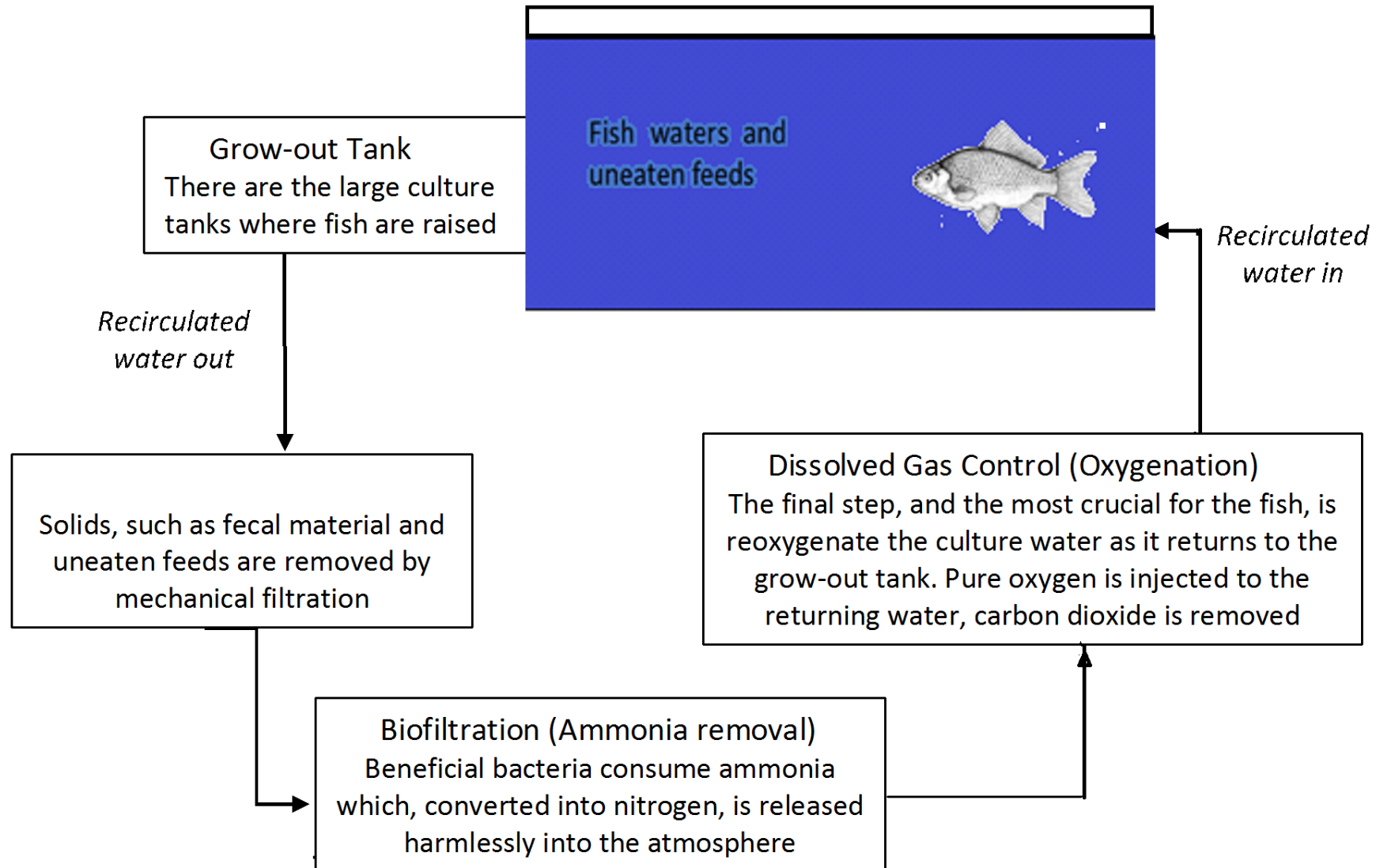
# Cages



Above: Cages in Zhohwe Dam (Umzingwane)

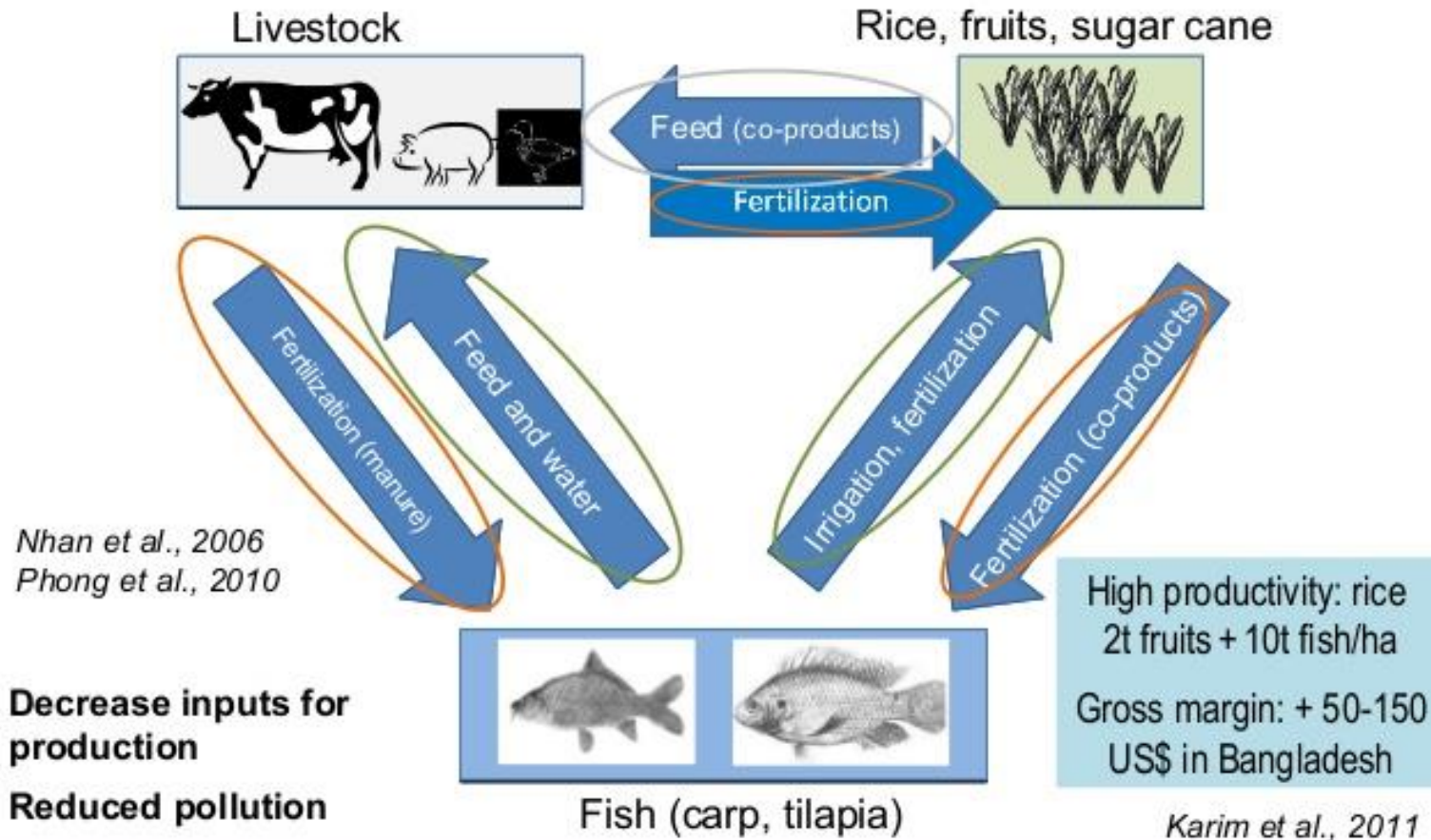
Left: Lake harvest cages in Lake Kariba (student on SADC Aquaculture Mentorship Program)

# Recirculation Aquaculture System (RAS)



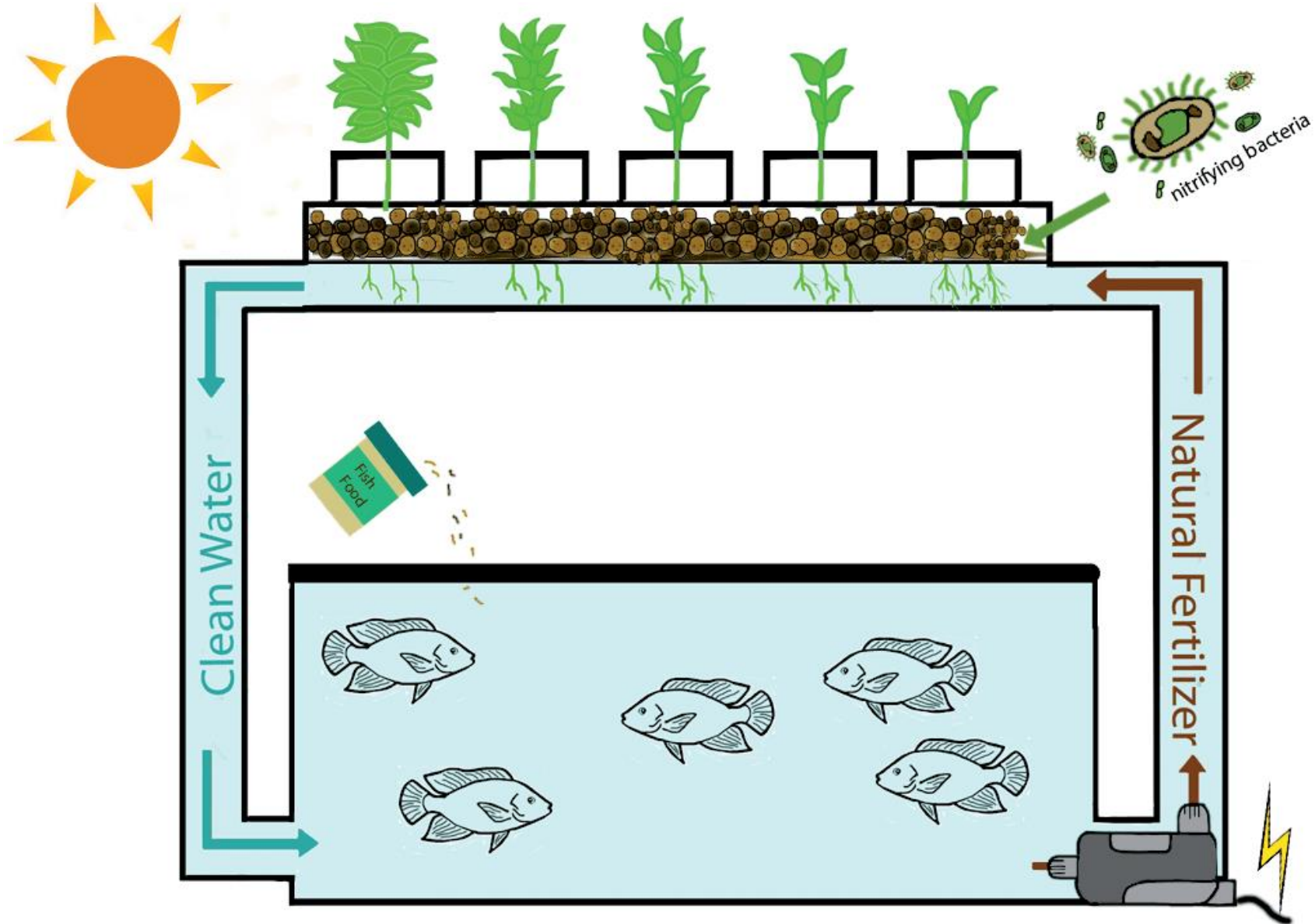
# Integrated aquaculture system

## Integrated agriculture-aquaculture systems



But fish can be contaminated with excreta-related pathogens or antibiotics! => WHO guidelines

# Aquaponics



# Factors to consider when designing aquaculture facilities

- **Farm layout** - aim for the lowest possible risk to surrounding land, accounting for run-off, flooding, noise and odour
- **Containment structures** - before building the containment structure, assess the design of foundations, embankments, freeboards, inlet/outlet works
- **Intake and discharge points** - by using concrete blocks, rock armouring and other design solutions one can minimise erosion and leaks around intake and discharge points
- **Buffer zones** - mound formations provide separation between containment structures and environmentally sensitive areas and beneficial land uses
- **Engineering plans and drawings** - seek the advice of a qualified engineer when designing aquaculture facilities. Up-front costs for their expertise can be offset by savings on construction and operating costs

# Selecting a Good Pond Site

## *Land area*

- Establish that the land is relatively level. Steeply sloped land is not generally suitable for building ponds. A slope of about 1% is considered ideal
- Determine that the area is large enough for your present plans and for any future expansion
- The area should not be prone to flooding. Study weather records for the area, ask local residents about flooding in recent years, and look for actual evidence that flooding has occurred
- The area should not be subject to pollution in runoff from adjacent land. Find out who owns adjacent and uphill land, how they use the land, and what chemicals (including fertilizers and pesticides) they use
- If possible, the land must be slightly lower than the water source, so that the ponds can be filled by gravity rather than by pumping
- Supplying water by gravity greatly reduces energy inputs and operating costs
- In most cases the larger the surface area (with gentle slope), the better. This is only true if the land and water are not expensive
- Consider development plans for neighboring areas and assess any causes for concern
- Steep hillsides or very rocky areas are not suitable

# *Water supply*

- A good water source is one that provides high quality water in sufficient quantity throughout the year
- The most common sources of water used for aquaculture are surface waters (streams, springs, lakes) and groundwater (wells, aquifers)
- Of these, wells and springs are generally preferred for their consistently high water quality
- The quantity and quality of water should be adequate to support production through seasonal fluctuations
- Determine that the quality of the intended water source is good enough for fish to thrive in
- A good water source will be relatively free of silt, aquatic insects, other potential predators, and toxic substances, and it will have a high concentration of dissolved oxygen; if fish are already living and reproducing in the water (for example a river or lake), this is usually an indication that the quality is good.
- Make the final site selection based on both the quality and quantity of water available

# Water source cont...

The quantity of water required depends on the species to be cultured and on the anticipated management practices, for example whether ponds will be operated as static ponds (no water flowing through) or as flow-through systems

- Coldwater species like trout require a lot of water because they prefer a continuous supply of clean water with high dissolved oxygen concentrations (above 9 mg/L)
- Warm water species like tilapia can tolerate water with lower dissolved oxygen levels, so tilapia culture is often done in static water, that is, without water flowing through the ponds
- However, the best situation is to have a lot of “free” water, meaning water available by gravity flow, even if it is not always being used
- For earthen ponds, the water source should be able to provide at least 1 m<sup>3</sup> of water (1000 litres) per minute for each hectare of ponds that will be built. This quantity will be sufficient for quickly filling the ponds as well as for maintaining water levels throughout the culture period
- If the selected site has relatively poor soils (i.e., soils containing too much sand) the source should be able to provide two to three times more water (2-3 m<sup>3</sup> per minute per hectare).
- This quantity of water will be sufficient for maintaining water levels to compensate for losses that are likely to occur through seepage

# Soil

- Land should be comprised of good quality soil, with little or no gravel or rocks either on the surface or mixed in
- Areas with rocky, gravelly, or sandy soil are not suitable for pond construction
- The soil should be deep, extending down at least 1 metre below the surface
- There should not be layers of rock lying close to the surface
- Soils in the area where ponds will be built should have clay layers somewhere below the surface to prevent downward seepage
- Soil that will be used to build the dykes must contain at least 20% clay so the finished pond will hold water throughout the growing period
- Some soil with a higher clay content—preferably between 30 and 40%—should be available nearby. It will be used to pack the core trenches in the dykes

# Other factors to consider

## Proximity to a market

- Does market demand justify production?
- Will the existing physical infrastructure meet the farmer's needs for marketing the fish?
- Will there be sufficient demand nearby or will transporting to a distant market often be a necessity?
- It is easier to sell at your doorstep or to have a permanent buyer who takes everything you can produce and either picks the fish up or is close enough that you can deliver the fish to them.

# Infrastructure

- Are the roads good enough to bring supplies to the farm and take the product to the market?
- Are telephone service and electrical power available at the site?
- If an intensive production system is necessary due to constraints of space or water, access to power is a must
- Electrical power is about two times cheaper than diesel power at some instances
- Telephone service may be needed for ordering supplies, arranging marketing, or requesting technical assistance

# Availability of needed inputs

- Are fertilizers and lime available at reasonable cost?
- Are fingerlings available at a reasonable cost?
- Are fish feeds available for purchase, or are suitable ingredients available so the farmer can produce his own?

# Personnel

- Hire qualified people as farm staff
- Raising fish requires specific knowledge acquired only through training
- However, training is not the only criterion to use when selecting workers: Look for workers who understand farming and are dedicated to a successful operation

# Competition

- Know who your competitors are and how much they sell their fish for
- Consider whether you will be able to match their price and quality or even outsell them by producing a better product or selling at a lower price
- If fish demand is high, cooperating with nearby fish producers to market the fish might be a possibility
- The presence of several fish farmers in an area may make it possible for inputs to be obtained less expensively by forming a purchasing block (cooperative or group)

# Legal issues

- Consider whether or not there are any legal issues that will affect your ability to culture fish at this site
- Would any of the following prevent you from going into fish farming:
  - Land Use Act? Water Act? Environmental Management Act?
  - Others?

# Gender and Social Inclusion in CSA

Abby Taka Mgugu Mhene

WOMEN AND RESOURCES IN EASTERN AND SOUTHERN AFRICA (WARESA)

8<sup>th</sup> February 2018

Training Management Bureau- Harare

# Introduction

- ▶ My presentation is based on the chapter on Gender Social Inclusion from chapter 4 the Manual on
- ▶ The presentation endeavours to be as practical as possible to allow you as trainers to utilize the information

The objective of the presentation is to

**build capacity of trainers to mainstream gender and social inclusion into CSA**

Key messages from the chapter

- ▶ To create awareness of the links of gender with agriculture and climate change;
- ▶ To promote the mainstreaming and integration of gender in climate change policies and academic curricula; and
- ▶ To create awareness of existing climate-smart agricultural practices that promote gender equality.

# Background

- ▶ Agriculture especially small holder agriculture wears the face of a woman
- ▶ Globally women make up just under half (43%) of the agricultural labour force,
  - ▶ while
- ▶ in Zimbabwe, 70% of agricultural labour is provided by women, a sector with the lowest wages in relation to other economic sectors
- ▶ Women assumed this role from a long time: during the hut tax era when men had to migrate to urban areas to seek paid employment in order to pay taxes.
- ▶ Women have fewer rights to land than men
- ▶

# Background

- ▶ work activities such as subsistence agriculture are often underestimated or excluded for reasons such as limitation of data
- ▶ sources and data collection approaches which do not include the **unpaid care work of women**
- ▶ CSA strategies are unlikely to be effective, let alone equitable or transformative, without active attention to women and gender dimensions
- ▶ In terms of this presentation, the term gender will be used as an analytical tool to assist the trainers to assess equity and equality.

## Drivers and strategies to mainstream gender and social inclusion

- ▶ Institutions
- ▶ Livelihood assets
- ▶ Food system activities
- ▶ Food system outcomes

These drivers will assist to attain food security and nutrition security in a changing climate

## Institutions - formal and informal

### ▶ **Formal**

- ▶ These are the various institutions that provide services to the small holder farmer: how are these services provided? Is there a sense of equity and eventually equality?
- ▶ Eg access to inputs? Is there a sense of equity

### ▶ **Informal**

- ▶ The family- this is a private domain issues of decision making

## Livelihood assets

- ▶ under this as we train we assess whether all parties have the following:
- ▶ Human capital----- labour to work on the land
- ▶ Natural capital----- secure access to key factors of production
- ▶ Financial-----access to loans with reasonable interest rates  
flexible collateral

## Livelihood assets

- ▶ Social----- addressing the practical and strategic needs of the target group. Here as trainers we need to take into account a number of issues---- because the majority of the target group have a number of roles to play and balance

# Food System Activities

- ▶ Farming systems
- ▶ Processing
- ▶ Marketing

# Food system and outcomes

- ▶ food and nutrition security
- ▶ Health
- ▶ Poverty reduction
- ▶ Natural resource sustainability

# Strategies to effective mainstreaming of gender and social inclusion

- ▶ Planning and designing
- ▶ Implementation
- ▶ Monitoring and Evaluation

# Planning and Design

- ▶ Gender and social inclusion analysis
- ▶ Analysis of trade offs
- ▶ Identification of alternatives/compensatory measures

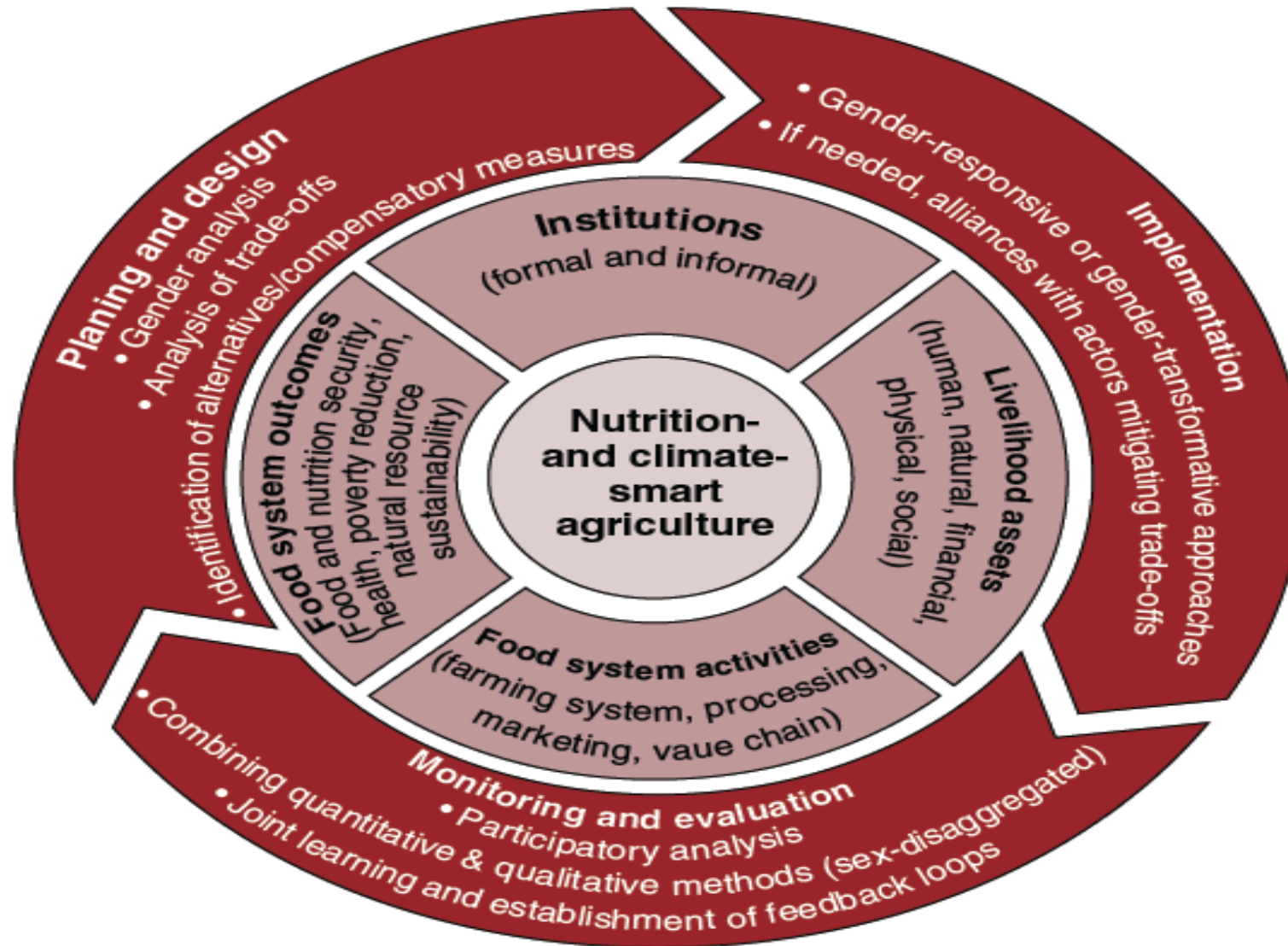
# Implementation

- ▶ Gender and social inclusive approaches
- ▶ Formation of alliances

# Monitoring and Evaluation

- ▶ Participatory analysis
- ▶ Combining quantitative & qualitative methods (sex-disaggregated)
- ▶ Joint learning and establishment of feedback loops

# Conceptual framework in gender and social inclusion in CSA adapted from FAO



# Conclusion

- ▶ The important point in the discourse around gender and social inclusion is to remember that the terms are analytical concepts and can be applied to any discipline so that we have some degree of equity that will eventually lead to equality in the provision of services at different levels.
- ▶ Having adopted the concepts as analytical tools we then move away from the rhetoric that gender is about women.

- ▶ THANK YOU
- ▶ ASANTE SANA
  - ▶ TATENDA
  - ▶ SIYABONGA

# Post CSA Plans and Strategic Policy Developments

By Emily F. Matingo  
Climate Change Scientist, Adaptation Office  
Climate Change Management Department  
Ministry of Environment Water and Climate

# Climate Change Response Strategy

- ▶ Strengthen capacity to generate new forms of empirical knowledge, technologies and agricultural support services
- ▶ Develop frameworks for supporting agricultural specialization according to agro-ecological regions
- ▶ Strengthen the capacity of farmers, extension agencies, and private agro-service providers to take advantage of current and emerging indigenous and scientific knowledge on stress tolerant crop types and varieties
- ▶ Strengthen the capacity to identify and promote adoption of indigenous and improved livestock breeds that are tolerant to climate related stresses.
- ▶ Establish monitoring systems for greenhouse gas emissions in agricultural systems and support mechanisms for their reduction
- ▶ Promote resource use efficiency and less carbon intense pathways in all economic activities

# Nationally Determined Contributions

- ▶ Mitigation & Adaptation
- ▶ Vulnerability of agric sector
- ▶ Agric offers opportunities of mitigation through CSA
- ▶ Adapted crop and livestock and CSA practices:
  - ▶ Strengthening capacities to generate new forms of empirical knowledge, technologies (including conservation agriculture) and agricultural support services that meet climate challenges
  - ▶ Promoting the use of indigenous and scientific knowledge on drought tolerant crop types and varieties and indigenous livestock that are resilient to changes in temperatures and rainfall.
- ▶ Promotion of water harvesting
- ▶ Strengthening of water and moisture conservation practices

# National Climate Policy

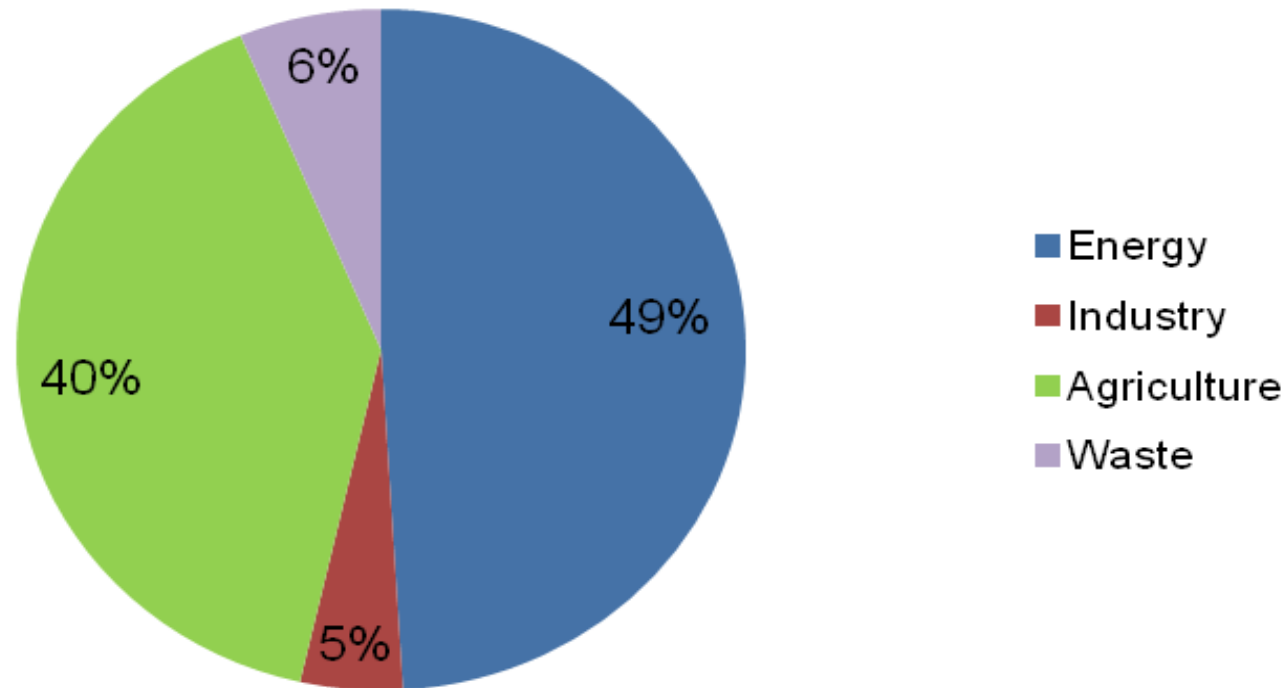
- ▶ Reduce vulnerability to climate variability and climate related disasters by strengthening adaptive capacity.
- ▶ Promote technology development and transfer, capacity building and information sharing
- ▶ Undertake comprehensive analysis to understand the barriers to adaptation
- ▶ Promotes water use efficiency and irrigation
- ▶ Encourages the adoption of irrigation technologies
- ▶ promote adoption of improved seed and crop varieties that are tolerant to climate related stresses
- ▶ Accelerating mitigation measures by adopting and developing low carbon development pathways.

# National Adaptation Plan

- ▶ Under Draft.
- ▶ Build resilience of agricultural sector and communal farmers
- ▶ Build medium to long term adaptation interventions.
- ▶ Plan identifies CSA as a tool to build resilience of the agricultural sector and rural communities.

# Low Emission Development Strategy

- ▶ Forward looking national economic development that encompass low-emission and climate-resilient economic growth
- ▶ CSA critical to LEDs agric sectoral contribution
- ▶ The distribution of Zimbabwe's emissions by sector (Source: SNC, 2012)



# CSA Interventions

- ▶ Efforts to promote CSA through pilot projects : SECA, OXFAM
- ▶ GCF Pipeline projects

# Soil and Water Management as a CSA approach

Managing water to :

- **increase productivity and incomes** (e.g.....cost of production in irrigation systems, profitability of crops grown, cost of water, power.....)
- **Increase resilience of production** systems and populations (long-term consequences.....(e.g. dam siltation, in-situ water harvesting.....)
- **Reducing GHG emissions** (renewable energy sources)-efficiency of irrigation process ( precise water requirements, avoiding leakages-expertise!!!)



## ...Soil & Water Management as a CSA practice

Climate change impacts that necessitate sustainable water management:

### Water deficit-

- dry spells,
- late onset /unpredictable onset,
- early cessation, droughts



- **We need appropriate technologies for different farming enterprises**
- efficient irrigation systems: **supplementary irrigation** as a cheaper option ( late-onset; dry spells, early cessation)
- **water harvesting** for both animals and crops (to address temporal rainfall distribution)

# Excess moisture

- Heavy down pours
- Floods



- **appropriate practices- ridging, creating drainage, terracing; etc.**
- **Appropriate animal housing, disease management, etc.**

## Different Water Management aspects

- Water management at household level- small earth dams, drip-irrigation kits (need expertise & technical support)
- Use of water-efficient irrigation systems ( currently 90% use surface & sprinkler despite 40-60% efficiency of the systems!!!!)
- Water management at community & watershed level- e.g. use of underground water, dams ....need for appropriate legislation and policy



# Soil management as a CSA approach

- **Managing soils to increase productivity and incomes**

-productivity/unit area/ unit period/unit investment!!!!

....growing several crops in a field/year vs growing one crop?

....growing one long season maize variety vs growing a short season plus a legume, relay cropping, etc...

- **Managing soils to increase resilience of production systems and populations**

...appropriate farming enterprises!!!; soil conservation works, maintaining carrying capacities for livestock; no-till systems for long term health and sustainability of soils; soil organic cover, use of legumes

- **Managing to reduce GHG emissions.....crop production intensification ( more produce/ unit area); appropriate livestock management & pasture practices**

# **Soil and water management are interdependent!!!**

- Poor water management affects soil physical, chemical and biological properties

-erosion removes top fertile soil and organic matter; affects nutrient intake.....

- Poor soil management affects soil water properties-infiltration, water retention, etc.

But

**Soil and Water management go beyond individual households- !!!!!**

## Discussion issues

- Water productivity- how much produce per drop of water
- Cost of irrigation vs value of crops grown
- Productivity of existing irrigation schemes????
- Reducing siltation of dams.....legislation
- How should we define productivity .....e.g. is yield per hectare adequate????
- Soil management in-field and off-field .....what is the status
- Ensuring appropriate land use.....depending on soil type and agro-ecology (changing landscapes???)

# Climate Smart Agriculture Is Not Business As Usual



# SUSTAINABLE FOREST MANAGEMENT & AGROFORESTRY

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# Chapter outline

- Section 9.1: Importance of forests and their classification;
- Section 9.2: Linkages of land degradation to climate change and forests;
- Section 9.3: Sustainable forest management, deforestation and forest degradation;
- Section 9.4: Agroforestry ;
- Section 9.5: Some forestry-related aspects in Zimbabwe including policy issues
- Section 9.6: Conclusion and Recommendations

# Chapter highlights

- Chapter focuses on how forests/trees, and agroforestry can contribute to combating climate change.
- It also explores how land degradation is linked to climate change and that sustainable forest management can address forest land degradation and deforestation while increasing direct benefits to people.
- One section is devoted to agroforestry as a practised of deliberately integrating woody perennials (e.g., trees, shrubs, palms or bamboos) and agricultural crops or animals on the same piece of land in some form of spatial and temporal arrangement.
- The planting of trees in croplands increases the absorptive capacity of the soil and reduces soil temperatures, evaporation, raindrop impact and soil erosion for the crops planted beneath.
- The chapter also shows how forestry and agroforestry contribute to the three pillars of climate-smart agriculture.

# Importance of forests and their classification



- General introduction to forests and their importance. Forests can still provide a part of the world's oxygen.
- Forest loss and the consequences of climate change.
- Agriculture, land use, and deforestation. About a quarter of the world's forests are lost each year.
- Zimbabwean forests with actors in the forest and tertiary production.
- In farms, agroforestry practices increase tree cover.

Here you can add pictures of different types of forests and different types of forest industries including farmers selling non timber forest products e.g. wild fruits

# Classification of forest resources in Zimbabwe

- How many forest types do we have in Zimbabwe?
- Flora Zambesiaca and Afromontane phyto region.
- The Afromontane phyto region covers 781 500 ha.
- The Flora Zambesiaca comprises five woodlands types: dry Miombo (17 690 074 ha), Mopane (12 277 515 ha), *Combretum-Terminalia* (2 374 729 ha), *Acacia* (1 581 070 ha) and Zambezi teak (1 404 544 ha).
- In **Zambezi teak woodlands**, commercial timber species are mainly *Baikiaea plurijuga* and *Pterocarpus angolensis* found in the.
- **Mopane woodlands** provide communities with the mopane worms (*Gonmbresia belina*) for subsistence and commercial purposes.
- The **miombo woodlands** and *Terminalia combretum* woodlands are home to a wide range of wildlife and supply communities with a range of non-timber forest products (mushrooms, fruits, insects, medicines etc.).

# Plantation forests

- List the type of species used in Zimbabwean commercial forestry sector?
- The plantation forests account for 0.4% of the land area covering 155 000 ha of land area comprising exotic species of pines, eucalypts and the black wattle (*Acacia mearnsii*).
- Zimbabwe had a very simple but effective advanced generation breeding programme of *Pinus patula*, *P. taeda*, *P. elliottii* and *P. kesiya*, *Eucalyptus grandis*, *E. tereticornis*, *E. Closiana* and *E. camaldulensis* that produce and markets high quality tree seed locally, regionally and internationally.
- *E camaldulensis* commonly planted in rural areas.

# Cont.

- Forests and trees are important for human wellbeing as they provide them with goods and services.
- A significant majority of the local communities sustain their livelihoods by direct use of the forest ecosystem goods and services for household consumption, including food, fuelwood and medicinal purposes.
- Forests also generate income from the trade of both timber and non-timber forest products (NTFPs).
- Forests and trees support SDG goal 15.

## **Sustainable development goal 15**

Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss.

# SFM and SDG 15

Sustainable forest management is promoted by two targets under goal 15 of SDGs: “By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally” and “By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development”.

- **Link with SDGs- Goals 2, and 13**
- **Goal 2: to end hunger, achieve food security and improved nutrition and promote sustainable agriculture;**
- **Goal 13: to take urgent action to combat climate change and its impacts**

# Cont.

- **QN:** Identify the major environmental stresses in Zimbabwe and explain how environmental policy has evolved in response to these stresses.
- In forest ecosystems:
  - ✓ species and habitat loss,
  - ✓ deforestation and forest degradation, and
  - ✓ the largely unregulated overuse of common property areas have produced a complex situation of vulnerability that poses a growing threat to the continued existence of forest ecosystems.
- The main causes of this situation includes rural poverty, common property land ownership and to some extent the lack of knowledge of alternative resource management strategies.

# Linkages of land degradation to climate change and forests;

- **Desertification - causes and consequences (Brain storming)**

- **Definition –**

the process by which fertile land becomes desert, typically as a result of drought, deforestation, or inappropriate agriculture.

- **Causes-**

removal of the natural vegetation cover (taking too much fuel wood), agricultural activities in the vulnerable ecosystems of arid and semi-arid areas, which are thus strained beyond their capacity.

Urbanization, climate change, overdrafting of groundwater, natural disasters and tillage practices in agriculture that makes soils more vulnerable to wind and water erosion.

- **Effects-**

Hunger, Farming becomes next to impossible, poor water quality, poverty, Flooding

# Cont.

- **What are the major driver of deforestation in Zimbabwe?**
- Drivers of deforestation in Zimbabwe have been increasing since 2000, when significant environmental and land-use changes began to take root due to land conversions for crop production, grazing land, energy uses, fire and frequent droughts.
- On the other hand, population increase and migration have pushed people to areas in the vicinity of protected forests, resulting in encroachments on forest land, both planted and natural.
- The conversion of forest land to agricultural purposes, its clearing for firewood and over-grazing by livestock, mainly goats, has impacted negatively on forest and woodland regeneration in Zimbabwe.
- Agricultural productivity and food security can be increased while halting or even reversing deforestation by using sustainable and climate-smart technologies such as agroforestry.

# Sustainable forest management and climate change

## Role of forests in the environment- what are the four categories?

### Productive Services

- Timber, Food, Fiber and Fuel
- Genetic Resources
- Biochemicals
- Fresh Water

### Regulating Services

- Invasion resistance
- Herbivory
- Pollination and seed dispersal
- Climate regulation
- Pest and disease regulation
- Natural hazard protection
- Erosion regulation and Water purification

### Cultural Services

- Spiritual and religious values
- Knowledge system
- Education and inspiration
- Recreation and aesthetic value

### Supporting Services

- Primary production
- Provision of habitat
- Nutrient cycling
- Soil formation and retention
- Production of atmospheric oxygen
- Water cycling

# Trees and rural livelihoods

- Explain how trees and forests contribute to rural and urban livelihoods
- The majority of rural households particularly the vulnerable households, often led by women and children, rely heavily on forest products for subsistence and supplementing their cash income.
- They harvest, process, transport and sell both wood and non-wood forest products (NWFP) (such as fruits, honey, bush meat, gums and resin, medicinal plants etc.) at local and to nearby urban centres.
- Trainer should give examples of NWFP used by rural Zimbabweans including wild fruits, fibre, mushrooms, wild meat, firewood etc.
- **QN:** Discuss why environmental degradation has continued in Zimbabwe despite the existence of good environmental policies.

# Sustainable forest management

Section includes issues to do with international agreements to combat climate change including the conventions and issues to do clean development mechanisms and REDD+.

**Sustainable forest management** suggests that forest resources will be managed to supply goods and services to meet the current demands of society while conserving and renewing the availability, capacity and quality of the resource base for future generations. Sustainability encompasses social, environmental and economic values depending on characteristics, stakeholder interests, and local values.

# SFM Cont.

- SFM can play an important role in integrating forests into strategies for development, food security, poverty reduction, sustainable land use and climate change mitigation and adaptation.
- To enhance SFM as a responsive measure, capacity-building in remedial practices is essential if Zimbabwe is to combat climate change effectively.
- This capacity-building should include integrated fire management, integrated pest and disease management, harvest planning (including road-building), silvicultural practices and nutrient and water regulation.

## Cont.

- **Environmentally**, SFM also contributes to carbon sequestration.
- There is an important relationship between carbon storage and sequestration by forests and changing temperatures: the more carbon that is stored in forests, the lower are CO<sub>2</sub> emissions into the atmosphere.
- This relationship is gaining traction in the climate change negotiations, as tropical countries are preparing themselves to reduce emissions through increasing forest carbon stock so as to benefit from REDD+ issues.
- The United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD) which is supported by FAO, UNEP and UNDP, provides an economic incentive for conserving and enhancing forest carbon sinks and changing the way forest resources are used.
- **QN: There is hope for African forests and woodlands to be saved through climate action. Discuss.**

- Discuss local and international processes supporting forestry as a climate change mitigation and adaptation option.
- This is a new way of curbing CO<sub>2</sub> emissions, by paying for actions that prevent forest loss or degradation. The reduced CO<sub>2</sub> emissions can be traded as carbon credits, while people can be paid to manage forests.
- UN **Explain the emergence of REDD as an international strategy for climate change solutions**  
“rec  
con: **How feasible is the REDD process to small holder farmers in Zimbabwe?**
- The  
Africa, which covers four rural district councils (Nyaminyami, Hurungwe, Mbire and Binga) extending over 1.4 million hectares in two provinces.

## Section 9.4: Agroforestry

- **Definitions-**
- a dynamic, ecologically based natural resource management system, through the integration of trees on farms and in agricultural landscapes or through the production of agricultural products in forests, to diversify and sustain production for increased economic, social and environmental benefits for land users.
- Briefly explain the need for agroforestry in Zimbabwe
- What are the advantages of agroforestry?

# Benefits of agroforestry??

- **Economic benefits** - reduction of agricultural inputs, especially when using leguminous species which fix nitrogen to improve soil fertility.
- At the same time, this maintains or increases production and may diversify production in farming systems, for example, food, fodder, lumber, building materials and wood fuel.
- **Social benefits** - Include improvements to the health and nutrition of the rural poor. The on-farm production of several products, often collected from off-farm sources, can reduce the time and effort needed to obtain them, often lessening the burden on women or generating money if the products can be sold.
- **Environmental benefits** - may include a range of environmental services such as improving soil fertility, minimising soil erosion, giving crops and livestock protection from the wind, restoring degraded lands, and water conservation.
- If properly designed and managed, agroforestry systems can also contribute to biodiversity conservation and climate change adaptation and mitigation.
- What are the consequences of bad design?

# Concepts and principles -satisfying four key criteria

- The 4 I's of agroforestry:
- **Intentional.** Combinations of trees, crops and/or animals are intentionally designed and managed in order to yield multiple products and benefits in order to yield multiple products and benefits. **Important to emphasise these giving examples**
- **Intensive.** Agroforestry practices are intensively managed to maintain their productive and protective functions. These practices often involve annual operations such as weeding, cultivation, pruning, pollarding and fertilisation;
- **Interactive.** The biological and physical interactions between the tree, crop and animal components are actively manipulated to yield multiple products and benefits; and
- **Integrated.** The tree, crop and/or animal components are structurally and functionally combined into a single integrated management unit. Integration may be horizontal or vertical, and above or below ground, either sequentially or simultaneously.

# Agroforestry Systems (Brainstorm)

- **Silvoagriculture** –
- Trees with crops
- **Agrisilviculture**
- Cropping with trees
- **Silvopasture** –
- Combines trees and pasture
- **Agrosilvopasture**
- Combines crops, trees and livestock, cropping main component
- **Silvoagropasture**
- Trees main component
- **Forest farming**
- Trees are main component
- **Pastoral silviculture**
- Pasture main component with trees
- **multipurpose** – multiple use
- **Other-** include apiculture, aquaculture, etc.

# Agroforestry

- Agroforestry practices



**Windbreaks**



**Alley cropping**



**Farm woodlot**



**Live fence**



**Silvopasture**

**Others include Fodder banks, Taungya in areas around forest estates, Improved fallows, Home gardens and trees in croplands**

# QN

- Distinguish between sequential and simultaneous agroforestry practices giving examples.

# Contribution to CSA

Forest and tree based activities contribute to both mitigation and adaptation to climate change and these actions can contribute to all three CSA pillars:

**Mitigation:** Includes actions that increase tree cover (afforestation, reforestation, and agroforestry) and reduce deforestation and degradation and increasing carbon sequestration in biomass and soil. Trees can supply fuelwood, poles and other forest based products preventing destruction of natural forests.

**Adaptation:** Forest ecosystems provide human societies with a wide range of services that reduce the vulnerability to climate change impacts (particularly changes in the frequency, duration, and intensity of temperature, rainfall, floods, and droughts).

Forests regulate water, climate, and soil erosion. In order for communities to continue to benefit from the forest ecosystem services, adaptation strategies must also reduce the impacts of climate change on forest growth, species diversity, and ecosystem function.

# QNS

- Discuss the need for and limitations for improved fallows
- What kind of trees and shrubs should be used in the following agroforestry practices
  - Woodlots for fuelwood production
  - Fodder banks
  - Windbreaks and shelterbelts
  - Alley cropping
  - Home gardens

# Cont.

- **Productivity:** Forests facilitate primary production, nutrient cycling, soil formation and provision of ecosystem goods, such as non-timber forest products, food and fuel.
- By adopting agroforestry practices on farms, farmers are able to harvest tree products, supplement their diets, and also develop additional income streams. Integrating trees in farming systems can also improve soil quality, leading to higher and more stable crop yields.
- SFM, where, for example, local communities are given concessions to harvest timber and non-timber products, likewise adds to the productive portfolio of small-scale farmers and supports forest and biodiversity conservation.
- Therefore, CSA in the forest sector entails the design of adaptation actions targeted at the most vulnerable communities and sectors of the population (e.g. children, women, elderly, indigenous people) and forested ecosystems (e.g. woodlands, mountains, wetlands), focusing on the most efficient and cost-effective mitigation options besides capitalising on adaptation-mitigation synergies.

# QN

- Describe some of the constraints in adopting agro forestry by the farmers

# Forestry, agroforestry and climate change in Zimbabwe

- The Zimbabwe Agenda for Sustainable and Socio-Economic Transformation (ZIMASSET) was clearly in line with SDG goal 15, showing the importance of conserving natural resources.
- Agriculture and forestry have been antagonistic practices due to the fact that the highest percentage of deforestation at global, regional and national level is attributed to clearing forests for agriculture (about 300 000 ha/yr).
- Despite this scenario, forests provide human beings with both timber and non-timber forest products including sequestering carbon.
- SFM should be considered a viable solution to the challenges within the agriculture sector especially use of land and other natural resources through e.g. CAMPFIRE, agroforestry, woodland management, reforestation, tobacco wood energy programme etc.
- The forests and woodlands in Zimbabwe are home to a large number of species of flora and fauna and they preserve national watersheds.

# Role of Higher and Tertiary Institutions in climate-smart practices ???

- Higher and Tertiary institutions have a especial role for research in suitable agroforestry species for recommending to farmers and extension agents.
- They can also facilitate in capacity building within local institutions and strengthening governance process for SFM.
- Training of community leaders and extension officers
- Facilitate understanding and training in the REDD+ process including issues of monitoring reporting and verification (MRV) as communities participate in REDD+ projects.
- The dissemination of agroforestry practices and the provision of support for farmers in form of reading materials, courses and workshops are essential for the effective uptake of agroforestry.
- Curriculum should include issues of climate change and SFM including international agreements.

# Policy Implications, Opportunities and Challenges

- **What are the implications, opportunities and challenges of the implementation of agroforestry?**
- Forest and tree based resources are not only supported by local legislation but also by regional and international treaties and arrangements.
- Opportunities for SFM and agroforestry include the availability of International climate funds and National and local approval.
- The development and up-scaling of traditional and improved agroforestry systems also requires an enabling environment, such as clear land and tree tenure, a robust legal framework, support for agroforestry product value chains, and coordination among the various sectors involved.
- The issue of illegal settlers needs total political commitment to save both planted and natural forests
- Agroforestry promotes growing of multipurpose trees which are also palatable to livestock and these are threatened by the free range policy for livestock during the off season periods.
- In areas where goats are kept, regeneration of natural forests and any agroforestry attempts may not succeed unless the laws are modified to protect agroforestry in rural areas.

**Discuss the limitations of the environmental policy instruments in protecting natural resources.**

# 6.0 Conclusion and Recommendations

- Zimbabwe is endowed with natural capital, especially forests resources, land, and climate which can sustain the livelihoods and economy of the people in both urban and rural areas.
- Degradation of forest resource base is a result of a combination of factors that have their roots in the economy, social organisation, policy/politics and ecology.
- However, mounting pressure on the forest resources has caused large-scale forest and land degradation, calling for immediate attention for seeking newer approaches in the farming system to meet the basic needs of present and future generations.



## What should we do to achieve green

### landscapes

degradation, resources-based conflicts and other illegal activities.

- Therefore, to improve the livelihood, the economic condition and the environmental sustainability, improved agroforestry systems using combination of crops, multipurpose trees and pasture becomes inevitable.

THANK YOU

# THE LANDSCAPE APPROACH



# KEY MESSAGES

- To meet national food security objectives as well as needs of a variety of stakeholders in a specific landscape, land-use planning and the management of natural resources, need to be Coordinated across sectors and through a participatory and consensus-based decision-making process;
- Building national and local capacity in developing inclusive governance arrangements.
- Harmonisation and enforcement of public policies and land-use legislation through strengthened national and local institutions and governance;
- The implementation of REDD+ can play a catalytic role in promoting a landscape approach by reinforcing the forest-agriculture nexus; and
- Develop a common knowledge base on feasible concepts, techniques and methods to allow stakeholders to develop, implement and monitor landscape approaches.

# DEFINITION

- Landscapes provide the setting over which problems unfold, and the Landscape approach provides the social-ecological systems framework by which these problems are dealt with

# DEFINITION

- A Landscape Approach can broadly be defined as a framework to integrate policy and practice for multiple land uses within a given area to ensure equitable and sustainable use of land while strengthening measures to mitigate and adapt to climate change
- It is also to balance competing demands on land through the implementation of adaptive and integrated management systems

# DEFINITION

- Landscapes are the result of interactions between geo-ecological processes, social rules, stakeholder actions and economic activities.
- Landscapes provide the setting over which problems unfold, and the Landscape approach provides the social-ecological systems framework by which these problems are dealt with

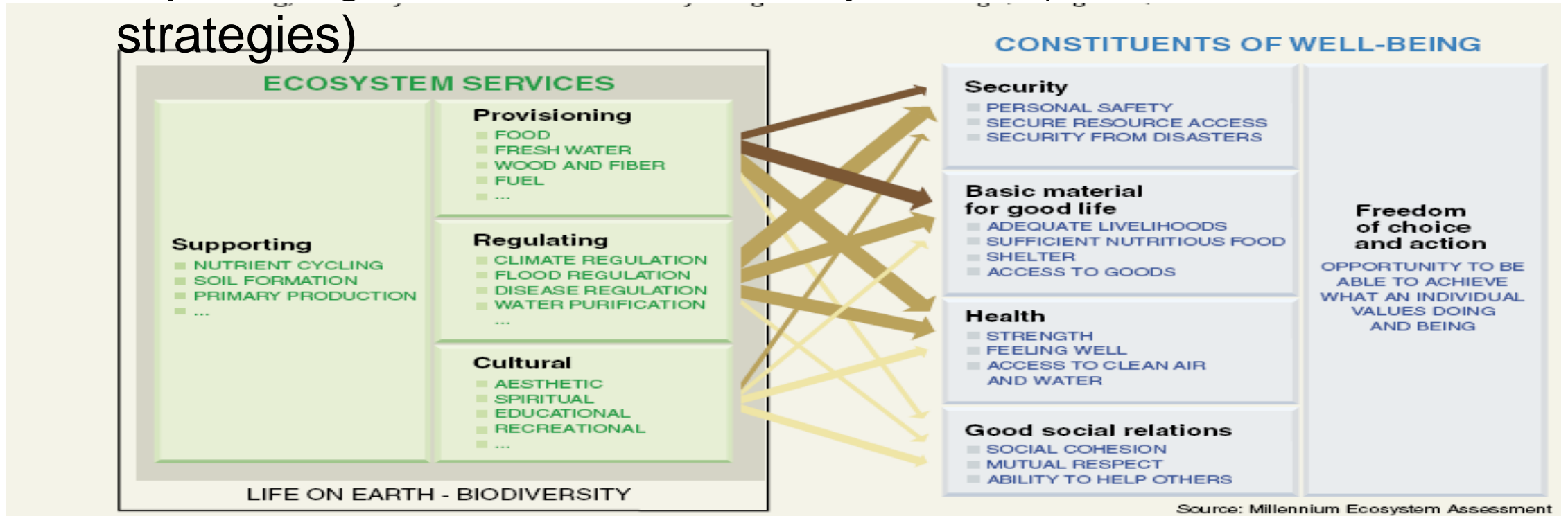
# Driving Forces for a landscape approach

- Conservation – Development Debate
  - Increasing pressure (and conflict) on PA system
  - Broadening Development Agenda (linkages to poverty Alleviation, MDG and new aid modalities (sector approach))
- International Dialogues
  - Indigenous rights of communities and minority groups
  - Linking policy dialogue (conventions, EA) to practice
  - Multistakeholder dialogues (and negotiated outcomes in NRM) increasingly recognized
- Innovations:
  - Merging ecosystem thinking with MSP (emphasis on social learning)
  - Attention for markets for environmental services

# Characterising Landscape approach

It recognises:

- ❑ various ecosystem services (valued!)
- ❑ to multiple stakeholders,
- ❑ pursuing different land use objectives (or livelihood strategies)



# Characterising Landscape approach

- Seeks to link local-site level action, at farm, forest and protected area level, to the broader landscape level
- recognises that land use trade-offs will need to be made-
  - using a multi stakeholder approach for negotiated outcomes.
  - offers opportunity to place local people's needs at the centre of all forest and agricultural land use decision-making while simultaneously incorporating ecosystem goods and services as well as human well-being objectives in order to develop more sustainable land use practices.

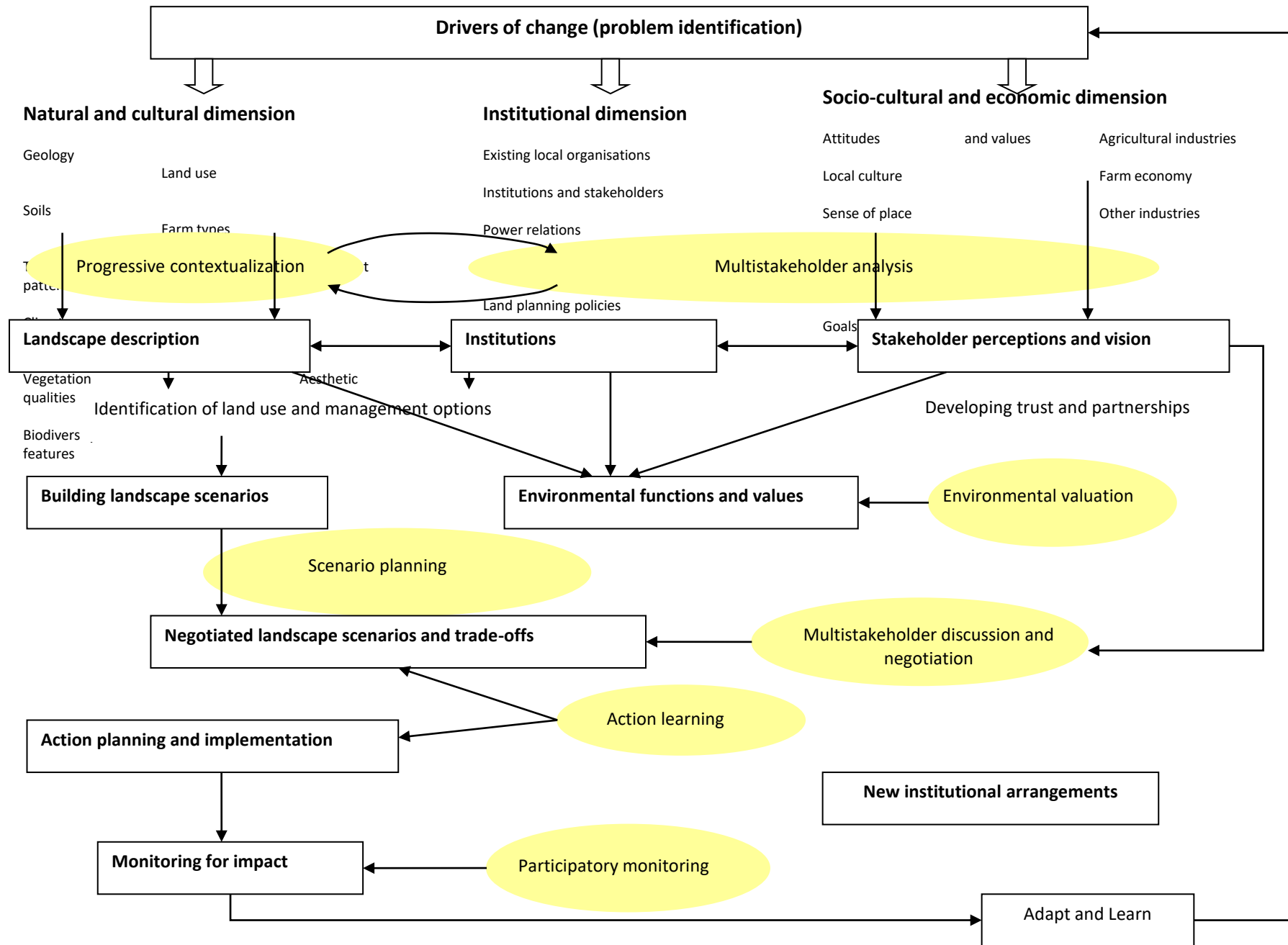
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Thank you

# Climate Information Services: Trainer of trainers course

D. Mwenye

Department of Research and Specialist Services.

8-9 February, 2018





# Expectations

# Course outline

- Part 1: Understanding Climate Information Services
- Part 2: Climate information and CSA
- Part 3: Extension and CI
- Part 4: Practical examples:
  - Climate field schools
  - Demonstrations
  - Master farmer training.



# **Part I Understanding Climate Information Services**

# Climate Information Services

- Climate information services cover the whole process of obtaining the climate data, its storage and processing into specific products that are required by different users within the climate sensitive sectors such as agriculture, disaster risk reduction, health.
- In short it is the packaging and dissemination of climate information to specific users ([www.uneca.org](http://www.uneca.org)).
- Climate services encompass a range of activities that deal with generating and providing information based on past, present and future climate and on its impacts on natural and human systems. (past, present and future scenarios)
- CI provides an enabling environment for CSA.
- CIS- one of the 5 components of the Global Framework of Climate Services (GFCS)

Users, Government, private sector, research, agriculture, water, health, construction, disaster reduction, environment, tourism, transport, etc

User Interface

Climate Services Information System

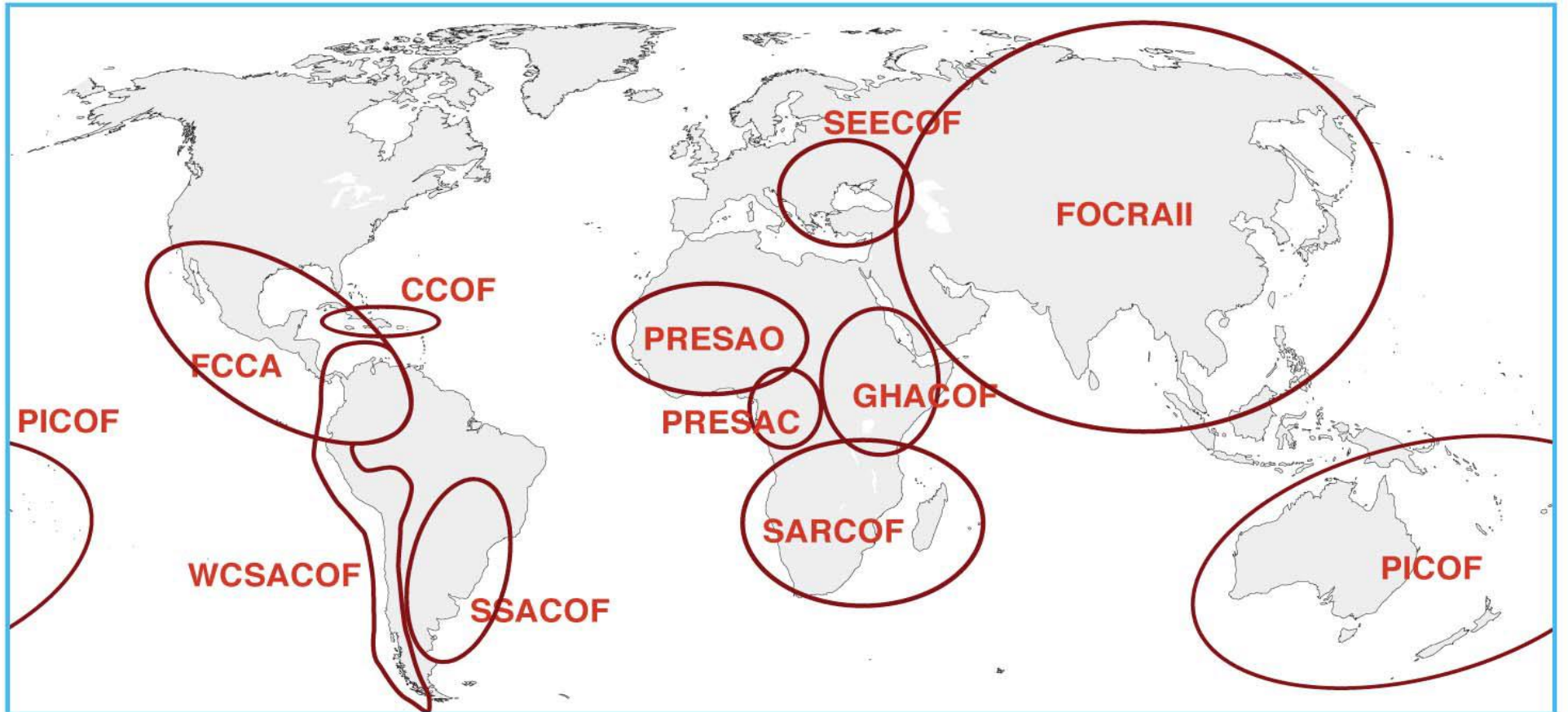
Observations  
and Monitoring

Research, Modeling  
and Prediction

CAPACITY  
BUILDING

```
graph TD; Users[Users, Government, private sector, research, agriculture, water, health, construction, disaster reduction, environment, tourism, transport, etc]; UI[User Interface]; CSIS[Climate Services Information System]; OM[Observations and Monitoring]; RMP[Research, Modeling and Prediction]; CB[CAPACITY BUILDING]; Users <--> UI; UI <--> CSIS; CSIS <--> OM; CSIS <--> RMP; OM <--> RMP; CB <--> OM; CB <--> RMP;
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# Global Outlook Fora



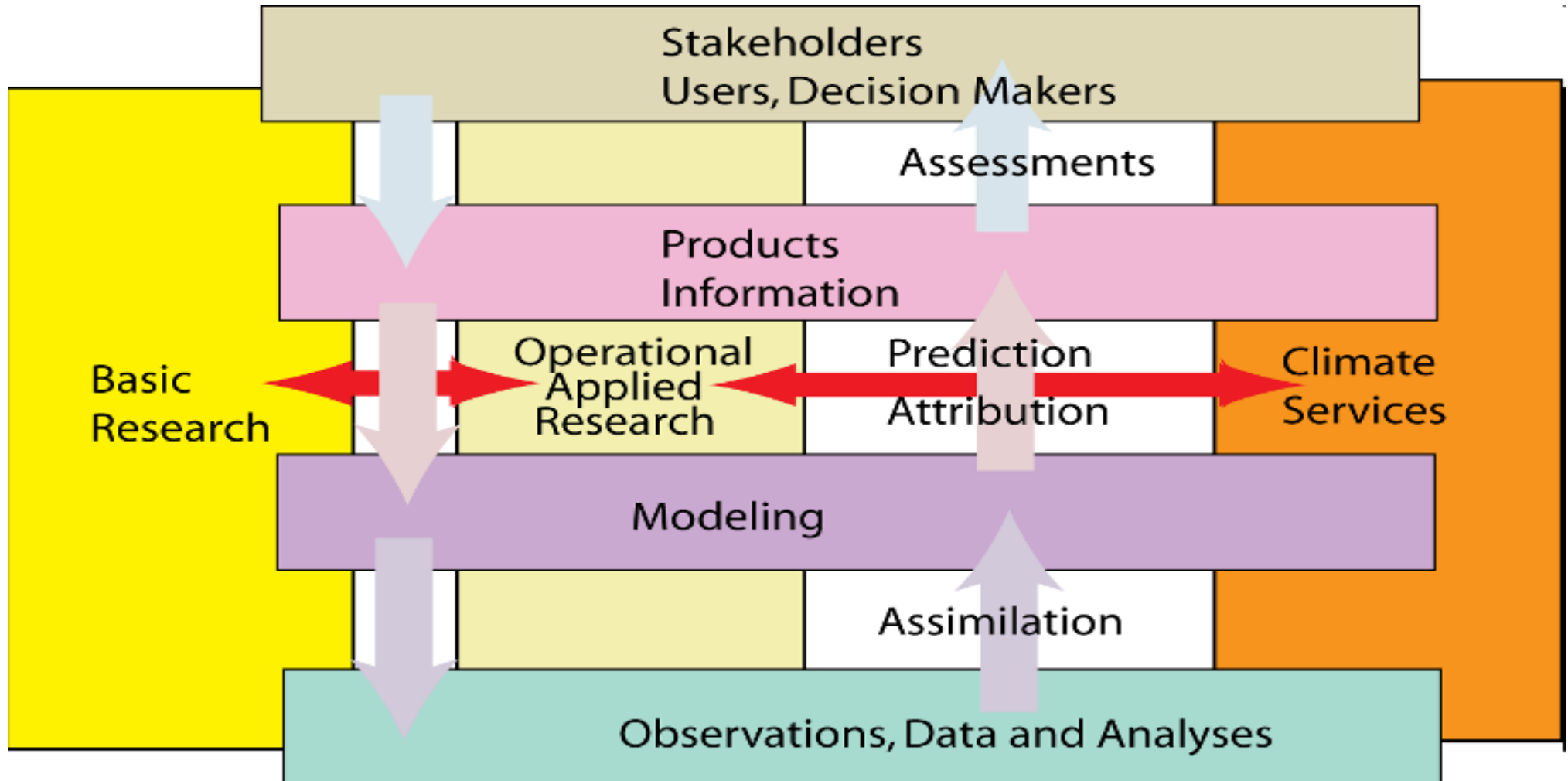
# Outlook fora

- Global
- Regional
- National

## Activity 1. (group work)

- Do you have access to CI
- What are the major sources of CI
- What do you do with the information after receiving it
- Who are the users of CI from your perspective
- Other regional climate outlook fora

# Climate information generation system



Activity 2. Draw your own version of climate information generation for Zimbabwe



## **Part 2: Climate Information Services and Climate Smart Agriculture**

## CIS and CSA

- Productivity: Effective climate services are part of the enabling environment for the transition towards CSA (*adequacy, timely, flexible planning and decision making*)
- Adaptation through risk management: CIS contributes to resilience by enabling farmers to better manage the negative impacts. It helps actors to adjust their plans as climate stressors and shocks unfold. (*developing a range of adaptation options and switching livelihoods options*)
- Mitigation: climate services can contribute to CSA by providing information that support more efficient use of CSA technologies (*use of fertilisers and pesticides*)

# Weather, Climate change and variability

- Weather is the state of the atmosphere at a given time and place with respect to variables such as temperature, moisture, wind, and barometric pressure.
- Climate refers to average weather in terms of the mean and its variability over a certain time-span and a certain area.
- Climate change is a change in the climate that persists for an extended period of time (WMO, 2011).
- Climate variability is any deviation in the long-term statistics of climate elements over a short period of time, which can be a day, intra-seasonal, inter-seasonal or related to differences in climate from decade to decade.

# Agro meteorological tools

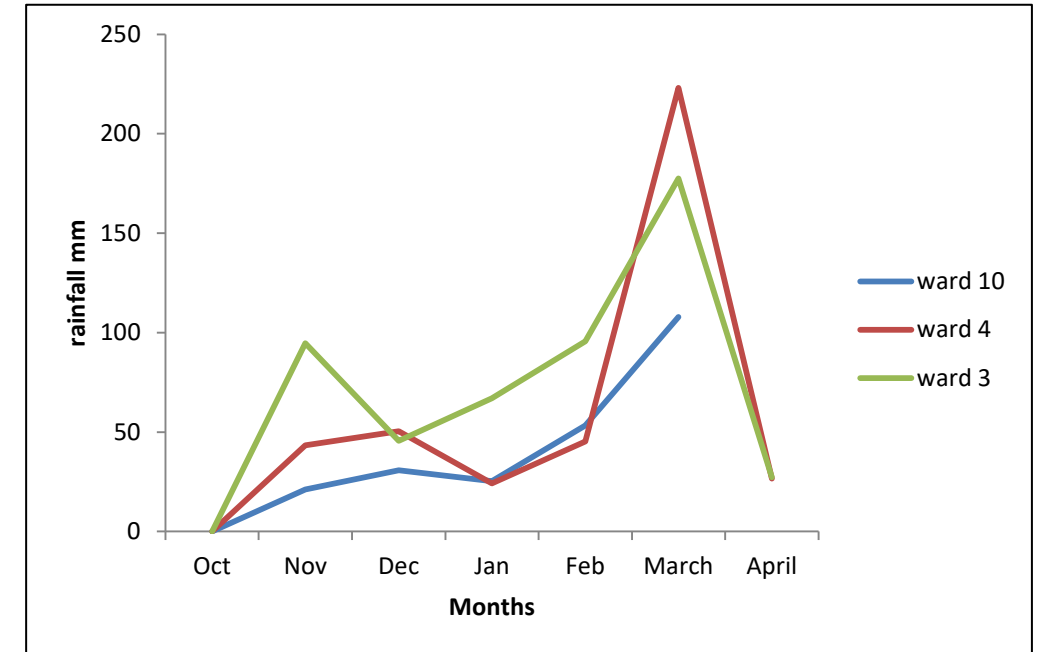
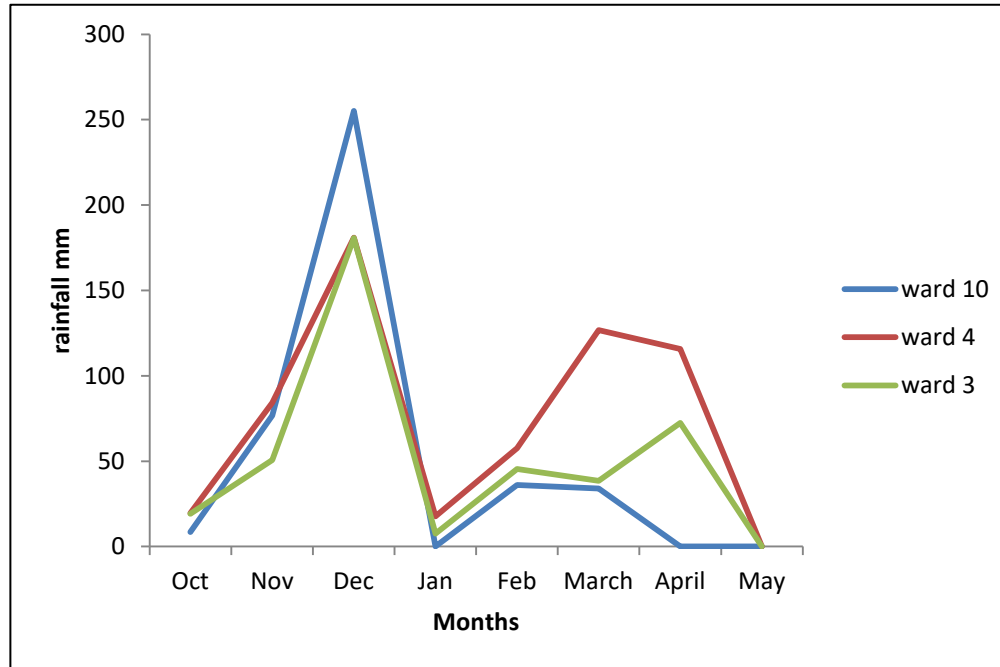
- Seasonal forecast: often referred to as the long range forecast is important as it assists in strategic planning by users
- 10 day weather forecast: is referred to as the medium range forecast and provides the likely weather conditions for the next 7-10 days. (*Agro met bulletin and farmer bulletin*)
- 3 day weather forecasts: (the short range forecasts and tend to have greater accuracy compared to the other forecasts. Such forecasts are useful in planning farming operations and especially during the cold season
- Probability of extreme events: (extreme weather or climate event is one that shows a deviation from the normal occurrence. *For example an increase in the number of rain days where the total amount received in 24hrs exceeds 50millimetres (mm)*)

Activity 3: Discuss indigenous indicators for forecasting weather and climate in your area (group wok)

# Tools continued

- Inter and intra seasonal variability (Rainfall performance varies between one season to the next (inter seasonal variability) as well as within the season (intra seasonal variability). (Refer to graph)
- Start of season: any day after the 10<sup>th</sup> of November when an area receives 20mm or more of rains in 3 days or less provided there is no dry spell of 10 days or more in the next 20 days
- End of season is: any last day before end of April when an area receives 15mm of rain provided there are no rains of 2.95mm or above in the next 20 days.
- length of the rainfall season can be calculated by subtracting the date of start of season from date of end of season (important for varietal selection)
- Length of growing season goes beyond length of rainfall season, as it takes into consideration the soil water balance, which at this time of the season should be at zero provided there won't be effective rains within the last 20 days.

## Intra and inter seasonal variability

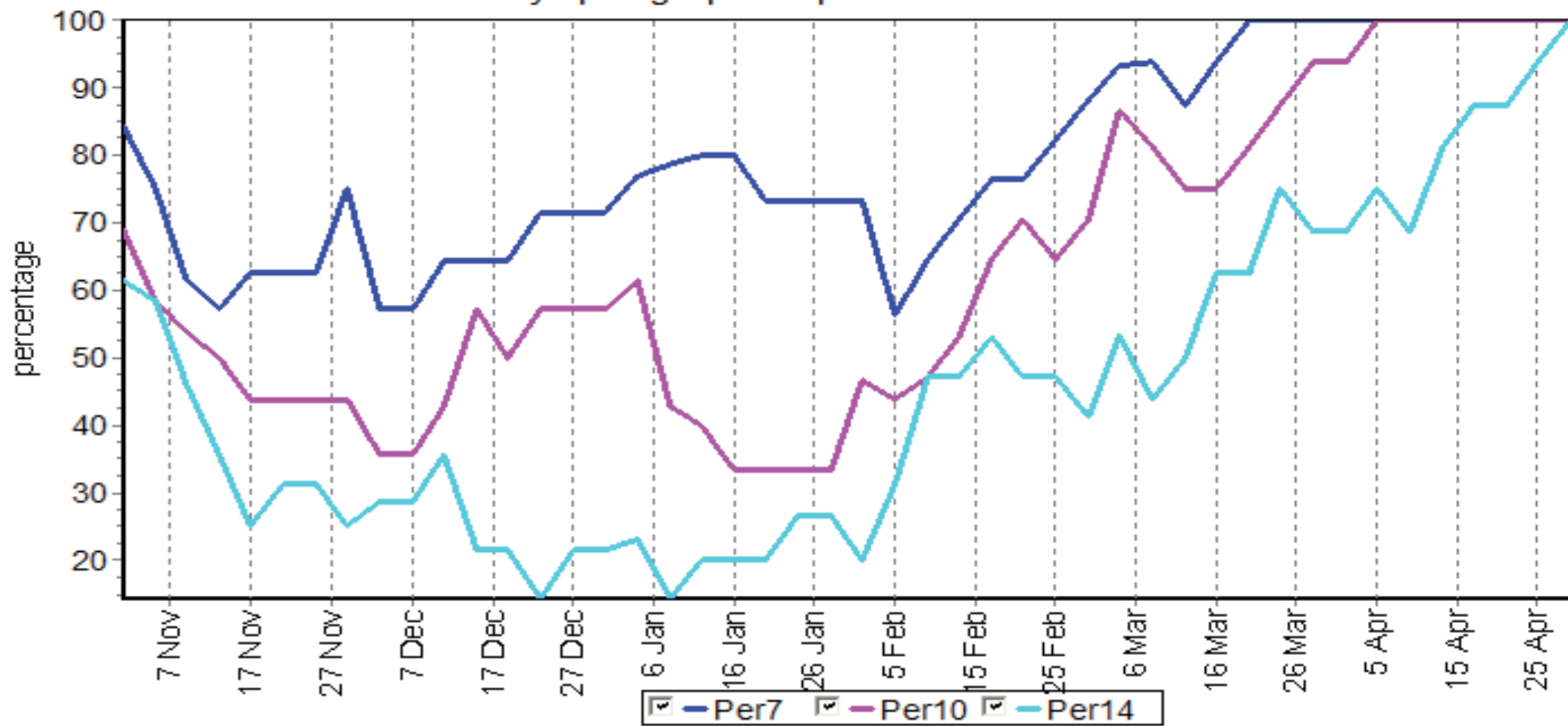


## Spatial and temporal variations in total seasonal rainfall

## Tools continued

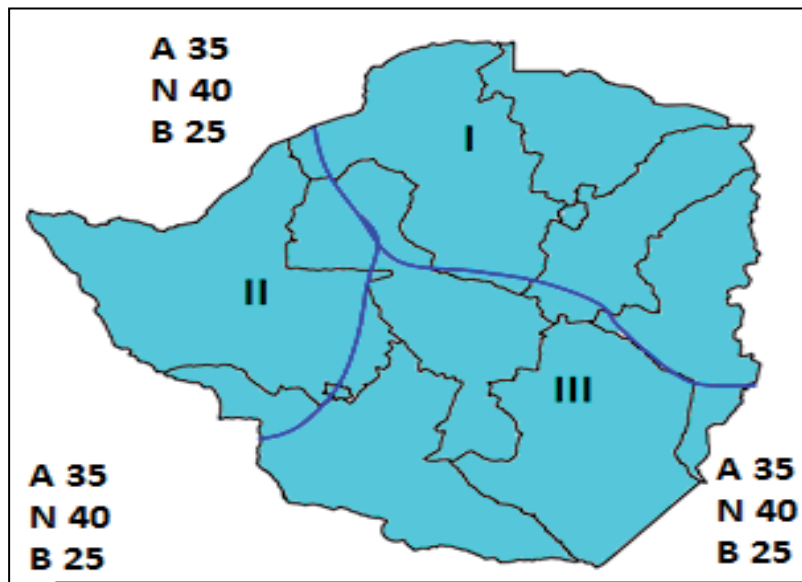
- Dry day can be considered to be any day that accumulates less than 2.95mm or 5mm of rain (less than 0.85mm)
- A wet day is considered to be a day that accumulates 2,95mm or 5mm of rain . (10mm and above)
- Rainy day 0.86- 10mm
- A dry spell is a period of days with little or no precipitation and is therefore a collection of dry days, where each day will have received less than 2.95mm or 5mm. Dry spell is defined as a period where the weather has been dry for an abnormally long time, shorter than and not as severe as a drought. (refer to graph Gutu)
- Wet spell is when 100mm is received in 5 days

Gutu dry spell graph for period 1987 to 2012

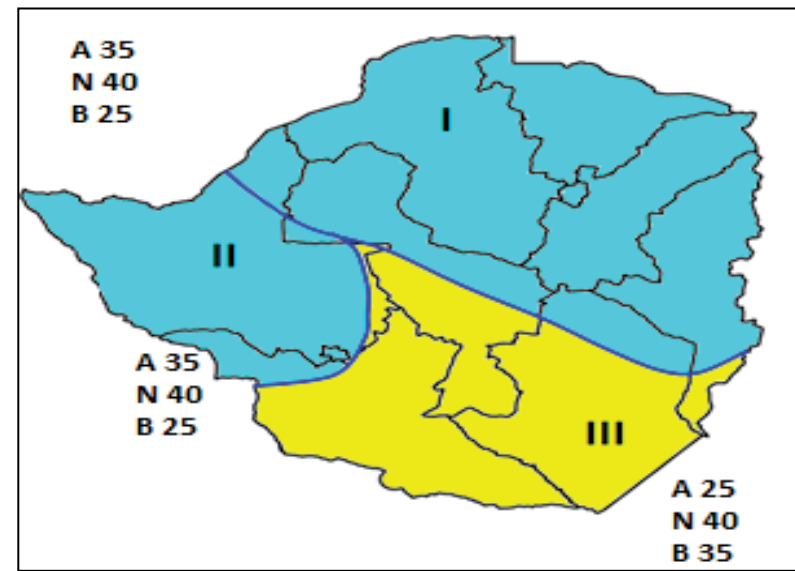


# Parameters

- Above normal season: Receives more than 125% of long term normal for the area
- Normal season: 75-125% of long term normal for the area
- Below normal: an area receives less than 75% of long term normal.
- Drought is defined as a period in which a region has a deficit in its water supply (3 forms of drought)
  - Meteorological drought (reduced precipitation, high infiltration, high temperature, high evaporation)
  - Agricultural drought: (soil water deficiency, plant water stress and reduced biomass and yields)
  - Hydrological drought ; (reduced stream flows and water levels in various water bodies. (p. 28))

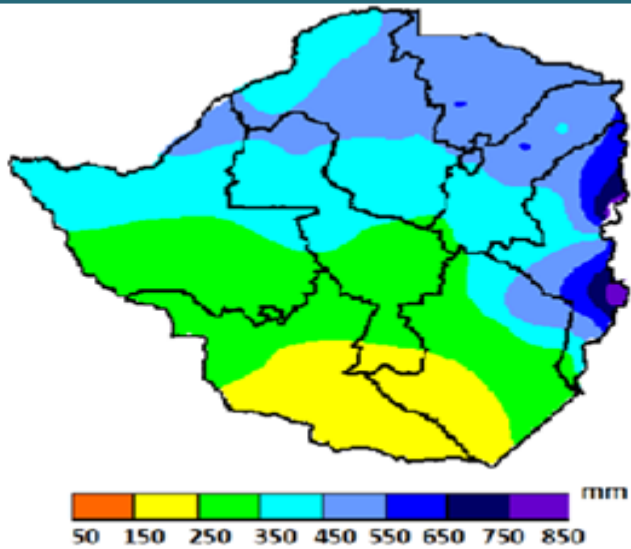


October to December 2016

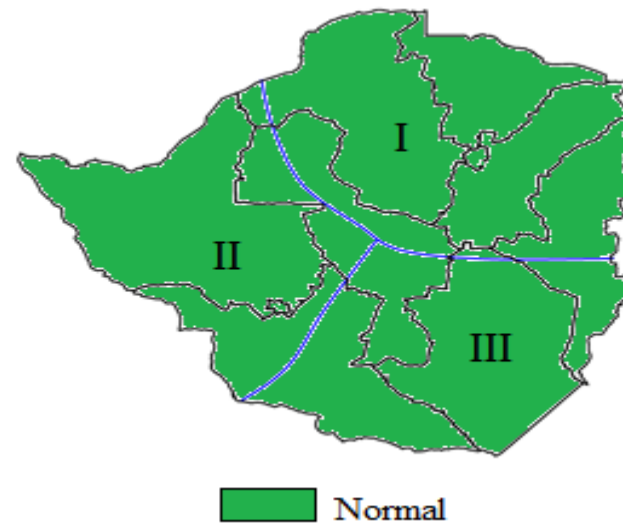


January to March 2017

(a)



(b)



(a) Long term mean rainfall for January-February-March (1981-2010)

(b) Seasonal outlook for January-February-March 2018.

## Activity 4

- What advice would you give to a farmer under the following scenarios?
  1. The three-day forecast indicates strong winds and morning rain/showers, and the farmer wants to spray.
  2. The 10-day forecast indicates heavy rains from 2–10 February, and the farmer would like to apply top-dressing fertiliser.
  3. In a certain ward in Chiredzi, a farmer wants to plant maize seed in February, since the area experienced a late start to the season.
- Discuss the importance of short-term, medium-term and long-term forecasts in agriculture



## **Part 3 Extension and Climate Information Services**

## Activity 5

- What is the importance of CI in CSA?
- What are your roles in CSA?
- What are the challenges?
- Proffer any solutions?
- Which extension methods do you use to disseminate climate information
- What are the advantages and disadvantages of the methods you use

# The role of extension services in CIS

Adaptation to climate change requires changes in knowledge; attitudes, resilience , capacities and skills of people and extension systems.

- **Technologies and management information** (CSA technologies)
- **Capacity development:** flyers , radio messages field demonstrations, adult education and experiential learning approaches such as climate field schools.
- **Facilitating brokering and implementing policies and programs** (brokering by bringing together different actors)
- **Coordination:** (research , extension, education, NGOs and the private sector)
- **Infrastructure /institutions** (facilitation and provision of inputs in time, DRR)
- **Materials: operational costs** should be reduced (use village libraries , lead and champion farmers)
- **Training:** In situ within the village, promote training by doing)
- **Technology demonstrations** (both method and result demonstration)
- **Embrace ICT**
- **Crop yield forecasts:** (adaptation practices require quality data and information not only on climate and agriculture but on environmental and social systems)
- **Feedback role;** (to government, stakeholders and farmers)

# Innovative Extension Approaches: Climate Farmer Field School

- The Farmer Field School is a group-based learning process.
- The FFS approach represents a radical departure from earlier agricultural extension programmes formulated by specialists from outside the community.

# Advantages of Climate Field Schools

- Increase farmers' knowledge on climate and assist them on translating the climate (forecast) information
- Enables farmers to anticipate extreme climate events for farming activities;
- Farmers are supported on their farming activities, in particular planting decision and cropping strategy
- Use climate information in managing their soil, water and crop resources for best effects.
- Use weather forecasting in planning

## Advantages cont

- Rainfall: Farmers will have a good understanding of the rainfall pattern that occurs in their locality
- Total rainfall: FFS provide an opportunity for farmers to learn on the importance of setting up rain gauges to help them in measuring the rainfall throughout the season.
- Effective rainfall: This is the amount of rainfall which is effective in facilitating growth. Farmers participating in a FFS have the opportunity to determine when to plant their crop being informed by the soil moisture content .
- The FFS, provides an opportunity for farmers to study a crop and be able to make the necessary adjustments in response to season length.



## Part 4. Practical examples

## Procedures used to disseminate CI

- CFS (hand out and group discussion)
- Demonstrations hand out and group discussion)
- WII (case study of old mutual and eco farmer, Hand out)
- Hand out on (Climate information communication model)

# Activity 6

- How can we incorporate Climate Information in the MFT programme.



**THANK YOU**

# Further reading

- <http://www.climatetechwiki.org/content/farmer-field-schools>
- <http://www.agriculturesnetwork.org/magazines/global/dealing-with-climate-change/climate-field-schools-in-indonesia>
- **Climate application. A glossary of terms used in weather (MSD)**

**Book Chapter 8:**  
**Climate Smart Agriculture in Livestock and  
Rangeland Management in Zimbabwe**

(i) Prof Irvin DT Mpofu and (ii) Walter Svinurai

(i) Chinhoyi University of Technology (ii) University of Zimbabwe  
Marondera niversity of Agricultural Sciences and Technology

# Book Chapter Objectives

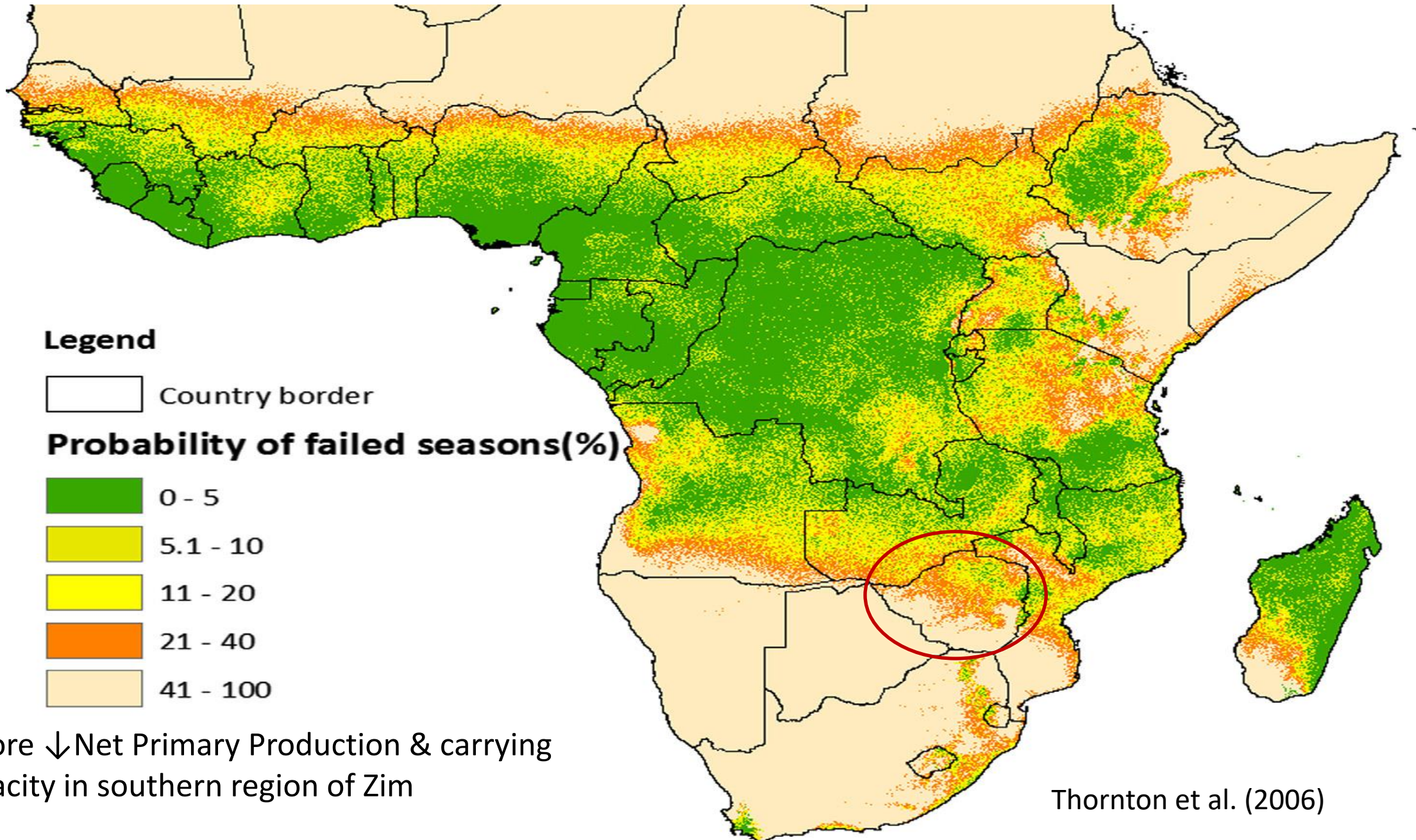
By the end of this chapter you should be able to:

- **Explain** what CSA is in terms of livestock and rangeland management.
- **Outline** the pillars of CSA using livestock as a vehicle out of poverty.
- **Identify** appropriate livestock-based policies, strategies and activities that contribute to the pillars of climate-smart livestock systems.
- **Recommend** CSA policies and practices that are suitable in your own area in managing livestock and rangelands productively and sustainably.

# Introduction

- Livestock are assets (**stock**) which are a live; **Rangelands**: habitat with a range of natural feeds;
- **Management**: cost effective, quality decisions (policy, strategies & MEL)
- Livestock requires conducive environment (nutrition, veterinary protection, rangelands, breeding & general good management).
- Unfortunately all these environmental factors are prone to CC stressors (i) **low or short duration, unpredictable precipitation**, (ii) **warm temperatures**, (iii) **unexpected disease pandemics**

# Climate change impacts on growing season & drought



# Introduction ....

- To make matters worse livestock especially ruminants (sheep, goats and cattle) also contribute to climate change mainly through
  - **Greenhouse gas (GHG) emissions (methane) and poor manure management (nitric oxide).**
- Of the **14% of global GHG** contributed by agriculture about **65%** of these are contributed by **cattle**.
- The overall direct GHG emissions from **livestock** and feed production constitute some **80% of total global agriculture emissions**.

# Introduction .....

- Climate change contributes to **rangeland degradation** yet rangelands can be used to reduce climate change pressures through **carbon sequestration**.
- Fortunately many options exist to conserve or reverse rangeland degradation in specific habits for our livestock inclusive of wildlife management. This is particularly important for sustainability.

# *What is **climate smart agriculture** in terms of livestock and rangeland management?*

- Climate-smart agriculture (CSA) as formulated & defined by FAO at The Hague Conference on Agriculture, Food Security and Climate Change in 2010 is an approach to farming that address three objectives:
- **Food and nutrition security** through efforts that sustainably increase agricultural productivity, household farm income and support sustainable development.
- **Adapting or building resilience** to climate change stressors at multiple levels; and
- **Mitigating climate change stressors** chiefly through reducing greenhouse gas emissions from agriculture (including crops, livestock and fisheries).

# Situational analysis in Zimbabwe

- In 2015 = 5,3 million down from nearly 6 million cattle in 1996.
- More than 90% of these cattle are reared in the smallholder farming areas.
- National Livestock Policy Draft (& Strategy) are expected to assist farmers to be able to exploit their animals' full genetic potential particularly cattle, sheep and goats.
- The livestock sector currently contributes 18 % of the total agricultural GDP & has potential to rise to 36 %.

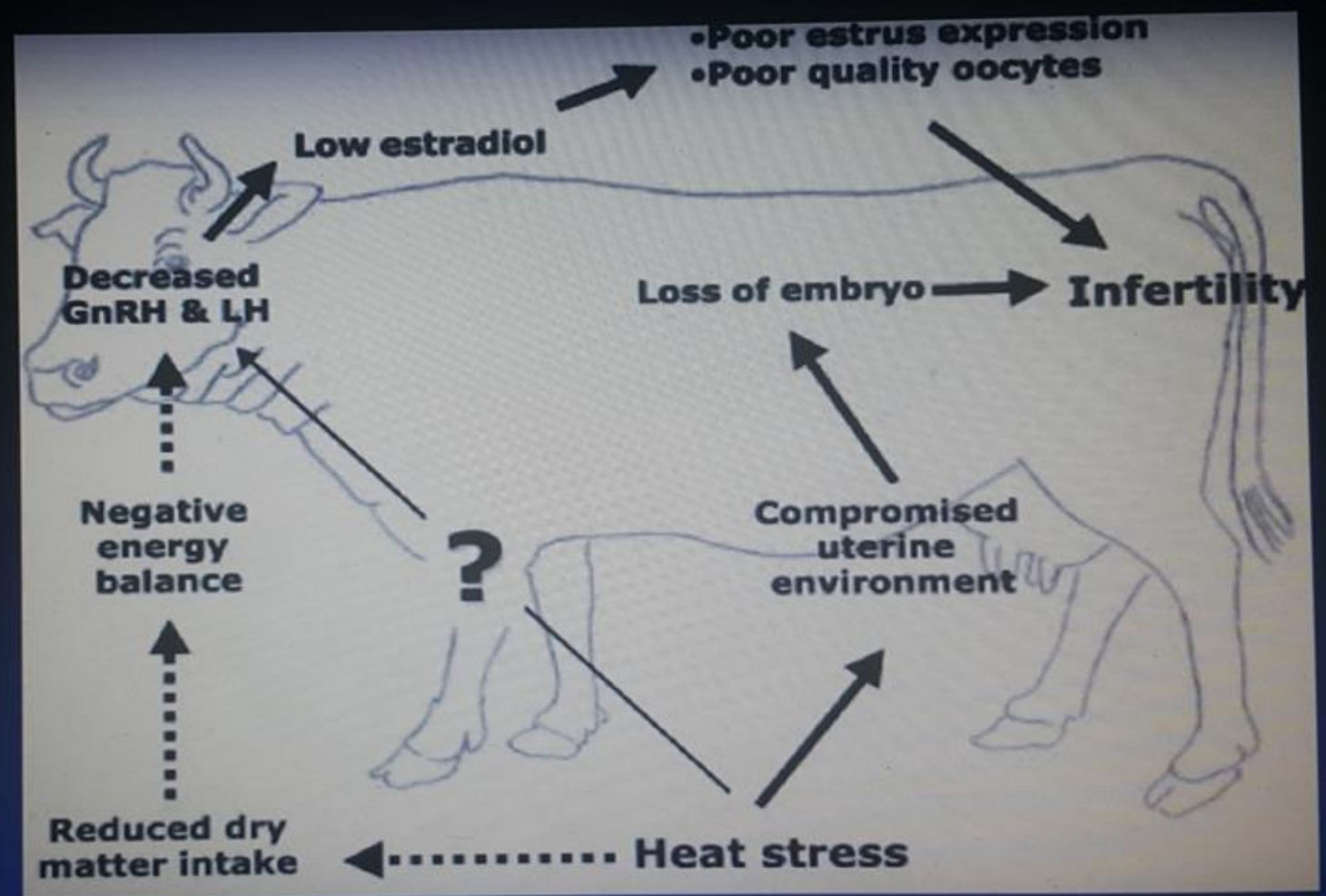
# **WORRYING OBSERVATIONS**



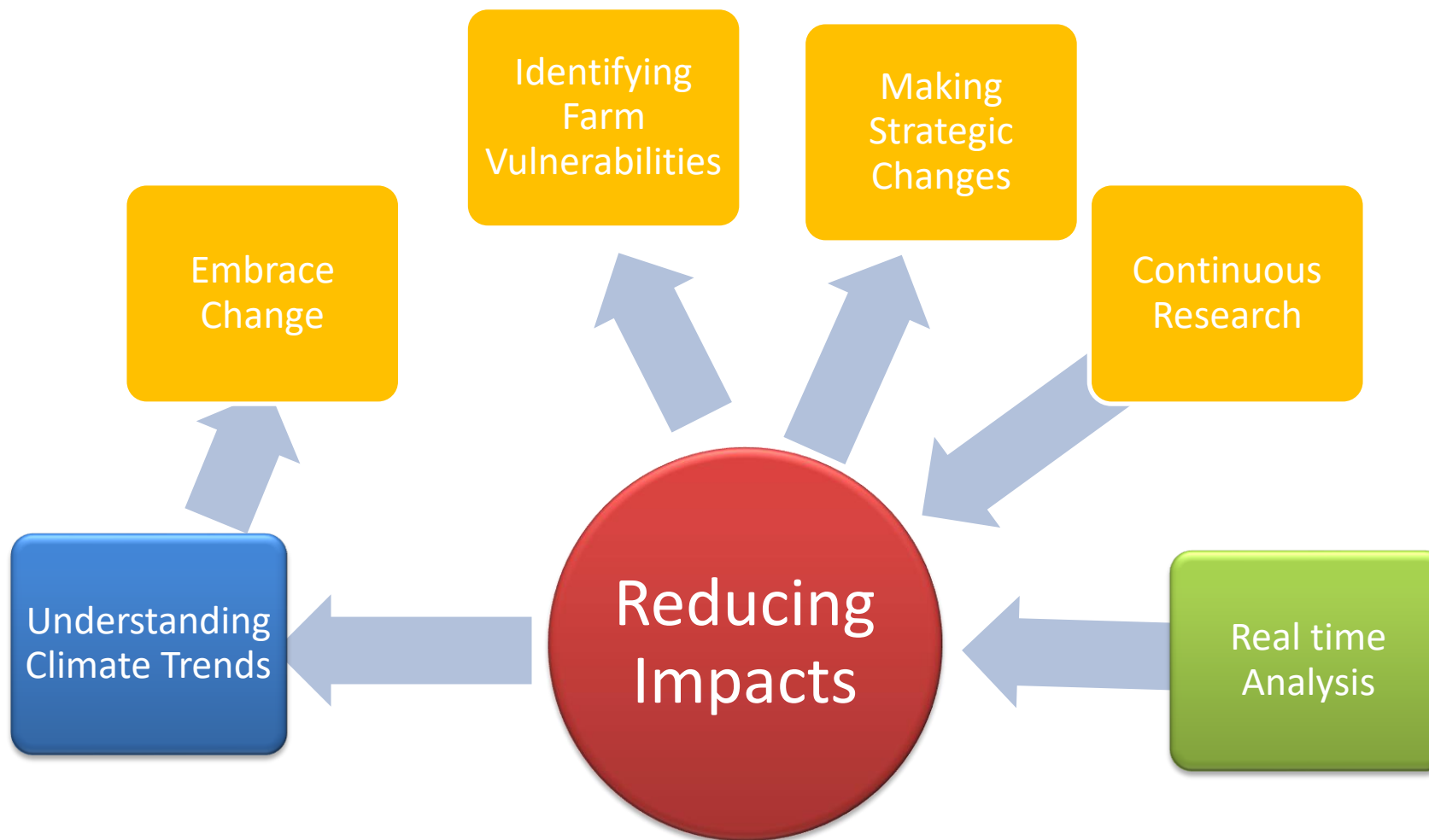
# Prominent Climate Change Stressor

**Heat Stress**

# Climate Change Impacts on Animal Agriculture




# Pathways to Reduce CC Impact on Livestock



Prof. Rogier Schulte - A new equation for climate-smart livestock farming


$$\text{Food} = A \times f_p$$

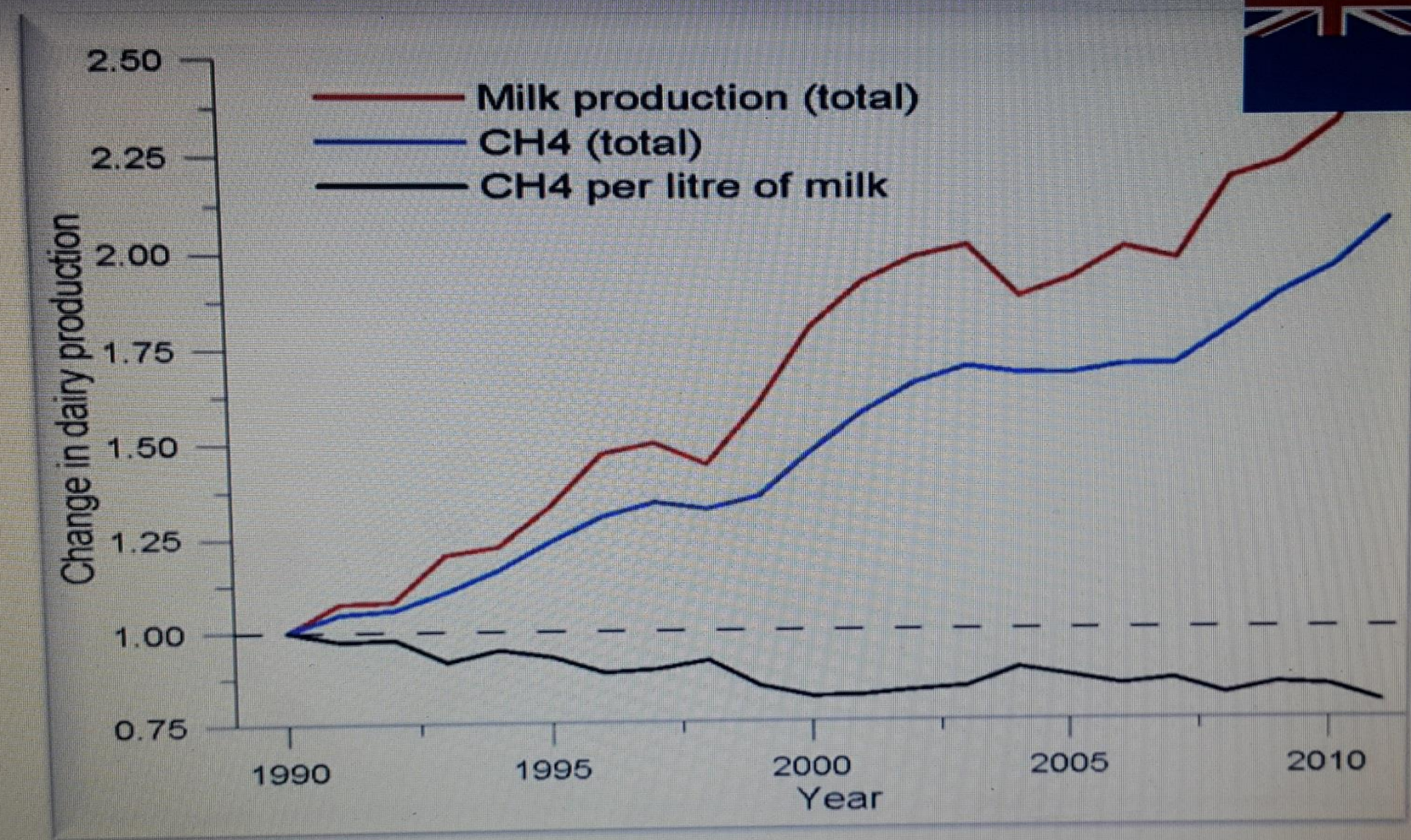
Activity      Productivity



$$\text{GHG} = A \times f_e$$

Activity      Emission intensity





Graph courtesy of:  
Andy Reisinger, Victoria Hatton, Harry Clark

$$\frac{\text{Food}}{f_p} = A$$

$$\text{GHG} = A \times f_e$$

$$\text{GHG} = \text{Food} \times \frac{f_e}{f_p}$$

Emission intensity

Productivity

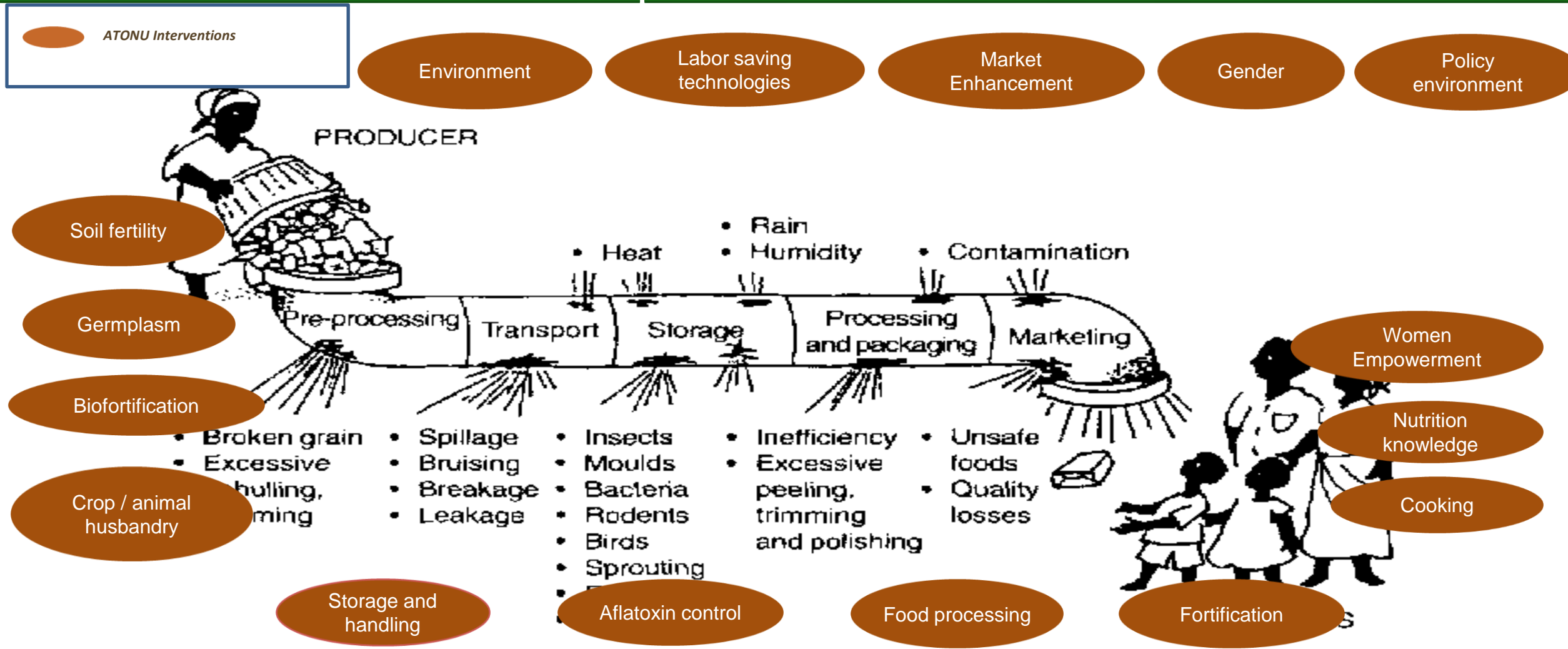


$$\text{GHG} = \text{Food} \times \frac{f_e}{f_p}$$

Emission intensity

Productivity

# Where are the opportunities for Mitigation, adaptation and production



# Prioritised Commodities

## Cereals



Maize



Millet



Sorghum

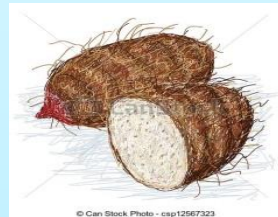


Rice

## Roots & Tubers



Cassava



Yam



Sweet Potato

## Legumes



Beans



Cow peas

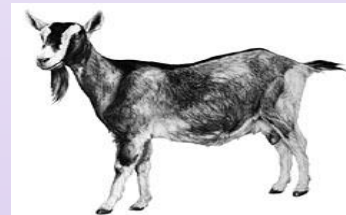


Ground nuts

## Livestock



Cow



Goat



Chicken

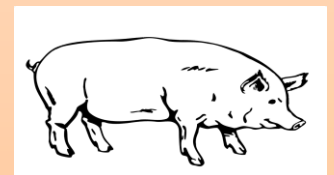
## Other Commodities



Plantain



Local vegetables



Pig



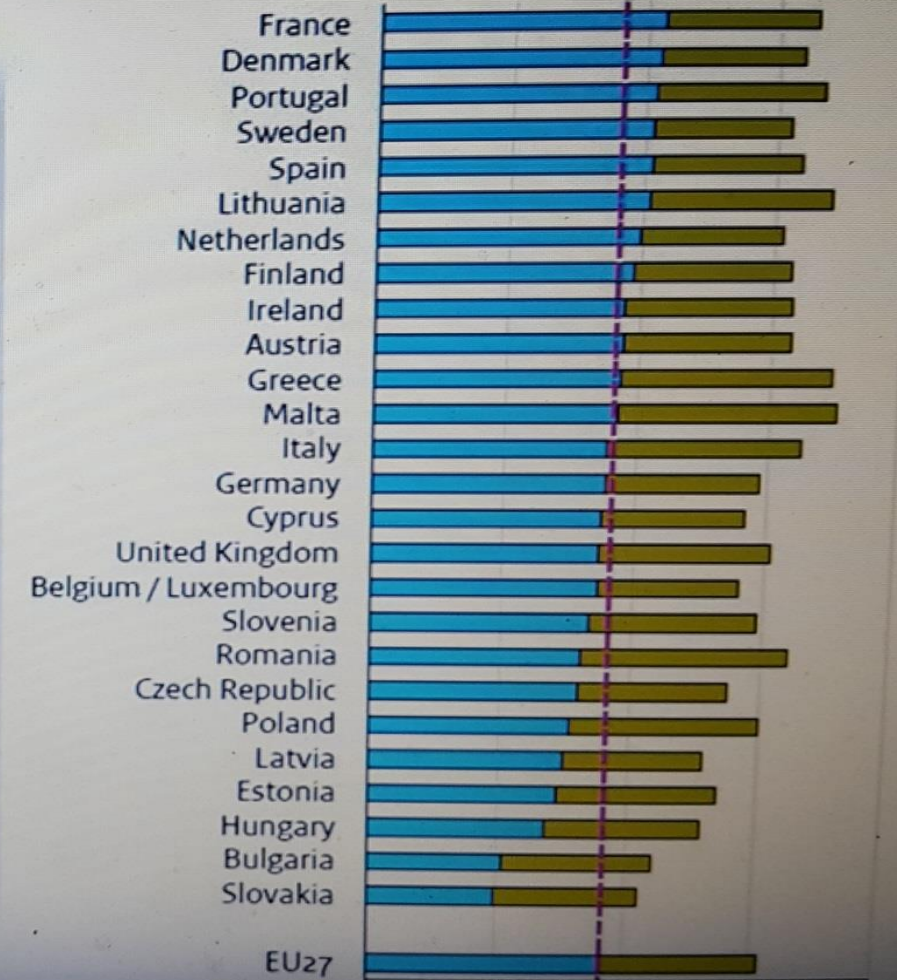
Fish

# Prof. Rogier Schulte - A new equation for climate-smart livestock farming

## How much food do we need?

■ Animal  
■ Vegetal

! Recommended amount of p



## Global Change Biology

Global Change Biology (2013) 19, 3–18, doi: 10.1111/j.1365-2486.2012.02786.x

### REVIEW

# Livestock greenhouse gas emissions and mitigation potential in Europe

JESSICA BELLARBY\*, REYES TIRADO†, ADRIAN LEIP‡, FRANZ WEISS‡, JAN PETER LESSCHEN§ and PETE SMITH\*

**Table 11** Summary of mitigation options

Description	Emission savings in Mt CO <sub>2</sub> e per year	Emission reduction in%*
Production related mitigation options		
Choice of production system to grass-fed beef	12–26	2–4
Grassland management	4–10	1–2
Consumer-impacted mitigation options		
Eat no beef from South America	22–31†	3–5
Eat no meat from European beef suckler herd	67–94	10–14
One less serving of milk or cheese (per week)	15–19	2–3

11:40 / 29:34

### 1. Milk: role in nutritional security

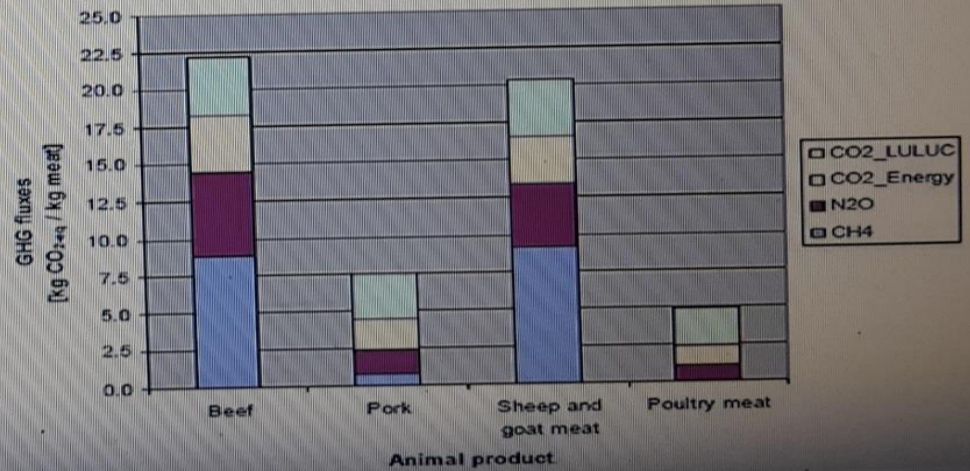


### 2. Mono-gastrics: efficient... ... but competing for cereals...



Food item	Nutrient density	GHG emission	NDCI index
Milk	53.8	99	0.54
Soft drink	0	109	0
Orange juice	17.2	61	0.28
Beer	0	101	0
Red wine	1.2	204	0.01
Mineral water	0	10	0
Soy drink	7.6	30	0.25
Oat drink	1.5	21	0.07

Food & Nutrition Research 2010, 54: 5170 - DOI 10.3402/fnr.5405170



Leip, A. et al., 2010. Evaluation of the livestock sector's contribution to the EU greenhouse gas emissions (GGELS) – final

3. Ruminants: ... less efficient but... ... can convert inedible protein...



ii a.com

Handle 1:

Should the question "which food?"

be replaced with: "which food, for whom, and where?"



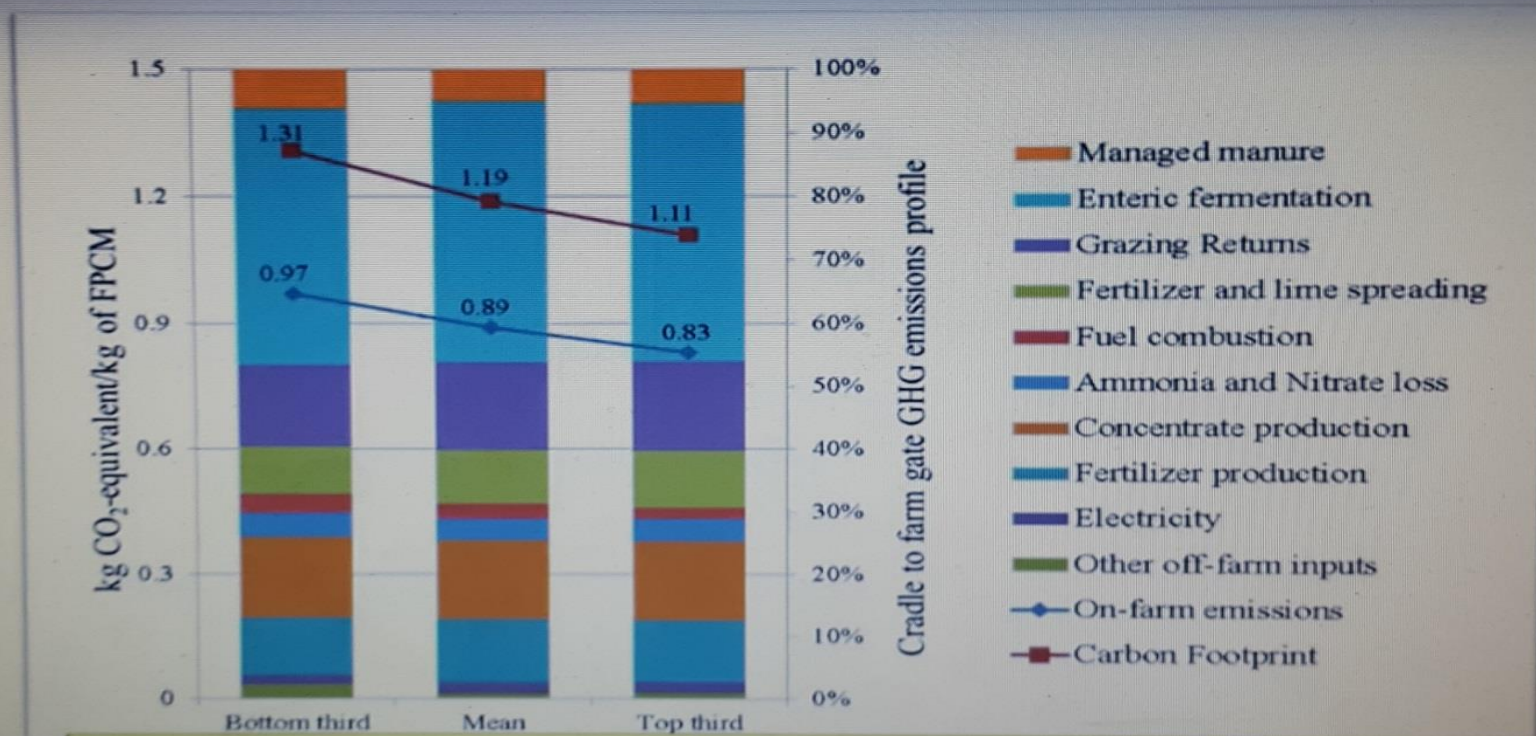
15:15 / 29:34

$$\text{GHG} = \text{Food} \times \frac{f_e}{f_p}$$

Emission intensity

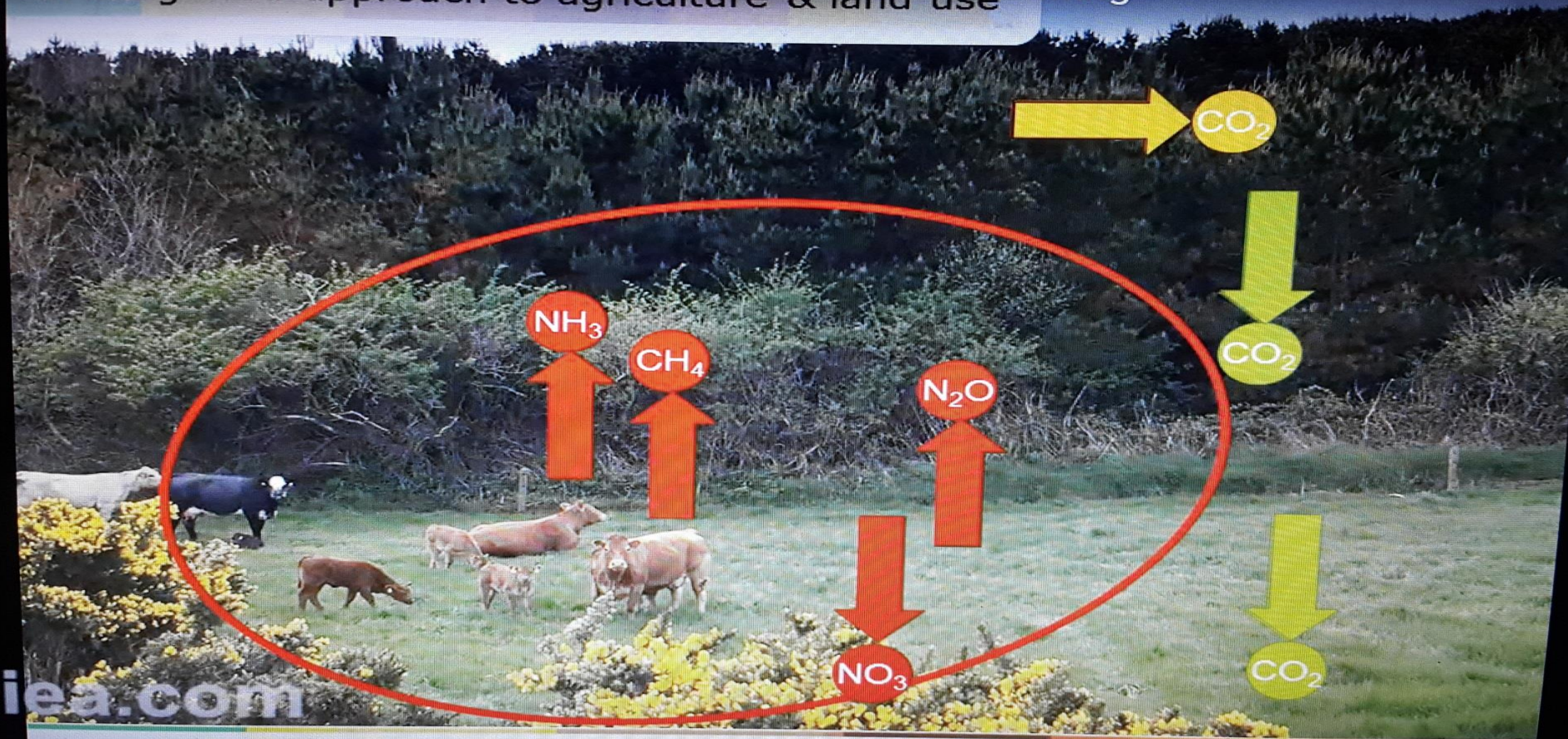
Productivity

Prof. Rogier Schulte - A new equation for climate-smart livestock farming  
 higher productivity = lower emission intensity



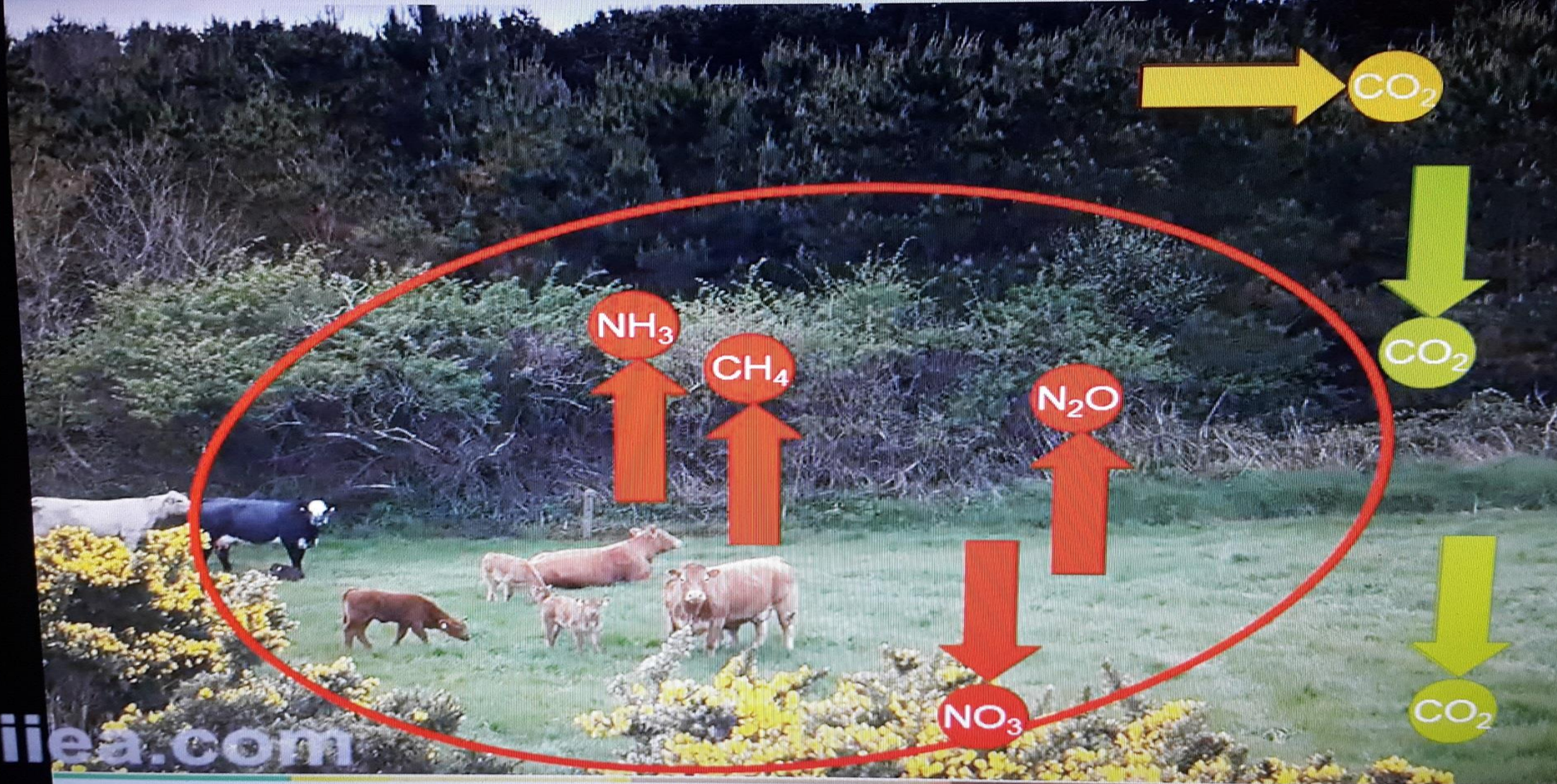
**Handle 2:**  
 How can we ensure the environmental integrity of gains in productivity?

An integrated approach to agriculture & land use



iiea.com





iiea.com

eagasc

21:17 / 29:34 The Irish Agriculture and Food Department

$$GHG = \overset{1}{\text{Food}} \times \frac{\overset{3}{f_e}}{\overset{2}{f_p}} + \overset{4}{\delta S_c}$$

1. Which food, for whom, produced where?
2. Can we ensure that intensification is sustainable?
3. Can we reduce the costs of mitigation?
4. How can we govern integrated land management:
  - Plug carbon sources
  - Increase sinks

## Climate Change Impacts on Animal Agriculture



▶ ▶▶ 🔊 1:53 / 21:17

# Reducing IMPACTS

- Understanding Climate Trends
- Identifying Farm Vulnerabilities
- Making Strategic Changes

# CSA options for landscapes



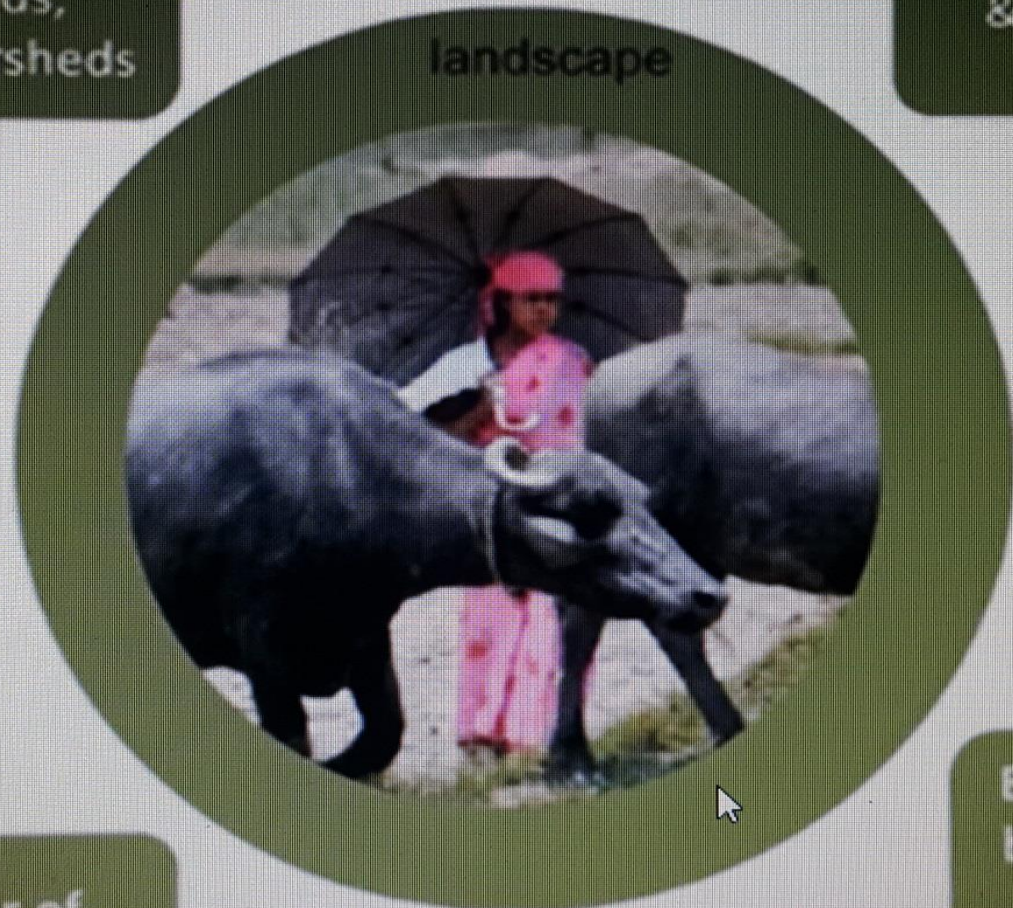
RESEARCH PROGRAM ON  
Climate Change,  
Agriculture and  
Food Security



Restore degraded wetlands, peatlands, grasslands and watersheds

Manage livestock & wildlife over wide areas

Create diversity of land uses



Harvest floods & manage groundwater

Address coastal salinity & sea surges

Protect against large-scale erosion

Increase cover of trees and perennials

Ensure close links between practice and policy (e.g. land use zoning)

# Climate-Smart Agriculture: Options for Practices and Systems (part 1)

## CSA options for livestock



RESEARCH PROGRAM ON  
Climate Change,  
Agriculture and  
Food Security



led by  
**CIAT**  
Centro Internacional de Agricultura Tropical  
International Centre for Tropical Agriculture

High-quality diets that increase conversion efficiency and reduce emissions

Improved pasture management

Herd management e.g. sale or slaughter at different ages



Livestock diversification and "climate-ready" species and breeds

Use of human food waste for pigs & chickens

Changing patterns of pastoralism and use of water points

# CSA options for services



RESEARCH PROGRAM ON  
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Agriculture and  
Food Security



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International Center for Tropical Agriculture  
Commissió Intercontinental d'Agricultura Tropical

