



RESEARCH PROGRAM ON  
Climate Change,  
Agriculture and  
Food Security

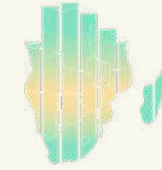


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**SADC Futures**  
Developing Foresight Capacity  
for Climate Resilient  
Agricultural Development



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## INFORMATION BRIEF

# Agriculture in the SADC Region Under Climate Change

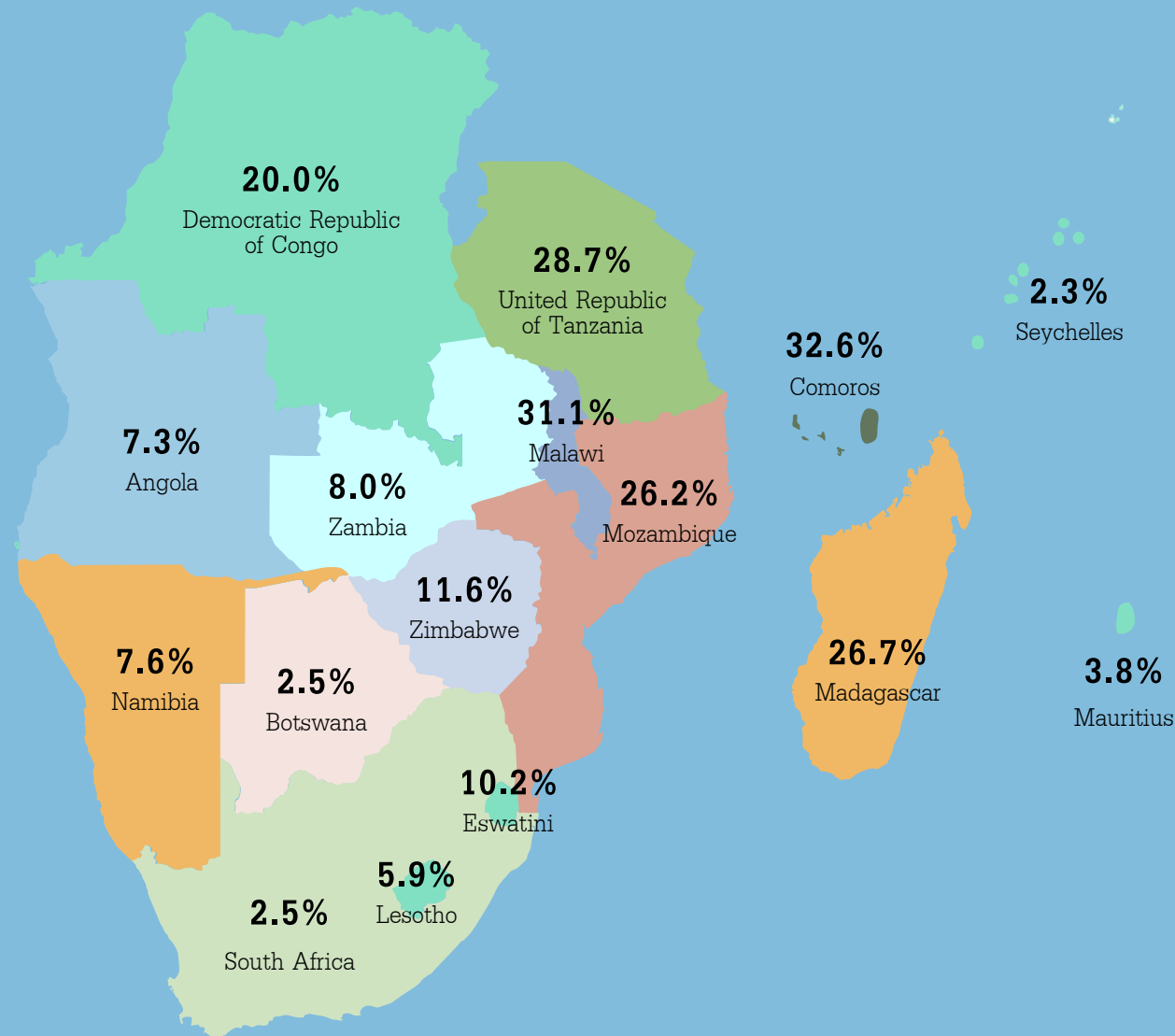
Amanda Gosling, Philip Thornton, Romy Chevallier and Sabrina Chesterman

## KEY MESSAGES

- The agricultural sector is of major social and economic importance in the SADC region.



**Agriculture** contributes between 2.3% and 32.6% to national GDP (most recent data, 2017 or 2018):



- Several climate hazards including drought, unpredictable and extreme rainfall events, heatwaves and strong winds are adversely affecting the region's predominantly rainfed (95% of cultivated area) agricultural sector.

- The most common climate hazards that affected the SADC region between 1970 and 2020 were drought and extreme rainfall events. By 2059, it is projected that drought will be a widespread and common occurrence with extreme rainfall events affecting most of the northern areas of the region.

- Climate hazards impact all actors along the agricultural value chain from pre-production to consumption. These impacts are further complicated by a variety of external trends and drivers of change.

- To move towards a more resilient agricultural sector there is a need to implement enabling policies and public and private investments, adopt innovative technologies and good agricultural management practices.



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## SNAPSHOT OF THE AGRICULTURAL SECTOR'S CONTRIBUTION TO THE SADC REGION



**Agriculture** is an extremely important sector in the SADC region with 70% of the population dependent on it for food, income and employment.



**Small-scale farming dominates the sector**, encompassing 80% of the region's cultivated land and contributing 90% of its produce. Small-scale farming relies on seasonal rainfall and uses traditional methods of farming. Small-scale farming is recognised as being central to rural livelihoods and therefore indispensable to food security and poverty reduction and the achievement of the Sustainable Development Goals (SDGs) in the region.



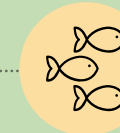
**The contribution of agriculture to the Gross Domestic Product (GDP)** of member states is varied, ranging from 2.5% - 31.1% in 2018.



**Employment in agriculture is generally the highest amongst sectors.** In Southern Africa, agriculture is credited for 65% of regional employment and 73% of employment of economically active women. SADC member states with the highest levels of agricultural employment include Malawi (85%), followed by Mozambique (75%) and Madagascar (73%) (for the period 2010-2018).



In Southern Africa, the values of **crop and livestock production** are similar at 47% and 53% respectively.



The **fisheries and aquaculture** sector in the SADC region employs around 2.6 million people and accounts for 11% of the region's agriculture GDP.



## IMPACT OF CLIMATE CHANGE ON AGRICULTURE

Due to the intensive **impact of climate change**, Southern Africa is referred to as a **'hotspot'** by the **Intergovernmental Panel on Climate Change (IPCC)**. The region is adversely affected by several climate hazards, including heatwaves, unpredictable rainfall, strong winds, drought and extreme rainfall. Over the period 1970 to 2020, droughts and extreme rainfall were the most common types of climate hazards.

A **climate risk analysis and mapping** study conducted by Quinn et al. (2020) indicates that by mid-century drought will be a common and widespread occurrence affecting most of the region and extreme rainfall events will increase particularly in the northern areas (for both RCP4.5 and RCP8.5 scenarios).

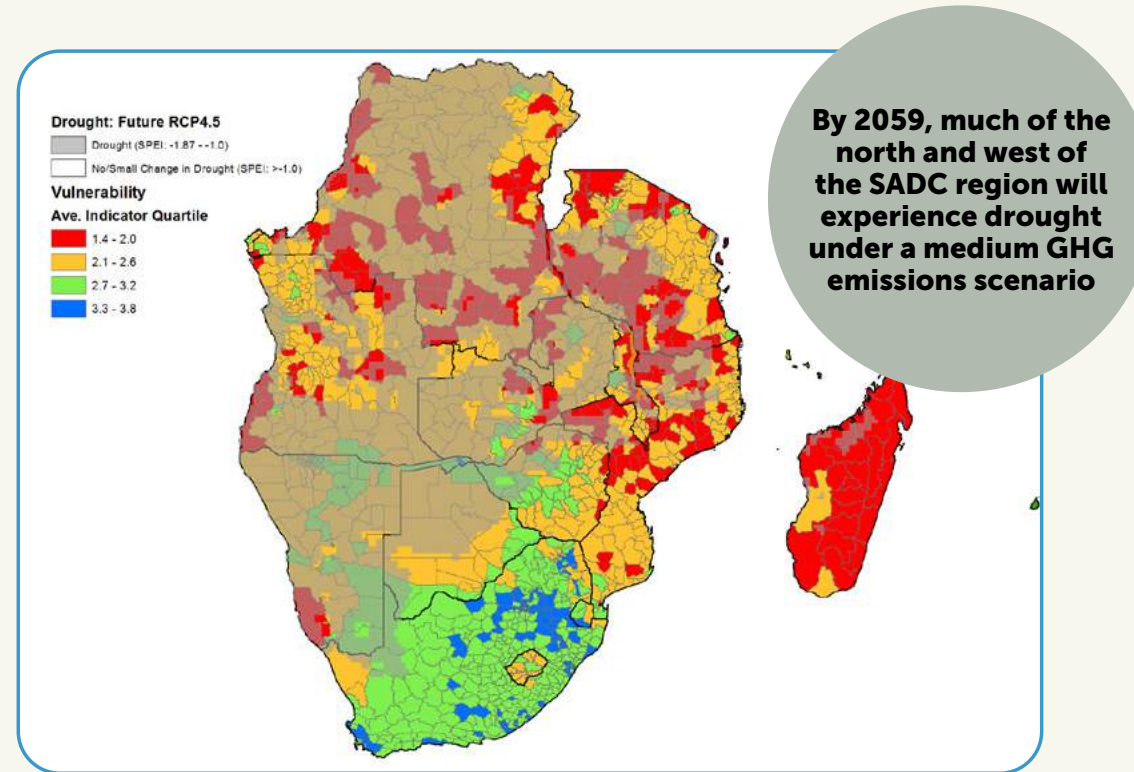


Figure 1. Multi-model ensemble mean 1-month droughts (SPEI <= -1) in mid-century in RCP4.5 (2031–2059). Overlaid on vulnerability map where red = more vulnerable, blue = less vulnerable.

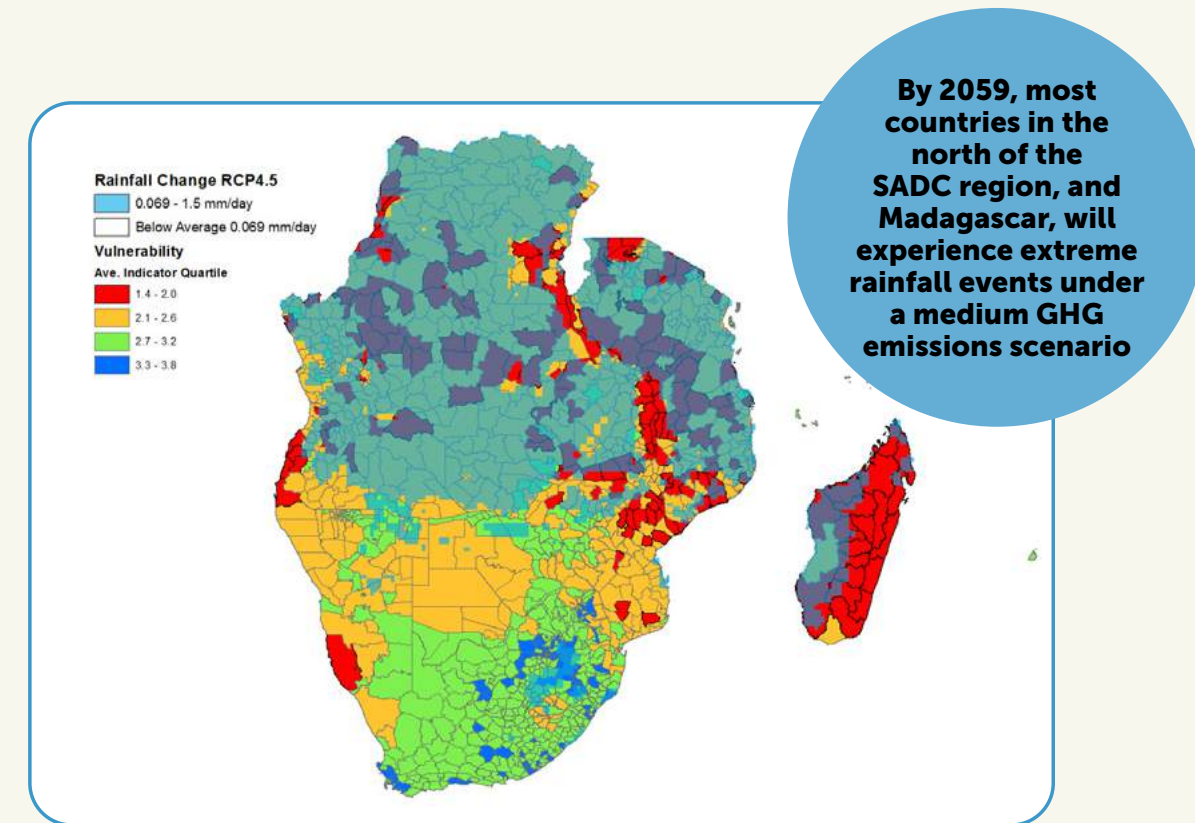


Figure 2. Multi-model ensemble mean of change in 95th percentile of rainfall (R95) by mid-century in RCP4.5 (2031–2059), as compared to the historical time period (1971–1999). Overlaid on vulnerability map where red = more vulnerable, blue = less vulnerable.



### What are RCP4.5 and RCP8.5?

They are Representative Concentration Pathways (RCPs) that describe different plausible climate futures. RCP4.5 represents an intermediate greenhouse gas emission scenario and RCP8.5 an extreme scenario.

A **climate hazard**, according to the IPCC, is the potential occurrence of a natural or human-induced physical event that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, and environmental resources.

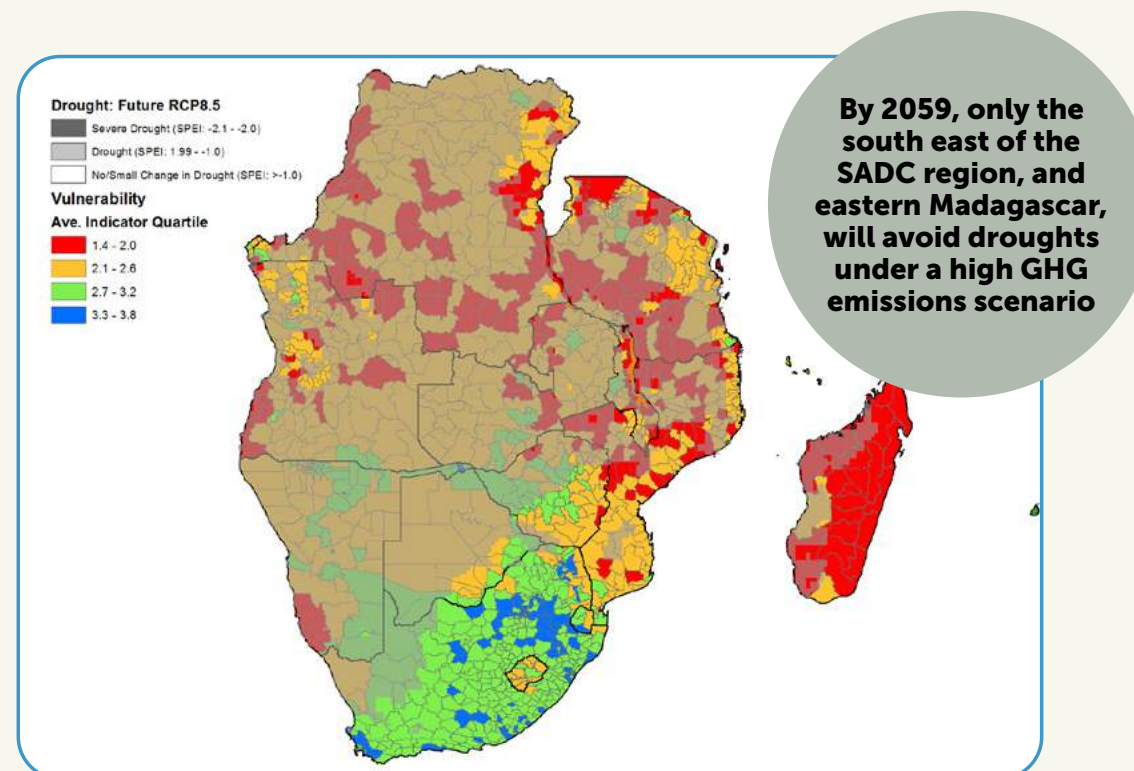


Figure 3. Multi-model ensemble mean 1-month droughts in mid-century in RCP8.5 (2031–2059). SPEI <= -1 used to indicated droughts, and SPEI <= -2 indicates severe droughts. Overlaid on vulnerability map where red = more vulnerable, blue = less vulnerable.

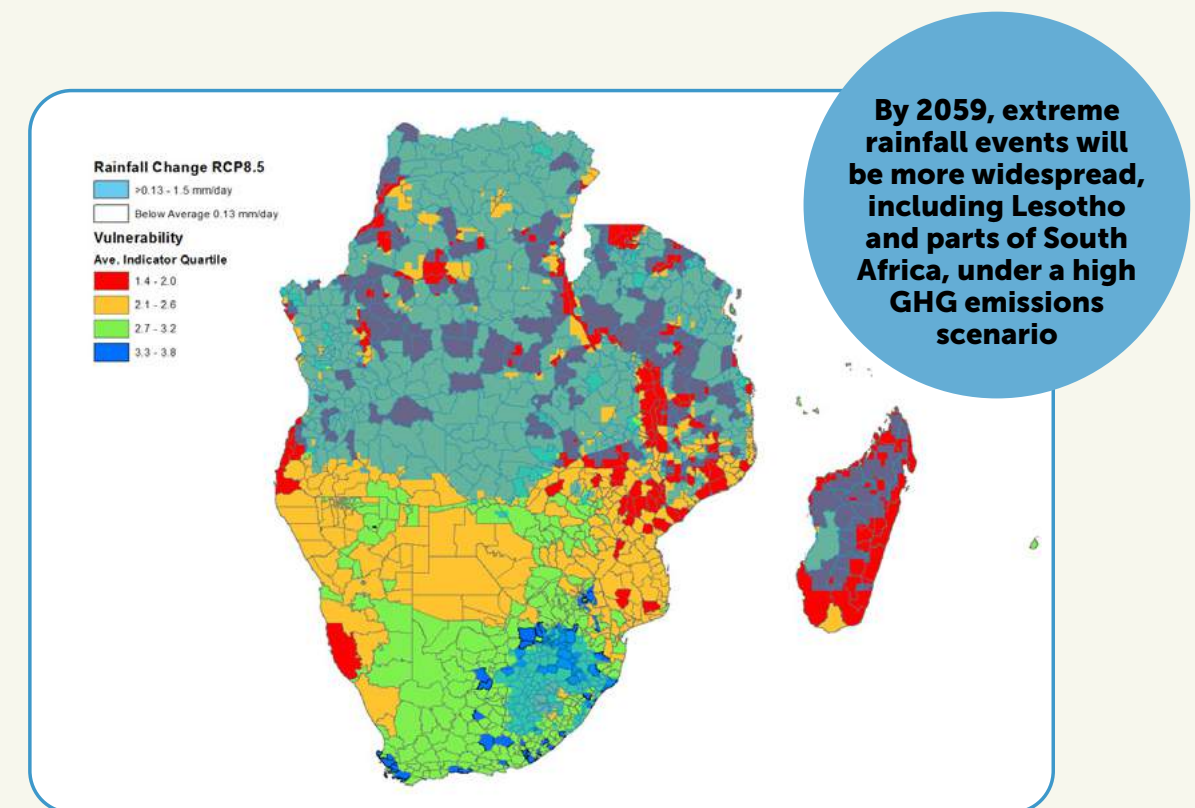


Figure 4. Multi-model ensemble mean of change in 95th percentile of rainfall (R95) by mid-century in RCP8.5 (2031–2059), as compared to the historical time period (1971–1999). Overlaid on vulnerability map where red = more vulnerable, blue = less vulnerable.

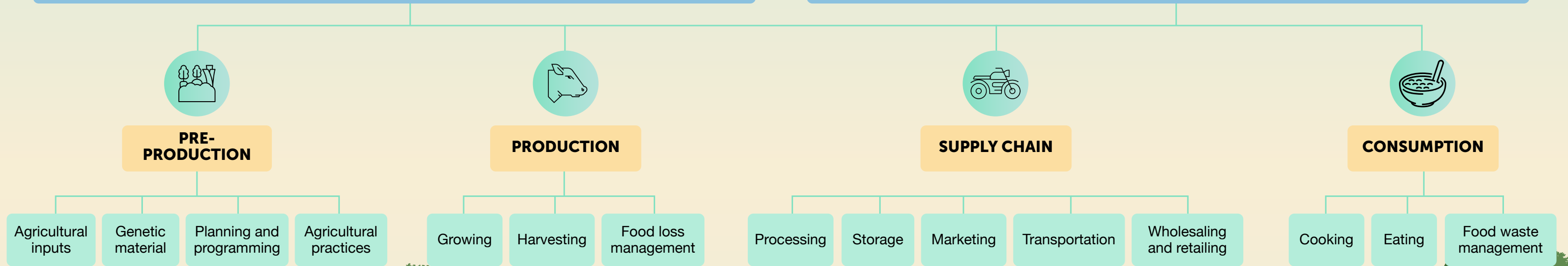
The SADC region's agricultural sector is particularly vulnerable to climate change as it is largely rainfed. Farmers tend to have limited financial resources, poor access to infrastructure, and disparate access to information.

It is important to consider that the impact of **climate change not only affects the producers but a whole chain of actors** that handle, process, and market agri-food products. To remain competitive and deliver value to end consumers a value chain approach to climate change adaptation and mitigation is required.

**COMPONENTS OF A VALUE CHAIN**

The FAO defines a 'value chain' in agriculture as the set of actors and activities that bring a basic agricultural product from production in the field to final consumption, where at each stage value is added to the product.

An **adapted value chain** is one where participating businesses, from farmers to retailers, are able to harness joint strategies to continue delivering value to the consumer, and as such, deliver value to the members of its chain.



# Key climate change impacts on agricultural value chains

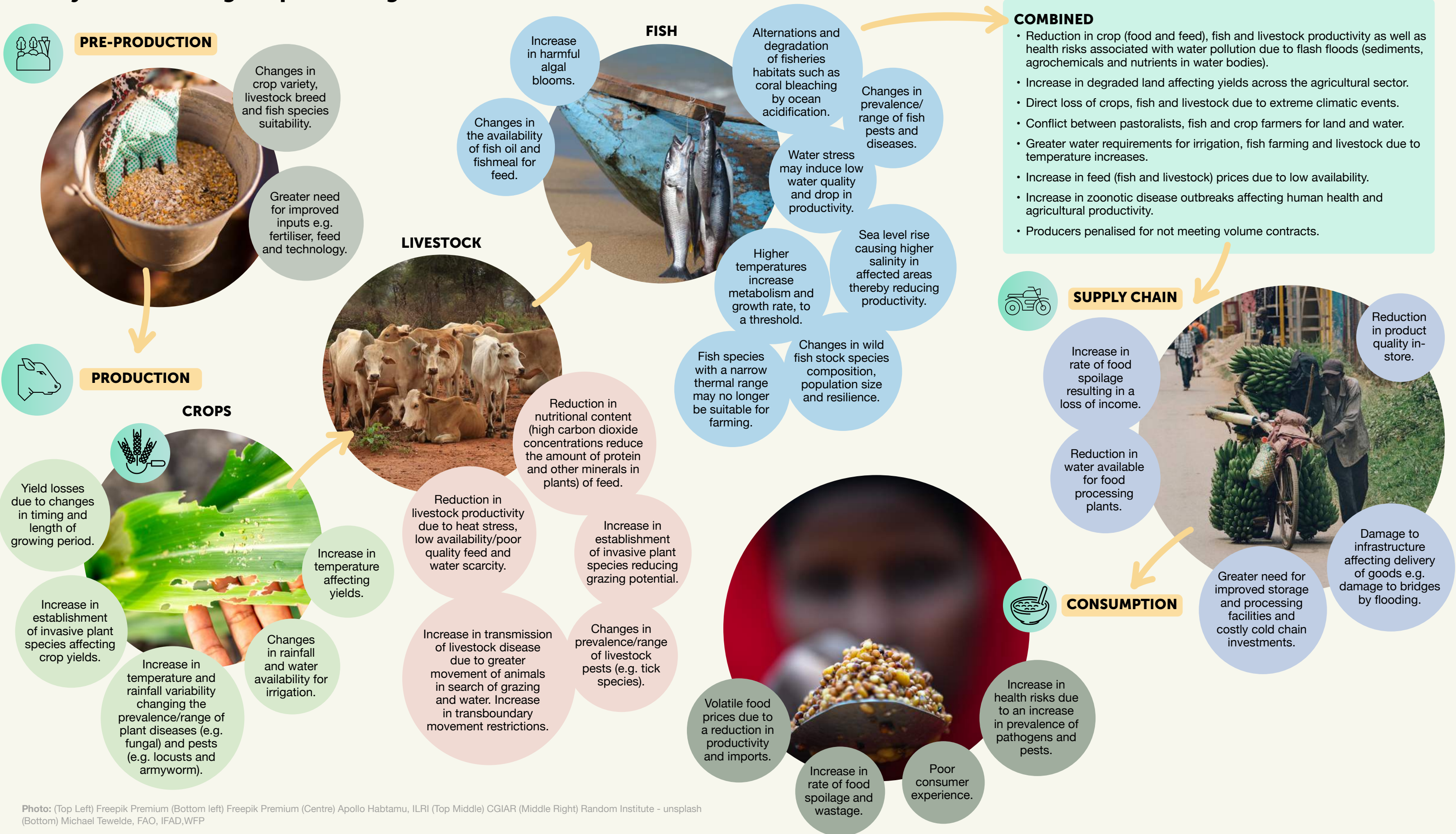


Photo: (Top Left) Freepik Premium (Bottom left) Freepik Premium (Centre) Apollo Habtamu, ILRI (Top Middle) CGIAR (Middle Right) Random Institute - unsplash (Bottom) Michael Tewelde, FAO, IFAD,WFP



## OTHER TRENDS AND DRIVERS OF CHANGE

The agricultural sector is not solely affected by climate change but is further influenced by a complex mix of external trends and drivers of change.



### Social

#### Current and future trends and drivers

#### Key implications for agriculture and food security



#### Opportunities



#### Challenges




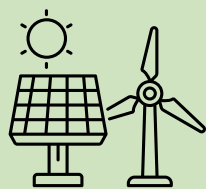
 <p><b>Rapid population growth.</b> The population of the SADC region increased to 345.2 million in 2018, from 336.9 million in 2017, representing a 2.5% annual population growth rate.</p>	<ul style="list-style-type: none"> <li>• Increase in the demand for food. This implies a need for growth in the agricultural sector.</li> <li>• Opportunity/need to promote climate-smart agricultural initiatives.</li> </ul>	<ul style="list-style-type: none"> <li>• Increased competition for land and water resources.</li> </ul>
 <p><b>Youth bulge - majority of the population under the age of 24.</b> In 2015, Angola, Zambia and the Democratic Republic of Congo (DRC) fell within the top 10 youngest countries in the world (all of which were in Africa). Their median ages were 16.9 in DRC, 16.1 in Angola and 16.9 in Zambia</p>	<ul style="list-style-type: none"> <li>• Growing workforce.</li> <li>• Access to, and availability of work, in a time of increasing mechanisation and volatility of the sector due to climate impacts.</li> </ul>	
 <p><b>Urbanisation - increasing in most countries.</b> More than half of the region's population already live in urban areas, a figure projected to rise to three quarters by 2050.</p>	<ul style="list-style-type: none"> <li>• Potential for improved rural-urban linkages within and between countries.</li> </ul>	<ul style="list-style-type: none"> <li>• Reduced labour availability. Fewer people engaged in agricultural activities.</li> <li>• Reduced agricultural productivity and food insecurity.</li> </ul>
 <p><b>Increased access to primary and secondary education.</b> Over the past 50 years, enrolment in education has increased at every level for both genders within the SADC region. Gender parity has been achieved for primary school enrolment in most SADC countries, but secondary school enrolments remain low with 13 countries with secondary school enrolments of only 11%-58%.</p>	<ul style="list-style-type: none"> <li>• Improved capacity to adopt new agricultural technology and financial lending services.</li> <li>• Potential increase in agricultural productivity.</li> </ul>	<ul style="list-style-type: none"> <li>• Women disadvantaged by unequal access to education.</li> <li>• Limited capacity to adopt new agricultural technology and financial lending services.</li> <li>• Loss of potential of women for improving household food security and welfare.</li> </ul>
 <p><b>Traditional exclusion of women from land ownership.</b> In Southern Africa, women provide 80-90% of agricultural labour in subsistence agriculture and 70% in cash crop production but their land rights are still largely discriminated against.</p>		<ul style="list-style-type: none"> <li>• Underutilised potential of women for improving household food security and welfare.</li> </ul>
 <p><b>Dietary trends - increased consumption of animal products and refined foods.</b> In Botswana, Eswatini, Lesotho and South Africa in particular, traditional and mainly plant-based diets are being exchanged for highly refined foods and animal products. FAO estimates that meat and fish consumption in Sub-Saharan Africa will increase by ~28% exclusively due to population growth.</p>	<ul style="list-style-type: none"> <li>• Larger market for meat production and processed foods.</li> <li>• Opportunity for growth in the livestock and fisheries subsectors.</li> <li>• Opportunity for growth in the secondary and tertiary agricultural industries.</li> </ul>	<ul style="list-style-type: none"> <li>• Increased need to adopt more stringent mitigation measures due to high carbon emissions, particularly from livestock (e.g. methane).</li> </ul>
 <p><b>Traditionally, women are responsible for food processing such as milling and grinding of cereals and drying of fish.</b></p>	<ul style="list-style-type: none"> <li>• High potential livelihood impact of improved food processing technology.</li> </ul>	
 <p><b>Increase in human and animal disease outbreaks e.g. Ebola Virus Disease (EVD), COVID-19, Foot and Mouth Disease.</b> According to USAID, 'nearly 75% of all new, emerging, or re-emerging diseases affecting humans at the beginning of the 21st Century were zoonotic'</p>		<ul style="list-style-type: none"> <li>• Reduced access to markets.</li> <li>• Loss of income.</li> <li>• Reduced food demand due to reduced buying power.</li> <li>• Food insecurity and malnutrition.</li> </ul>



Photo: Freepik Premium



## Technology and science

### Current and future trends and drivers

### Key implications for agriculture and food security



### Opportunities



### Challenges






 <p><b>Access to energy is low, particularly in rural areas.</b> Energy access in the Southern African region is still highly constrained, particularly in rural areas with average access to electricity at only 34%.</p>		<ul style="list-style-type: none"> <li>• Inability to adopt modern farming, storage and processing technologies.</li> </ul>
 <p><b>Improved renewable energy technology and increased adoption.</b> In 2018 in the SADC region, hydropower accounted for 43% of installed power generation, gas for 24%, solar systems for 11%, wind for 10% and coal only 7% (inclusive of commissioned capacity).</p>	<ul style="list-style-type: none"> <li>• Increased availability and affordability of renewable energy options for farmers.</li> </ul>	
 <p><b>Low levels of improved agricultural technology adoption amongst small-scale farmers due to geographic, social, financial and extension barriers.</b></p>		<ul style="list-style-type: none"> <li>• Loss of agricultural productivity potential.</li> </ul>
 <p><b>Limited research funding.</b> Most countries are still underinvesting in agricultural research and development and have limited human resource capacity.</p>		<ul style="list-style-type: none"> <li>• Limited scientific advancement and technological innovation in the sector resulting in stagnation of productivity.</li> </ul>
 <p><b>Information and communications technology (ICT) infrastructure development.</b> In 2019, 82% of SADC ICT projects were being implemented.</p>	<ul style="list-style-type: none"> <li>• Producers have improved access to climate, financial, market and agricultural information allowing for informed decision making.</li> </ul>	



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## Economy and financial

### Current and future trends and drivers



**Contribution of the agricultural sector to regional GDP is generally quite low (~15%).**



**Employment in agriculture is generally highest amongst sectors.**  
In Southern Africa, agriculture is credited for 65% of regional employment.



**Food prices have increased in recent years and are expected to continue to do so.**  
The Consumer Food Price Index nearly doubled for Eswatini, Lesotho, Namibia and South Africa during the period 2011 to 2019.



**Dependence on food imports.**  
In Sub-Saharan Africa, the ratio of the value of food imports as a percentage of the value of domestic agricultural output has been steadily rising since 2000, from 9.2% in 2001 to 24.1% in 2014.



**High pre- and post-harvest losses.**  
Pre and post-harvest losses in Southern Africa amount to 30% or more.

### Key implications for agriculture and food security



#### Opportunities



#### Challenges

- Importance of sector for providing employment to the burgeoning youth population.

- High potential for reducing food price volatility through intra-regional trade.

- This implies a need for growth in the agricultural sector.
- Opportunity/need to promote climate-smart agricultural initiatives.

- Regional policy focus on other sectors such as industrialisation.

- Loss of income.
- Food insecurity.
- Need for adequate pest management,
- Extension and infrastructural investments.



Photo: UNICEF Ethiopia/2019/ Nahom Tesfaye



## Political and institutional

### Current and future trends and drivers



**The region is one of the most politically stable in Africa.**



**Larger domestic food markets than international.**



**SADC has made progress on improving regional trade in agricultural products.** Compared with other regional trade agreements (RTAs), the SADC region has one of the least distorting policy frameworks for agricultural products.



**Poor regional infrastructure integration, particularly energy and water related.** Assessing the level of integration across the continent's regional economic communities indicated that the lowest points for overall integration were scored by SADC at 0.337.

## Key implications for agriculture and food security



### Opportunities



### Challenges

- Attractive to Foreign Direct Investment

- Domestic food demand can drive the development of agricultural value chains.
- Sector is less affected by external market factors.

- Increased access to regional markets.
- Opportunity for growth in the agricultural sector.

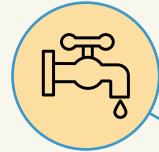
- Regional policy focus on other sectors such as industrialisation.

- Disparity in regional resource access and therefore agricultural productivity.
- The successful coordination in managing water and energy is essential to achieving SADC's agricultural development goals.



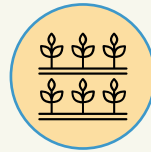
## ACTION RECOMMENDATIONS FOR CLIMATE-RESILIENT AGRICULTURAL PRODUCTION IN THE SADC REGION

Actions are needed to move towards a more resilient agricultural sector, thereby progressively addressing the impacts of climate change and increasing climate variability. These actions, amongst others, will include the provision of enabling policies and public and private investments, existing and innovative technologies and 'good bet' crop, livestock and fisheries management practices.



### Climate-smart agriculture (CSA)

seeks to increase productivity in an environmentally and socially sustainable way, strengthen farmers' resilience to climate change, and reduce agriculture's contribution to climate change by reducing greenhouse gas emissions and increasing carbon storage on farmland.

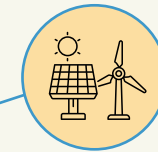


**Sustainable intensification** seeks to increase yield per unit of land to meet today's needs without exceeding current resources or reducing the resources needed for the future.

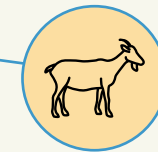


### Good agricultural practices (GAP)

is defined by the FAO as 'a collection of principles to apply for on-farm production and post-production processes, resulting in safe and healthy food and non-food agriculture products, taking into account economic, social and environmental sustainability'.



**Climate change mitigation** according to the IPCC is 'actions that reduce the rate of climate change'. For example, improving manure management or using renewable energy to power food processing machinery.



**Climate change adaptation** according to the IPCC is 'the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate harm or exploit beneficial opportunities'. For example, the adoption of drought and heat tolerant crop varieties, livestock breeds and fish stock.



## Actions for climate-resilient agricultural production in the SADC region



Photo: Mick Haupt – unsplash



### GOVERNANCE RECOMMENDATIONS



#### Inclusion of agriculture in climate change policies, strategies, and planning

- **Regional level** - Include climate-resilient agricultural strategies and input from national farmer organisations (NFOs) in the revision process of the SADC 2015 Climate Change Strategy and Action Plan (2020-2025).
- **National level** - Use the next iteration of Nationally Determined Contributions (NDCs) (2020) and Long-Term Strategies (LTSs) as vehicles to guide productive, resilient, and inclusive farming practices such as climate-smart agriculture (CSA), conservation agriculture and the ecosystem approach for sustainable agricultural intensification. A good example is Malawi's NDC which identifies extensive mitigation options for agriculture.



#### Policy implementation

- **Ensure that lead agencies entrusted with coordinating climate and agricultural policy implementation have clear mandates.**
- **Link climate and agricultural policy** (inclusive of pastoralism and fisheries) to poverty reduction, food security and sustainable development to leverage buy-in and effective engagement across levels of governance, horizontally and vertically. For example, Ghana's current NDC focuses on sustainable land use including food security, reinforcing infrastructure and equitable social development.
- **Ensure the collaboration of ministries responsible for climate change and agriculture** with those for planning and finance to allow for efficient planning, resource mobilisation and allocation needs.
- **Use parliamentary portfolio committees** to promote linkages between climate change and agriculture, as conducted in South Africa.



#### Finance and support

- **Develop a national climate finance strategy** and allocate resources to climate-resilient agricultural development.
- **National government should assist provincial and municipal levels** by providing guidelines and capacity-building on climate-resilient agricultural projects and allocate finances specifically designated to agriculture.
- **Support and empower farmers and other actors along the agricultural value chain to adopt climate-resilient practices.** Enable stakeholders to identify and request specific support for the means of implementation, including realistic and specific financial requirements.



## GOVERNANCE RECOMMENDATIONS (CONT)



### Stakeholder engagement

- **Consult and involve farmers and other actors along the agricultural value chain** in the decisions taken by their representative governments. Include their concerns and circumstances in climate policy such as the NDCs, National Adaptation Plans (NAPs) and LTSs.
- **Break down the current barriers inhibiting public-private sector engagement and provide opportunities for all stakeholders** to engage informally in non-governmental fora. For example, the Tanzania Climate-Smart Agriculture Alliance (TCSAA) discusses pertinent issues and then collectively advocates their needs to government.
- **Use a trusted neutral broker to facilitate stakeholder engagement.** For example, the Southern African Confederation of Agricultural Unions (SACAU) is a recognised platform for different organisations and individuals to develop policy engagement skills and produce climate-agriculture related input.



### Inclusion of vulnerable groups

- **Include gender equality and youth in climate and agricultural policies going forward.** For example, in Tanzania and Malawi parliamentary committees became more active following training by CGIAR-CCAFS on gender equality. Further, the Seychelles' National Climate Change Committee (NCCC) provides a good example of youth-led accountability, endorsed and made provision for by government, by reserving a seat for a youth candidate.



### Inter-governmental collaboration

- **Enhance inter-governmental collaboration and coordination of agricultural and climate change issues.** For example, the Long-Term Low Carbon Agricultural Climate Resilient Development Pathways process in Zambia, Kenya, Uganda and Ghana is enhancing collaboration between the countries.

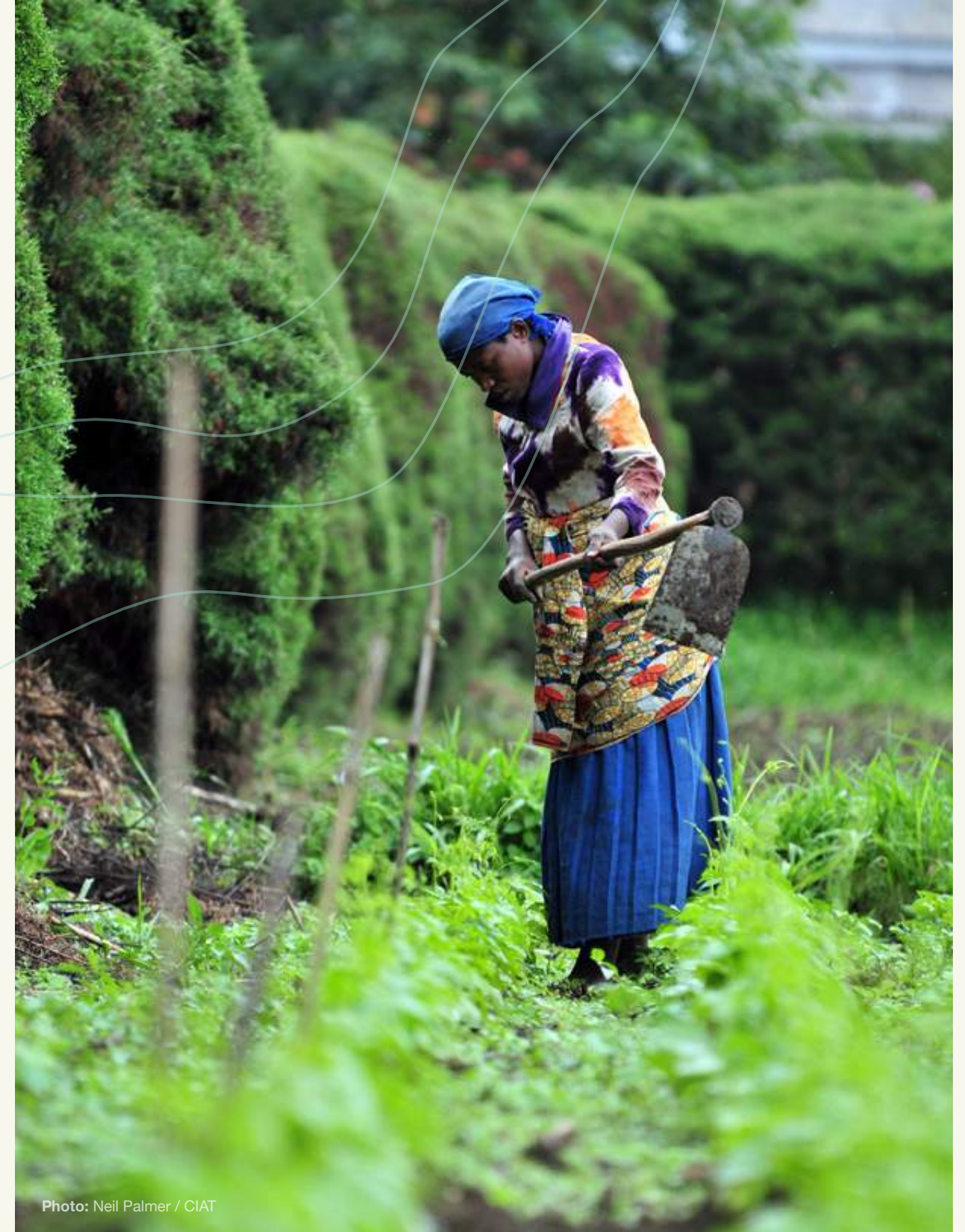


Photo: Neil Palmer / CIAT

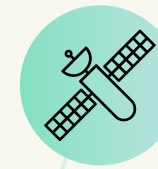


## AWARENESS AND TRAINING

- **Scale-up successful pilot community-based climate adaptation projects**, monitor and communicate the findings to encourage replication. For example, in Zambia, several farmer's organisations have formed the 'CSA Alliance' for promoting CSA in the country.
- **Educate producers** (including women) by establishing accessible farmer training facilities that provide training on climate change adaptation techniques, good agricultural practices (GAPs), food safety standards and market and finance accessibility.
- **Offer training and adequate resources to extension personnel to enhance their capacity to provide new management advice to producers**, to learn from their efforts and difficulties of implementation and to liaise with adaptive research systems to generate and disseminate new productive and sustainable practices.
- **Provide support and training to farmers, pastoralists and fishermen involved in co-management protection programs of vulnerable ecosystems** such as mangroves and wetlands which are important carbon sinks. For example, Conselhos Comunitarios de Pesca (CCPs), community-based organisations involved in the participatory management of fisheries in Mozambique.
- **Share information on alternative livelihood options** such as energy (biomass and biofuel) farming, beekeeping, sustainable non-timber forest product harvesting and ecotourism.



Photo: C. Schubert



## TECHNOLOGY AND RESEARCH

- **Share expert information, data and research relevant for climate-resilient agricultural development** with the public sector at little or no cost and in user-friendly formats to promote learning, collaboration and strengthen accountability.
- **Use big data analytics and ICT to enhance the evidence base for CSA** and conservation agriculture to better quantify the adaptation and mitigation effects and prioritise programs accordingly.
- **Increase investment in agricultural science and technology** to build adaptive research capacity to develop technological innovations for climate related farming and food system challenges.
- **Support action research to gather and share knowledge on climate adaptation by rural communities.** Disseminate learnings to key regional and national institutions to allow for transformative change.
- **Use ICT to provide stakeholders with access to market and financial** (credit, subsidy and insurance) information for improved decision-making at the farm level.

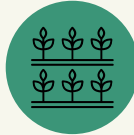


## RECOMMENDATIONS FOR THE AGRICULTURAL VALUE CHAIN Pre-production and Production



### Crops

- **Shift planting calendars from traditional dates** to match seasonal forecasts.
  - **Use improved seeds** (higher yielding, drought tolerant, disease and pest resistant).
  - **Use indigenous cereal and vegetable varieties** (where proven to be drought tolerant, disease and pest resistant).
  - **Practise intercropping** (growing two or more crops in a field simultaneously to potentially increase yields, improve soil fertility e.g. leguminous nitrogen fixers, reduce soil erosion and weed infestation).
  - **Practise crop rotation** (growth of different types of crops consecutively in an area to improve soil fertility, reduce soil erosion and weed infestation).
  - **Practise agroforestry** (agriculture incorporating tree cultivation to improve soil quality and minimise wind damage).
  - **Practise zero or minimum tillage** (minimise soil manipulation to maintain soil structure, moisture and fertility).
- **Improve soil fertility through:**
    - Integrated soil fertility management (the use of inorganic (NPK) and organic inputs and improved plant varieties to suit local conditions for maximum plant uptake efficiency).
    - Establishing on-farm surface watercourse buffer zones to limit pollution.
    - Applying biochar (burnt organic waste for fertiliser).
    - Incorporating green manure (use of cover crops for fertiliser).
    - Micro-dosing (applying small amounts of fertiliser with the seed at planting or shortly after germination to reduce wastage and water pollution).
    - Mulching (applying material on soil to improve fertility, moisture content and reduce weed growth).
  - **Use water saving irrigation methods:**
    - Precision irrigation such as drip irrigation (a micro-irrigation method for saving water).



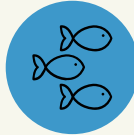
## Crops (cont)

- Deficit irrigation (applying water during the drought-sensitive growth stages of a crop).
  - Harvest rainwater (collecting and storing rainwater for use in times of drought).
  - Zai pits (pits to catch rainwater and concentrate compost).
- **Practise terracing, such as:**
    - Fanya juus (terracing of sloping land to prevent soil erosion and in some cases to catch rainwater).
    - Dead level terraces (zero gradient channels in sloping land to reduce soil erosion and enhance water infiltration).
  - **Practise integrated pest management** (sustainable approach to managing pests combining biological, cultural, mechanical, physical and chemical tools in a way that minimises economic, health and environmental risks).
  - Store and dispose of agrochemicals and their containers in accordance with safety guidelines.
  - **Use hermetic (waterproof) storage bags.**



## Livestock

- **Use improved feed** (diet supplementation, improved grass and fodder species).
- **Produce and store hay to prevent feed shortages** in times of drought.
- **Increase livestock feed availability and quality by using by-products** from other agricultural practices e.g. maize silage and molasses.
- **Use sustainable crop production methods for feed** (as per above crop production recommendations).
- **Manage grazing** (adjust stocking densities to feed availability and practise rotational grazing to prevent land degradation).
- **Manage manure** (practise composting, improved manure handling, storage and application methods).
- **Farm improved breeds or crossbreed** with hardy indigenous breeds (heat tolerant breeds, resilient to pests and diseases).
- Adopt alternative, better **heat and drought adapted small stock** e.g. goats.
- **Harvest rainwater** (collecting and storing rainwater for use in times of drought).
- **Apply best practice pest and disease management** (monitor animal health, provide adequate housing, follow dipping and vaccination programs).
- **Develop silvopasture systems** (integrate trees, forage plants and livestock grazing).
- **Restore degraded rangelands by planting native forage or grass** and by introducing indigenous trees to provide shade and reduce soil erosion.



## Fish

- **Select climate-resilient fish stock** with a higher tolerance to poor water quality.
- Select **fish breeds efficient in using plant feed**, for a lower carbon footprint.
- **Use good quality feed for optimal uptake and minimal wastage to maintain water quality.**
- **Use water harvesting and saving practices** (no water renewal, water recirculation).
- **Apply structural adaptations to ponds** (raised walls to prevent fish losses due to flooding, trees for shade and reduced evaporation rates, deeper ponds, boreholes for water supply in drought).
- **Use robust cages to prevent damage by extreme climatic events.**
- **Apply good husbandry practices** (maintain healthy stock and optimal stocking densities, monitor and maintain water quality, provide good nutrition).
- **Apply good biosecurity practices** (use indigenous species, know your pathogens and parasites, facility disinfection, facility sanitation, facility biosecurity maintenance).
- **Develop aquaculture agriculture systems** (e.g. irrigation-aquaculture, rice-fish farming, aquaponics).



Photo: Duangphorn Wiriy - unsplash



## SUPPLY CHAIN

- **Choose renewable energy to power food processing machinery** e.g. solar powered hammer mills.
- **Use rail or shipping for the transportation of goods, where feasible** (lower carbon emissions than conventional road transport).
- **Use electric/hybrid/biodiesel powered vehicles for road transportation of goods.**
- **Practise integrated pest management.**
- **Ensure the use of clean technologies** e.g. for wastewater treatment and improved environmentally friendly packaging.
- **Meet food safety standards** e.g. ISO 22000, GAP and Hazard Analysis and Critical Control Points (HACCP).
- **Ensure traceability of food products in accordance with health and safety standards.**
- **Use modern cold chain and storage technologies** for maintaining optimal temperature and humidity.
- **Monitor and manage water usage and adopt modern water efficient technology.**



## CONSUMPTION

- **Choose seasonal, organic, sustainably farmed, local produce.**
- **Reduce consumption of animal products and processed foods** (plant-based diets have a lower carbon footprint).
- **Choose unpackaged foods or those with environmentally sustainable or recyclable packaging.**
- **Store food in cool, dry environments that are free from pests to minimise wastage.**

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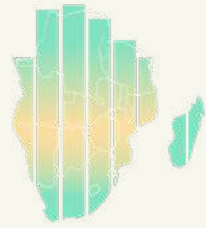
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# SADC Futures

Developing Foresight Capacity  
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