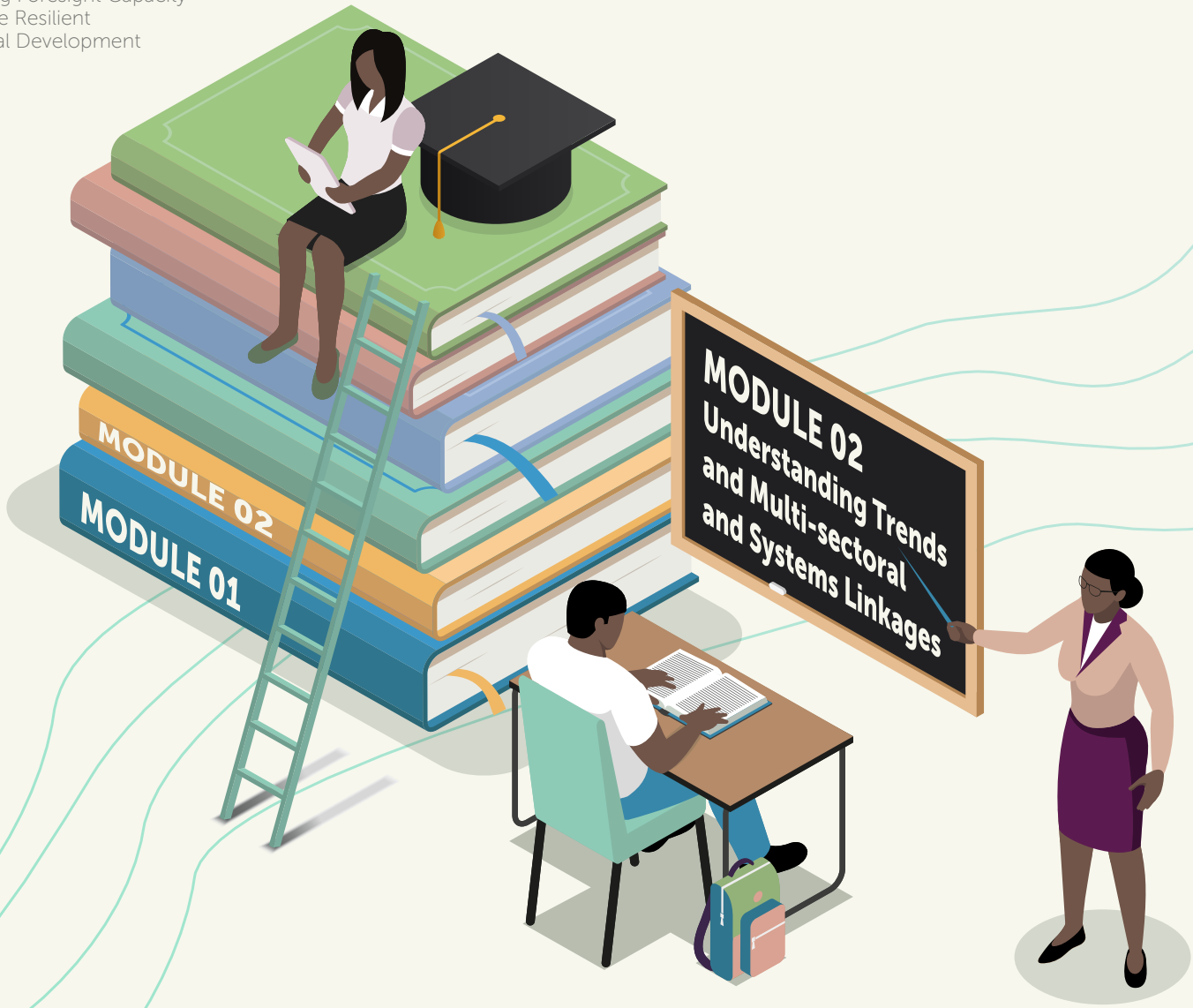
SADC Futures

Developing Foresight Capacity for Climate Resilient Agricultural Development

MODULE 02
Understanding Trends and Multi-sectoral and Systems Linkages



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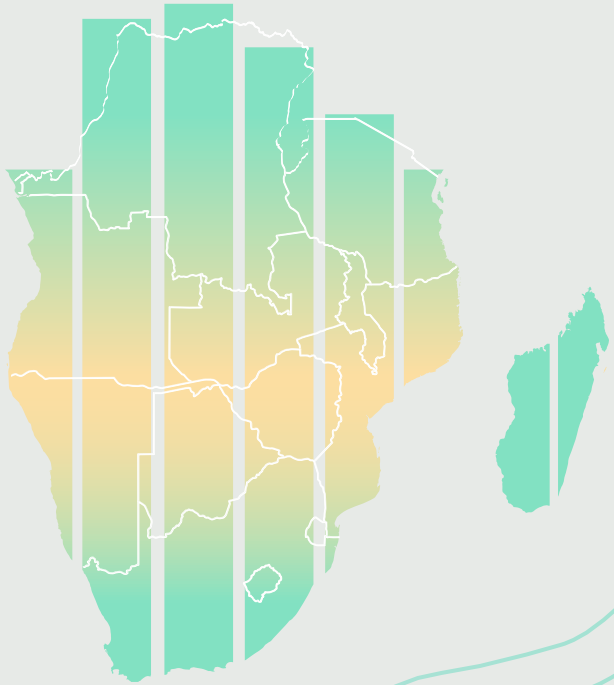

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SADC FUTURES FORESIGHT TRAINING TOOLKIT

The SADC Futures project (https://bit.ly/SADCFuturesForesight) has developed a range of foresight training materials. The SADC Futures Foresight Training Toolkit forms part of this knowledge series and presents content that was given during the SADC Futures webinar series, a six-part virtual webinar series and facilitated training.

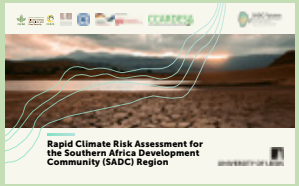
INPUT

Structures, Policies and Stakeholder Landscape Relevant to Climate Change and Agriculture in the SADC Region

ANALYSIS

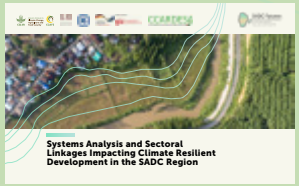
Historical Analysis of Climate Change and Agriculture Related Events in SADC

Mega-trends in the Southern African Region



Rapid Climate Risk Assessment for the Southern Africa Development Community (SADC) Region

INTERPRETATION



Systems Analysis and Sectoral Linkages Impacting Climate Resilient Development in the SADC Region

PLAN

Climate Resilient Development Pathways

PROSPECTION

What Are Scenarios Telling Us About Developing Climate-Resilient Pathways in the Southern African Region?

REFLECTION

STRATEGY

Applying Foresight For Enhanced Climate Resilience and Agriculture Policy Development in the SADC Region

SADC Futures Foresight Trainiing Toolkit

The purpose of the toolkit is to provide accessible training to multiple stakeholders on key foresight methods and how and when to apply them.

SADC Futures Foresight Framework

A tailored foresight training framework was created for the project, as a foresight exercise typically includes several methods and tools. The framework brings together the key stages of foresight, with methods and approaches that are relevant to the application for climate resilient agricultural development. This theme was chosen as **climate change poses the greatest threat to the SADC region's agricultural system and therefore technical capacity is needed to address these future impacts and adapt plans, policies, and programs**.

The foresight framework **guides users in the practical application of the chosen foresight tools and methods for innovative strategic planning and policy formulation for climate resilience**. It is important to note that there is no standardised way of doing foresight, the methods and tools presented in the framework were chosen specifically for the theme of climate-resilient agricultural development in the SADC region.

The foresight framework has been built around seven stages that address key questions.

Data, evidence, knowledge and creativity

Stakeholder engagement and participation

INPUT

Context

- Scope
- Theme or key topic
- Geopolitical boundary
- Structures & policies
- Timeline
- Stakeholder Mapping

ANALYSIS

What is happening?

- Trend Analysis
- Horizon Scanning
- Evidence

INTERPRETATION

Why is it happening?

- Systems Mapping
- Cross sectoral and multi-stakeholder approaches

PLAN

What do we want to experience in the future? What might get in our way?

What might we do to get there?

- Visioning
- Causal Analysis
- Stakeholder Analysis
- Backcasting
- Pathway Development & Trade-offs

PROSPECTION

What might happen that we have not thought about?

- Developing Scenarios
- Identify drivers and critical uncertainties
- Develop plausible future scenarios

REFLECTION

What might we want to do differently?

- Scenario Implications
- Transformation Elements
- Transformational Change

STRATEGY

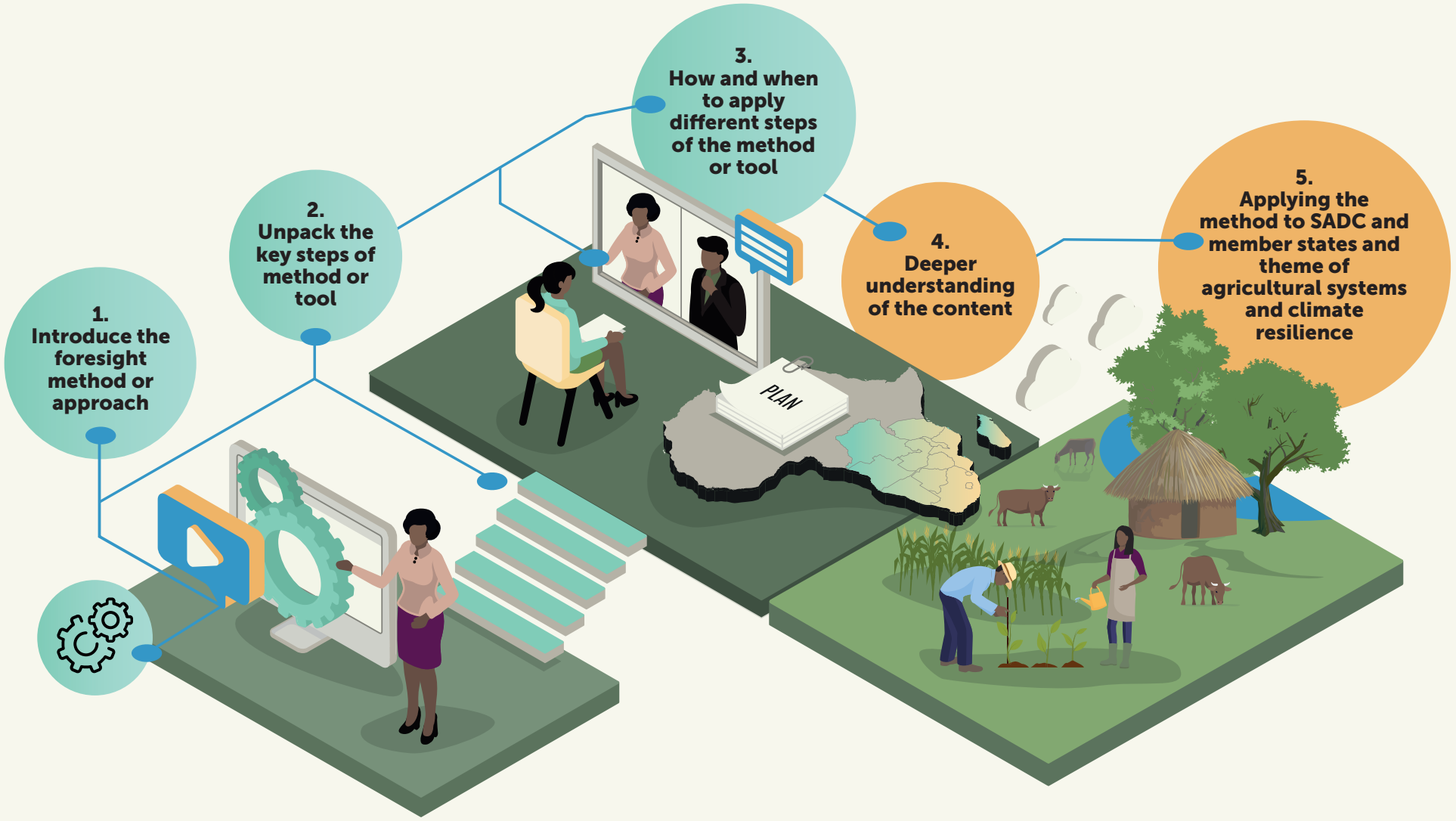
What will we do differently?

- Transforming Climate Resilient Pathways

SADC Futures
Developing Foresight Capacity for Climate Resilient Agricultural Development

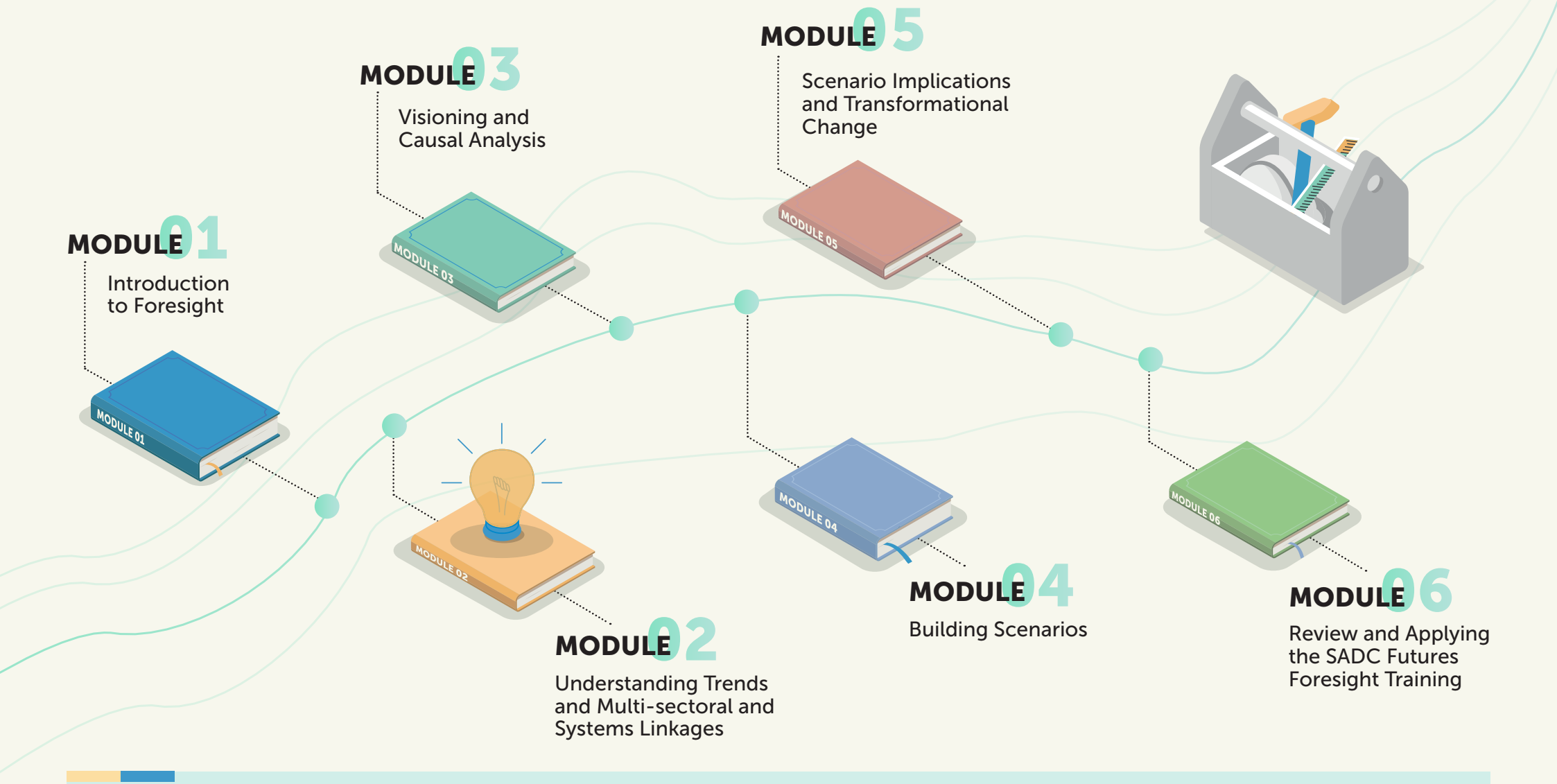
Training approach

The training approach used starts by introducing the foresight method or tool and the key steps to follow in using it. An explanation of how and when to apply the different key steps is provided. The application of the method or tool is then demonstrated in the context of climate-resilient agriculture development in the SADC region.



Structure of the toolkit

The toolkit comprises six modules. **This document presents Module 2: Understanding Trends and Multi-sectoral and Systems Linkages.**



Within the modules, reference is made to the SADC Futures knowledge series supplementary reports (as previously shown mapped to the foresight framework). These reports provide further detail on the use of the foresight methods and tools for building climate-resilient agricultural development in the SADC region.

How to use the toolkit

Exercises, learning reflections and key questions are provided throughout the toolkit modules to equip users to practically apply the range of foresight tools and methods. They are indicated by a variety of icons as illustrated below.

'Test Your Learning' exercises are provided at the start of each module. These exercises test the user's knowledge of the SADC Futures Foresight Training Framework. The exercises are based on information learnt in the preceding modules and provide a refresher for the user before progressing with the next module.

Learning Exercises are included throughout the toolkit modules to provide step-by-step guidance on how to apply the different foresight methods and tools. These exercises are demonstrated in the context of climate resilient agri-food systems in the SADC region.

Further practical exercises are provided to assist the user in applying foresight in the context of their chosen theme as they progress through the training. The materials produced by the user during the exercises are built upon in a sequential manner along the foresight framework.

Learning reflections are provided at the end of each foresight method. These allow the user to reflect on what they have learnt before moving on to the next method.

To guide the thought process of the user **key questions** and answers are highlighted throughout the manual.

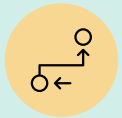
Questions and Answers from participants of the SADC Futures webinar series

'Questions and Answers' are scattered throughout the toolkit to provide an added learning experience. These questions were put forward by participants of the SADC Futures webinar series. The answers to the questions were provided by specialists in the respective fields in question.

Glossary of Key Terms[i]

Foresight

Term	Description
Backcasting 	The process of working backwards from the definition of a possible future to determine what needs to happen to make the future unfold and connect to the present.
Barrier 	Identified obstacle that could stop the achievement of an activity.
Black Swan 	An event that could absolutely not be predicted.
Brainstorming 	A method of obtaining ideas without judgement or filtering. It involves encouraging wild and unconstrained suggestions and listing ideas as they emerge.
Causality 	A logical link between events, where a cause precedes an effect and altering the cause alters the effect.
Complexity 	Complex systems are non-linear and diverse networks made up of multiple interconnected elements. Cause and effect relationships within the system are not easily discernible or predictable. Historical extrapolation is not possible for predicting emergence (new patterns and behaviours) in complex systems.

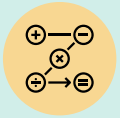
Term	Description
Critical Uncertainties 	Are drivers that are both highly impactful and highly uncertain.
Cross-cutting Issues 	Issues or challenges that affect more than a single interest area, institution, or stakeholder, and that need to be addressed from all points of view.
Drivers 	Are factors, issues or trends that cause change thereby affecting or shaping the future.
Driving Force 	A cluster of individual trends on the same general subject moving trends in certain directions, they are broad in scope and long term in nature (for example, climate change or globalisation).
Evidence 	The integration of raw data constituting numbers, words, images, and insights emerging from diverse knowledge sources.
External Driver 	External force of change, for example political or market drivers.

Term	Description
Feasible 	Possible and practical.
Forecast 	An estimate or best guess of what might happen in the future i.e. not a definitive prediction.
Foresight 	Structured tools, methods and thinking styles to enable the capacity to consider multiple futures and plan for them.
Foresight Organising Group 	A small core group that builds the foresight plan
Foresight Participating Group 	A broad mix of identified key stakeholders that need to be involved
Futuring 	The act, art, or science of identifying and evaluating possible future events.

Term	Description
Grey Rhino 	These are the large, obvious dangers that will sooner or later emerge but whose exact timing is unknown.
Impact 	Refers to the potential scale of impact of a driver on a scenario theme.
Internal Driver 	Internal force of change for example, social drivers within a farm or community directing the decision making of a farmer.
Mega-trend 	A trend that is apparent at a large or global scale e.g. growing youth population across the African continent.
Mind Mapping 	Allows a group's ideas to be charted in logical groupings fairly quickly, even when ideas are given in a non-sequential manner. This technique allows efficient brainstorming for ideas and at the same time creates a skeletal framework for later categorisation of the information generated.
Modelling and Simulation 	The process of creating and experimenting with a computerised mathematical model imitating the behaviour of a real-world process or system over time. Simulation is used to describe and analyse the behaviour of a system when asking 'what-if' questions about the real system and aid in the design of real systems.

Term	Description
Not Predictive 	Participatory with multiple viewpoints, bringing in quantitative and qualitative evidence but not predictive.
Pathway 	A trajectory in time, reflecting a sequence of actions and consequences against a background of separate developments, leading to a specific future situation.
Plausible 	It is reasonable to assume the scenario could happen. Plausibility does not mean that a future situation will happen.
Predictability 	The degree of confidence in a forecasting system based either on law derived from observations and experience, or on scientific reasoning and structural modelling.
Projecting 	A quantitative technique that can be used in the analysis phase of the foresight process. Projecting or time series analysis are used when several years of data are available, and trends are both clear and relatively stable.
Projection 	An expected value of one or more indicators at particular points in the future, based on the understanding of selected initial conditions and drivers.
Resilience 	A system's ability to cope with and recover from shocks or disruptions, either by returning to the status quo or by transforming itself to adapt to the new reality.

Term	Description
Scenarios 	Are storylines/narratives, answering 'what if' questions that describe multiple alternative futures spanning a key set of critical uncertainties. Scenarios identify future drivers of change and then plot out plausible directions that they may take.
Scenario Development 	An approach to understanding highly impactful and highly uncertain drivers and to describe possible future states. Although they address uncertainty, scenarios are not predictions or forecasts - they are not 'true' or correct/ wrong - only plausible.
Social Network Mapping 	A tool to identify the importance and influence of stakeholders as well as how they exchange information or are connected.
Time Frame 	The complete period (past-to-future) considered in a foresight exercise.
Transformation 	An agriculture and food systems transformation is a significant redistribution - by at least a third - of land, labour and capital, and/ or outputs, and outcomes (e.g. types and amounts of production and consumption of goods and services) within a time frame of a decade.
Trend 	A general tendency or direction of a movement or change over time e.g. increasing erratic seasonal rainfall patterns.

Term	Description
Trend Impact Analysis 	Collecting information and attempting to spot a pattern, or trend, and assess its influence from the information.
Uncertainty 	Refers to how much or how clear we are on how a driver will emerge or play out in the future. High uncertainty does not mean 'high improbability', high uncertainty can mean having little knowledge of how something may pan out.
Underlying Cause 	Unpacking why an obstacle is in place.
Unknown Unknowns 	Issues and situations in organisations that have yet to surface and which are blind spots for planners who are unaware that they do not know about them.
Viable 	Able to be done or could occur.
Vision 	A compelling image of a (usually preferred) future.

Term	Description
Visioning 	A well-known prospective technique with a highly participatory approach.
Wicked Problem 	A problem that is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognise.
Wild Card 	A low-probability but high-impact event that seems too incredible or unlikely to happen.

Climate Resilience

Adaptive Capacity 	The ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.
Climate Change 	Climate change is a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer.
Climate Resilience 	The ability of a system to 'bounce back' from the impacts of climate-related stresses or shocks. It is the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions.

Term	Description
Exposure 	Refers to the inventory of elements in an area in which hazard events may occur.
Hazard 	A possible, future occurrence of natural or human induced physical events that may have adverse effects on vulnerable and exposed elements.
Risk 	Intersection of hazards, exposure, and vulnerability.
Sensitivity 	The degree to which a system is affected, either adversely or beneficially, by climate variability or change.
Social Vulnerability 	Inability of people, organisations, and societies to withstand adverse impacts from multiple stressors to which they are exposed.
Vulnerability 	The propensity or predisposition of a system to be adversely affected by an event. Vulnerability is a function of a system's sensitivity, and its adaptive capacity.

Agricultural Systems

Term	Description
Agriculture 	Is the science, art, or practice of cultivating soil, producing crops, and raising livestock and in varying degrees the preparation and marketing of the resulting products.
Agricultural Value Chain 	Includes the people and activities that bring a basic agricultural product such as maize to the consumer. The activities include obtaining inputs and production in the field right through to storage, processing, packaging, and distribution.
Biological Diversity 	The variability among living organisms from all sources, including terrestrial, marine, and aquatic ecosystems.
Cross Sectoral Coordination 	The engagement, management, planning and implementation, of activities conducted across different thematic sectors to deliver development outcomes (e.g. food security, nutrition, sustainable landscapes, and agriculture).
Ecosystem Services 	These include provisioning services, such as the production of food (e.g. fruit for humans or grazing for cattle) and water; regulating, such as the control of flooding and disease; supporting, such as nutrient cycles and oxygen production; and cultural, such as spiritual and recreational benefits.

Term	Description
Elements 	The different, discrete elements within a system (e.g. farms, organisations, inputs, and soil).
Interconnections 	The relationships that connect the elements (e.g. rules, ideas, funding, or service relationships, among others).
Land Degradation 	A process in which the value of the biophysical environment is affected by a combination of human land-use activities. It is viewed as any change or disturbance to the land perceived to be undesirable.
Multi-Stakeholder Collaboration 	Consists of a mix of representatives or stakeholders from public, civil, and private domains of society.
Post-Harvest Loss 	Is the loss in quantity and quality of agricultural produce between harvest and consumption. It includes on-farm losses e.g. damage to grain by pests, as well as losses along the value chain during transportation, storage, and processing.
Pre-production 	This stage of the agricultural process is prior to production and may involve land preparation and the sourcing and purchasing of inputs such as seed and fertiliser.

Term	Description
Productive Inputs 	These are used to increase yields and range from improved seeds, genetics, fertilisers and crop protection chemicals to machinery, irrigation technology and knowledge.
System 	An interconnected set of elements that is coherently organised in a way that achieves something (function and purpose). For example, the purpose of an agricultural system could be to produce dairy products and the system could consist of interconnected elements such as the farmer, employees, cattle, machinery, feed, water, and energy.
Systems Thinking 	A mindset, tool, and process that is reserved for complex problems.
Systems View 	Understands life as networks of relationships.
Transboundary Animal Disease 	Epidemic disease which is highly contagious or transmissible and has the potential for very rapid spread, irrespective of national borders, causing serious socio-economic and potentially public health consequences.

[i]Definitions for the glossary were obtained from several information sources (listed below) as well as from specialists in the respective fields.

Cardona, O.D., van Aalst, M.K., Birkmann, J., Fordham, M., McGregor, G., Perez, R., Pulwarty, R.S., Schipper, E.L.F. and B.T. Sinh, (2012). Determinants of risk: exposure and vulnerability. In: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation [Field, C.B., Barros, V., Stocker, T.F., Qin, D., Dokken, D.J., Ebi, K.L., Mastrandrea, M.D., Mach, K.J., Plattner, G.-K., Allen, S.K., Tignor, M. and Midgley, P.M. (eds.)]. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC). Cambridge University Press, Cambridge, UK, and New York, NY, USA, pp. 65-108.

Conway, M., (2014). Foresight: an introduction. Thinking futures. Melbourne.

European Foresight Platform, (n.d.). For Learn: What is foresight? Retrieved from EFP Supporting Forward Looking Decision Making: https://foresight-platform.eu/community/forlearn/what-is-foresight/.

FAO Food Safety and Quality Program, (2014). Horizon scanning and foresight: an overview of approaches and possible applications in food safety. Presented at the Food Safety Technical Workshop, FAO, Rome.

Forward Thinking Platform, (2014). A Glossary of Terms commonly used in Futures Studies Full Version. Global Forum on Agricultural Research (GFAR).

Jackson, M., (2013). Practical foresight guide. Shaping Tomorrow.

OECD, (2018). Using foresight methods to adapt development co-operation for the future, in: development co-operation report. Paris: OECD Publishing.

UNDP, (2017). Africa and foresight: better futures in development. Singapore: Global Centre for Public Service Excellence.

UNDP, (2018). Foresight manual: empowered futures for the 2030 Agenda. Singapore: Global Centre for Public Service Excellence.

UNDP, (n.d.). Foresight: the manual. UNDP Global Centre for Public Service Excellence, Singapore.

Photo: Felix Clay, Duckrabbit 2012

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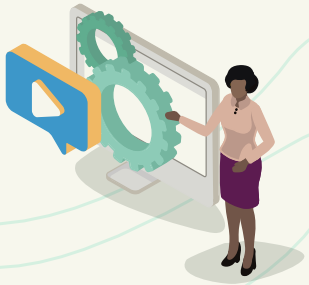
What Will You Learn?

Module 2 covers the **analysis and interpretation stages of the foresight process.** The analysis stage is important for understanding 'what is happening' by using trends analysis, horizon scanning and evidence gathering. The interpretation stage then investigates 'why it is happening'. The interpretation stage incorporates systems mapping as well as cross-sectoral and multi-stakeholder linkages. Throughout the module, examples of application of the foresight methods in the context of climate-resilient agricultural development in the SADC region are provided.

The following steps will be taken:

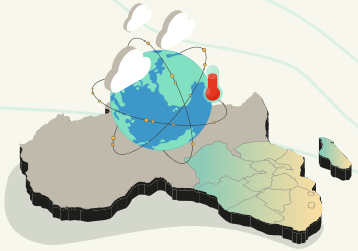
- **A historical analysis including the development of timelines to identify emerging patterns or signals of change;**
- **Interpretation of information obtained from trends analyses and horizon scanning activities, identifying where there may be gaps and how to deal with data uncertainty;**
- **An assessment of trends and drivers and how they may play out; and**
- **The importance of multi-stakeholder and cross-sectoral relationship building and engagement in foresight planning.**

Analysis Stage



Trends and Horizon Scanning Method

Evidence



Understanding Climate Risk

Interpretation Stage

Mapping Systems and Sectors

Test Your Learning of the SADC Futures Foresight Framework

Before diving into Module 2, test your understanding of foresight and information provided in Module 1 by answering the questions below:

What is your understanding of foresight and how do you define it?

Foresight is:[1]

'How one thinks about and anticipates the future.'

'An estimation of best-case scenarios.'

'Planning tools that help create clarity of sight into the future.'

'A strategic approach for approaching future scenarios.'

'Anticipating the future and planning to mitigate risks.'

'The appropriate use of data to predict future scenarios.'

'Helpful with future predictions.'

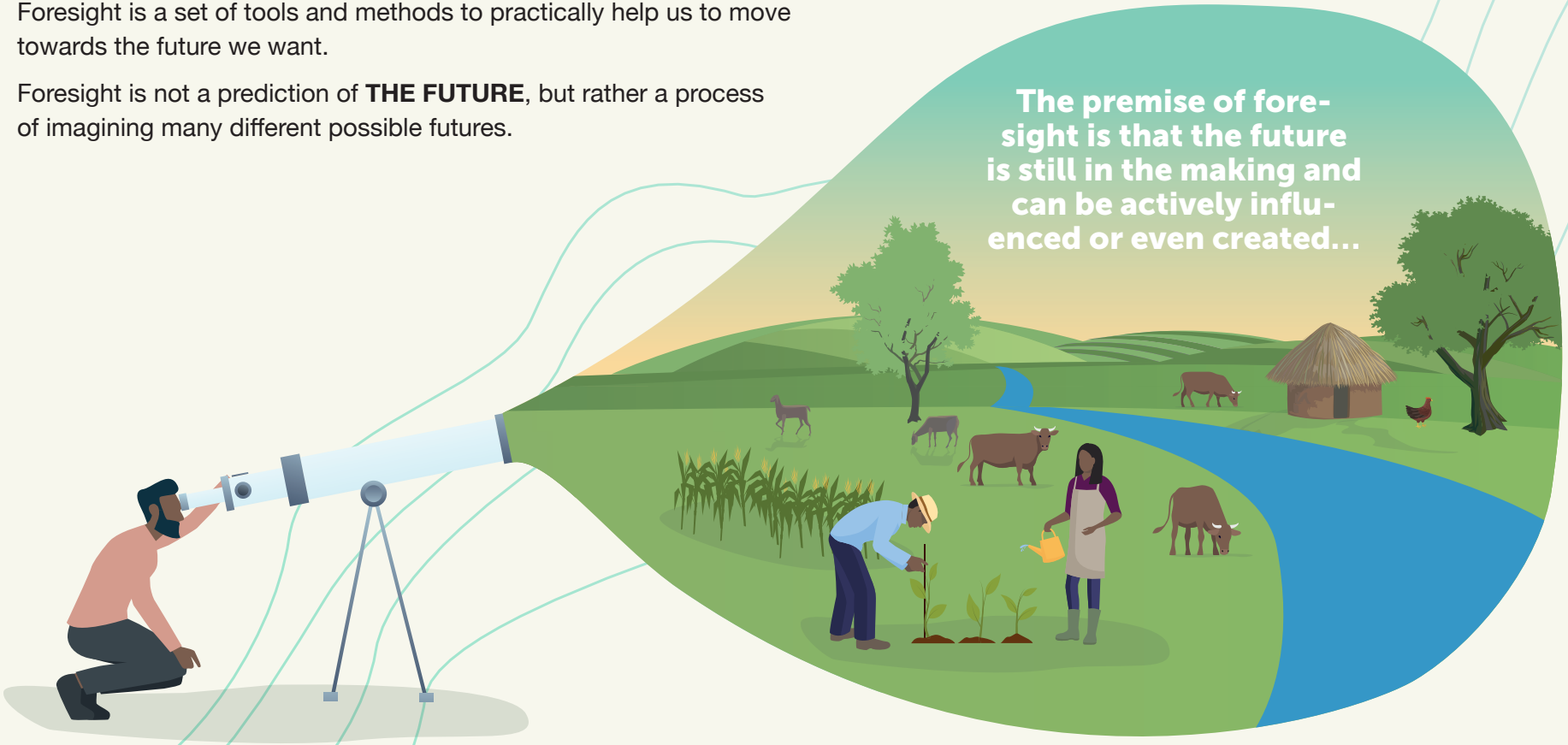
'A system used to establish how to move towards a desired future.'

[1]These responses are from the SADC Futures Webinar Series which was attended by participants from across the SADC region.

Foresight

Foresight is a set of tools and methods to practically help us to move towards the future we want.

Foresight is not a prediction of **THE FUTURE**, but rather a process of imagining many different possible futures.



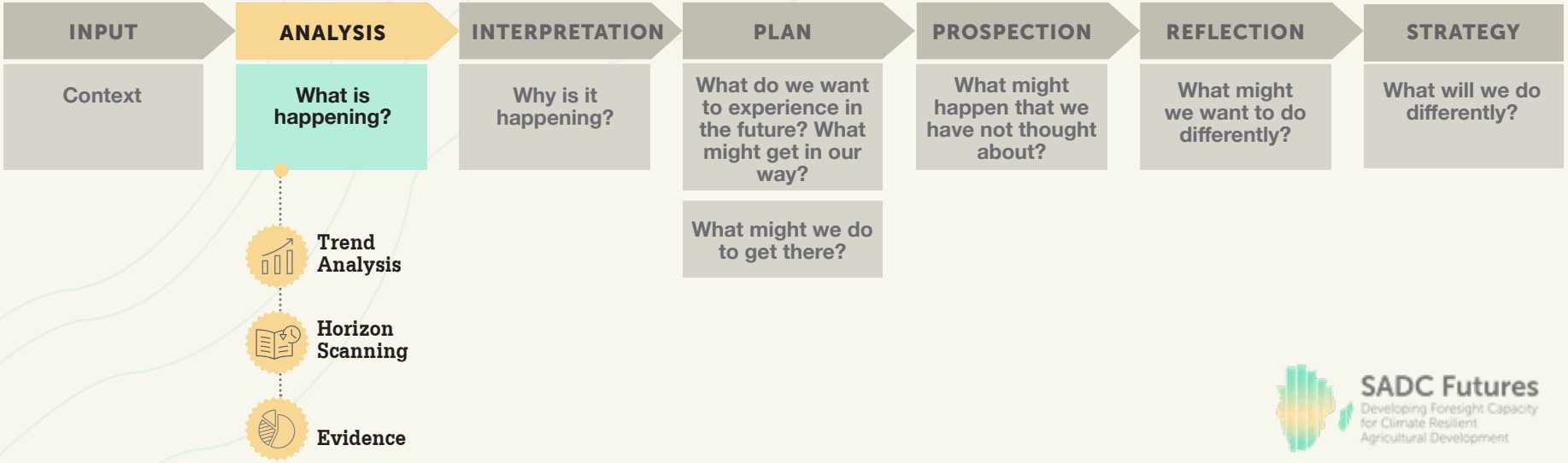
Analysis Stage

The analysis stage of the foresight process follows on from the input stage. The analysis stage deepens our understanding of what is happening around us in terms of influential historical events and key trends. Essentially, this stage involves the analysis of environmental scanning results to determine major change shifts that need to be explored to identify potential strategic implications (Thinking Futures, 2020). As this stage continues to explore the chosen context or theme, the key question remains the same as for the input stage:

What is happening?

It is important to reiterate that concepts from each stage are carried throughout the framework i.e. the framework stages should not be viewed in isolation or only applied in the order of the framework given. Furthermore, there is no standardised way of doing foresight, the methods and tools chosen depend on the specific topic or theme, the scale and objective(s) of the foresight process and the questions to be answered (Bourgeois, 2012).

Gathering and assessing information



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Trends Analysis

Foresight planning involves identifying possible futures based on key uncertainties and trends of the past. Trends analysis falls within the analysis stage of the framework, this is where we are trying to review key trends in relation to the scope we set for the foresight exercise.

Trend - is a general tendency or direction of a movement or change over time (Forward Thinking Platform, 2014).

Trends vary, they can be strong or weak; they can increase, decrease or be stable; they may continue into the future or they may not. Trends create broad parameters for shifts in attitudes, policies, and business focus over periods of several years that usually have a global reach. Therefore, they tend to affect everyone but most players, organisations or even nations cannot do much to change them (Saritas & Smith, 2011).

Drivers, trends, and megatrends are important components of foresight tools.

Megatrend - a trend that is apparent at a large or global scale e.g. growing youth population across the African continent.

When interrogating the future, it is important to examine the impacts of trends and drivers and their interactions, and the changes that would occur if different trends strengthened or lessened.

What is the method?

- **Collecting information on drivers and trends** and identifying which are most critical for consideration within the given topic.
- Trend analysis is a method that involves **reviewing historical data** to understand potential trends going forwards and what this means for shaping the future.

Why apply it?

- This is when we are trying to review **key trends in relation to the scope** we have set for the foresight exercise.
- Foresight planning involves **identifying possible futures based on key uncertainties** and trends of the past.

There are two key steps for undertaking trends analysis, these include historical analysis and reviewing existing data. The review of existing data is carried out in multiple stages of the foresight process. These steps are broken down further as follows:

Key Steps to Analysing Trends

Historical analysis:

- Developing timelines.

Review existing data:

- Desktop study;
- Statistical models;
- Key informant interviews;
- Surveys; and
- Workshop discussion.

Historical Analysis

Historical analysis involves looking at what has happened over a relevant, prescribed timeline to try to understand why current and future patterns are emerging. This is done by reviewing relevant events, stakeholders involved, processes, and patterns that occur within the chosen historical timeframe. Ideally the research is conducted with the involvement of a wide range of actors to gather information on events as experienced by them. To carry out this step you need to build a timeline, this requires thinking about:

What time frame is relevant to the chosen theme? How far back do I need to go? What should I focus on?

Learning Exercise

Think about your theme and what your time frame should be. Consider how valuable data from 10, 20, 50 years ago would be.

Think about when you were **unpacking your theme in Module 1**, what drivers of change did you identify?

Use this information to develop topics for your timelines. Draw a line on a piece of paper, the first marker on the line should denote the furthest point in time that you need to revisit. The last marker should be the present year. Based on how far back in time you want to go, split the timeline into sections e.g. decades. Use information gathered from books, knowledgeable persons, journals, and reputable websites to populate the timelines. Annotate the timelines with information on the scale or magnitude of the occurrence e.g. did the disease outbreak cause the loss of 2 lives or 2000?

Use the timelines given below to guide you. Now study your timelines, what are they showing you? Are there any obvious patterns or signals of change?

Questions & Answers

Who should do a trends analysis – a specialist?

It depends, sometimes no data is prepared before the workshop is held. From experience, it is preferential to **prepare data beforehand as it allows people to get involved in the analysis and discuss findings**, which is valuable to the process. If the scale of the analysis is small e.g. district level, it can be beneficial to meet with community members prior to contracting a specialist, as the community input can assist in focusing the analysis.

Photo: Ake Mamo

Application in the Context of Climate Resilient Agri-Food Systems in the SADC Region

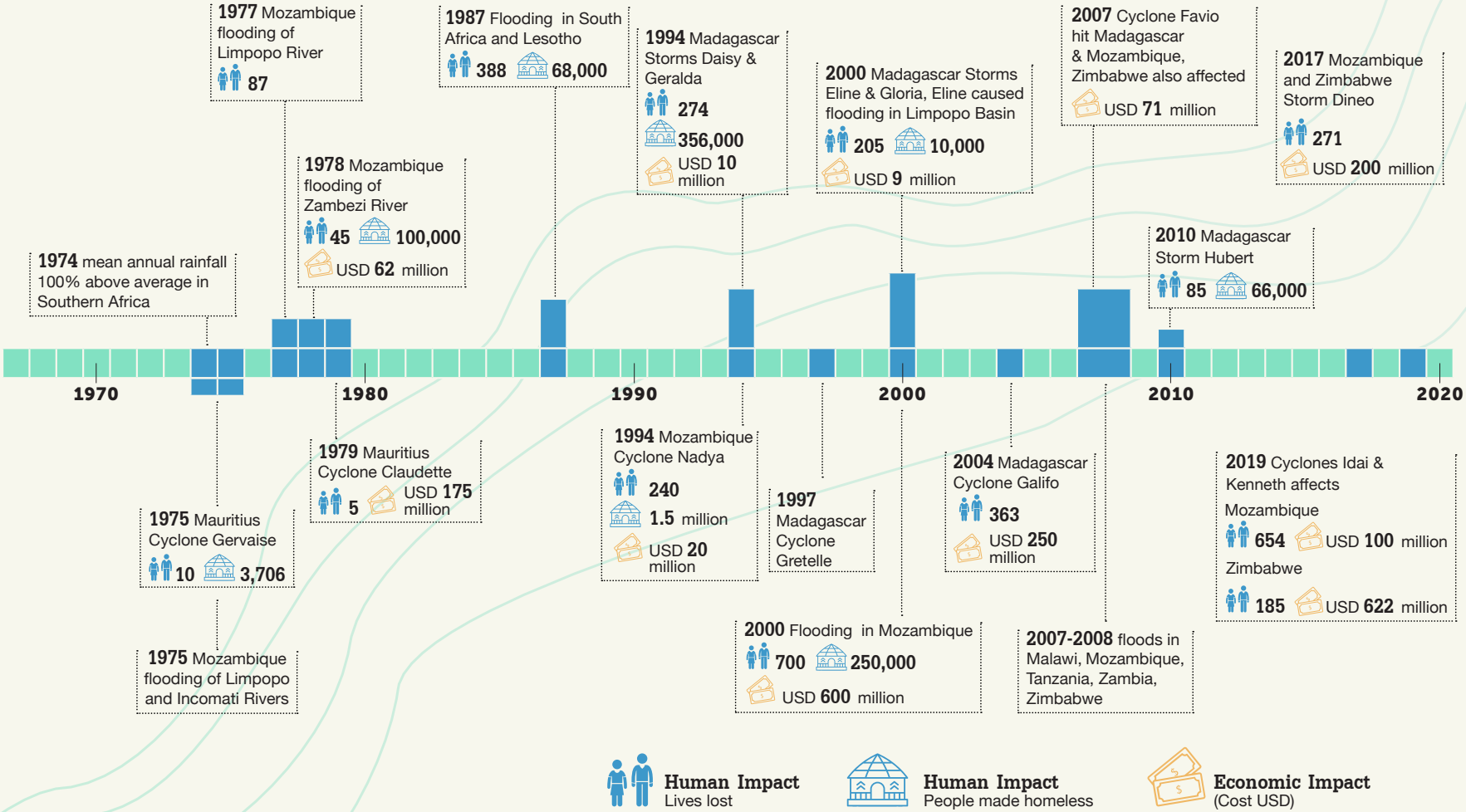
The **historical time frame selected as appropriate to the theme of climate resilient agri-food systems in the SADC region** is 50 years. The focus of the timelines are on external systems or drivers of change likely to impact the productivity of regional agri-food systems. Subsequently, the chosen topics for the timelines include climate change (droughts and flooding), agricultural pests and diseases, human health, trade, political past, and conflict. Refer to the supplementary report 'Historical Analysis of Climate Change and Agricultural Events in the SADC Region, 1970-2020' for the historical timelines and detailed descriptions of events. Examples of some of these timelines are provided in the following pages.

Over the period 1980-2015, SADC experienced 491 recorded climate disasters that resulted in 110,978 deaths, rendered 2.47 million people homeless and affected an estimated 140 million people (Davis-Reddy & Vincent, 2017). Floods disproportionately affect communities with poor infrastructure and health services where they often result in a loss of life, damage to property and infrastructure as well as disease outbreaks such as malaria and cholera.

This timeline provides evidence on the frequency of cyclone and flood occurrence in the SADC region. It is evident that the coastal country of Mozambique and the islands of Madagascar and Mauritius are repeatedly affected.

Cyclones and flooding

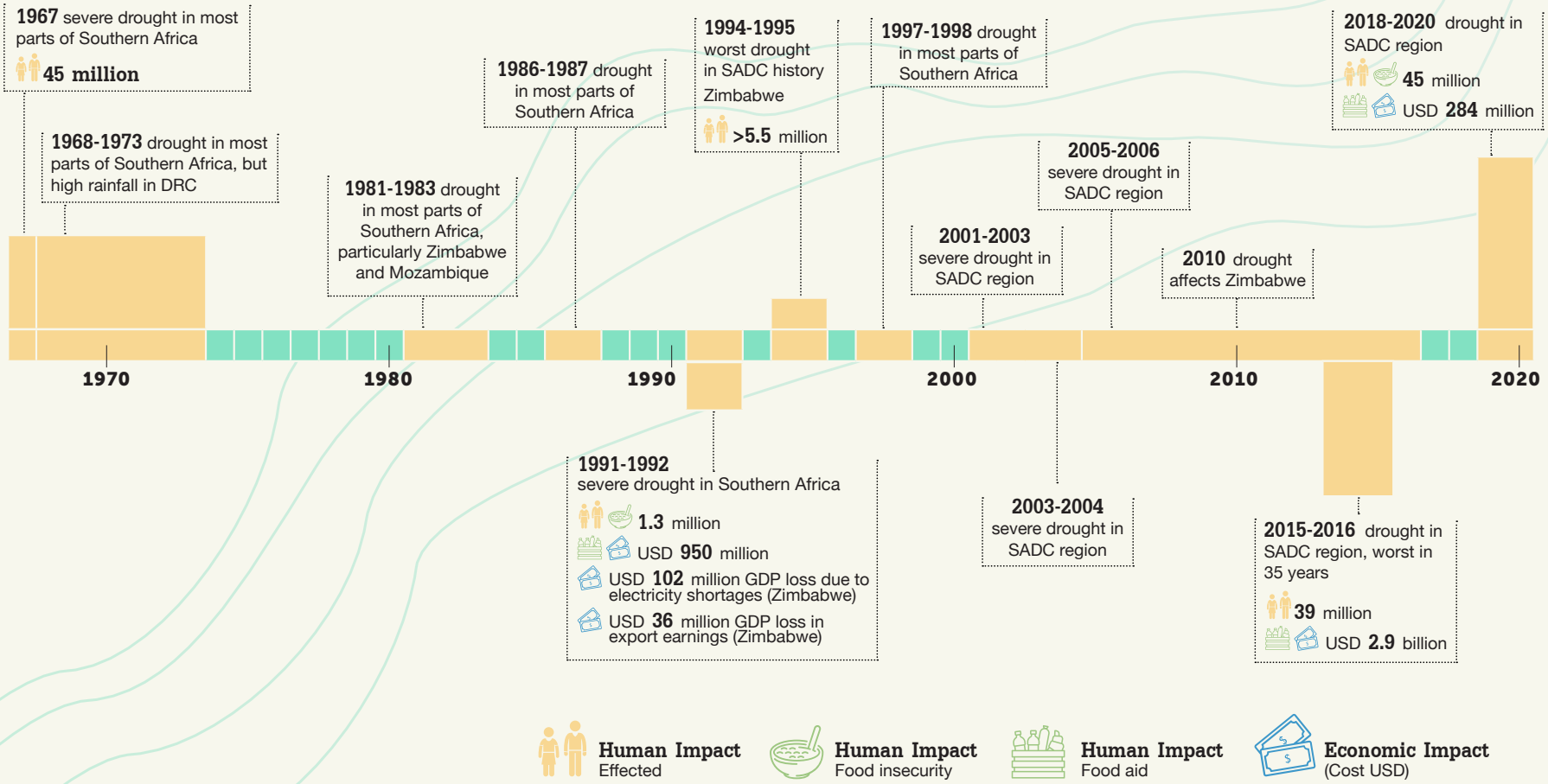
This timeline provides **evidence on the frequency of cyclone and flood occurrence in the SADC region**. It is evident that the coastal country of Mozambique and the islands of Madagascar and Mauritius are repeatedly affected.



The pattern of severe droughts in Southern Africa (such as those of 1982-1983, 1991-1992, 1997-1998 and 2014-2015) has been linked to the El Niño-Southern Oscillation (ENSO) phenomenon (Davis-Reddy & Vincent, 2017). The impacts of droughts in the region are exacerbated by land degradation, poor water conservation practices as well as political instability and poor economic growth. As Southern African economies are dependent on rain-fed agriculture they are more vulnerable to droughts.

Drought

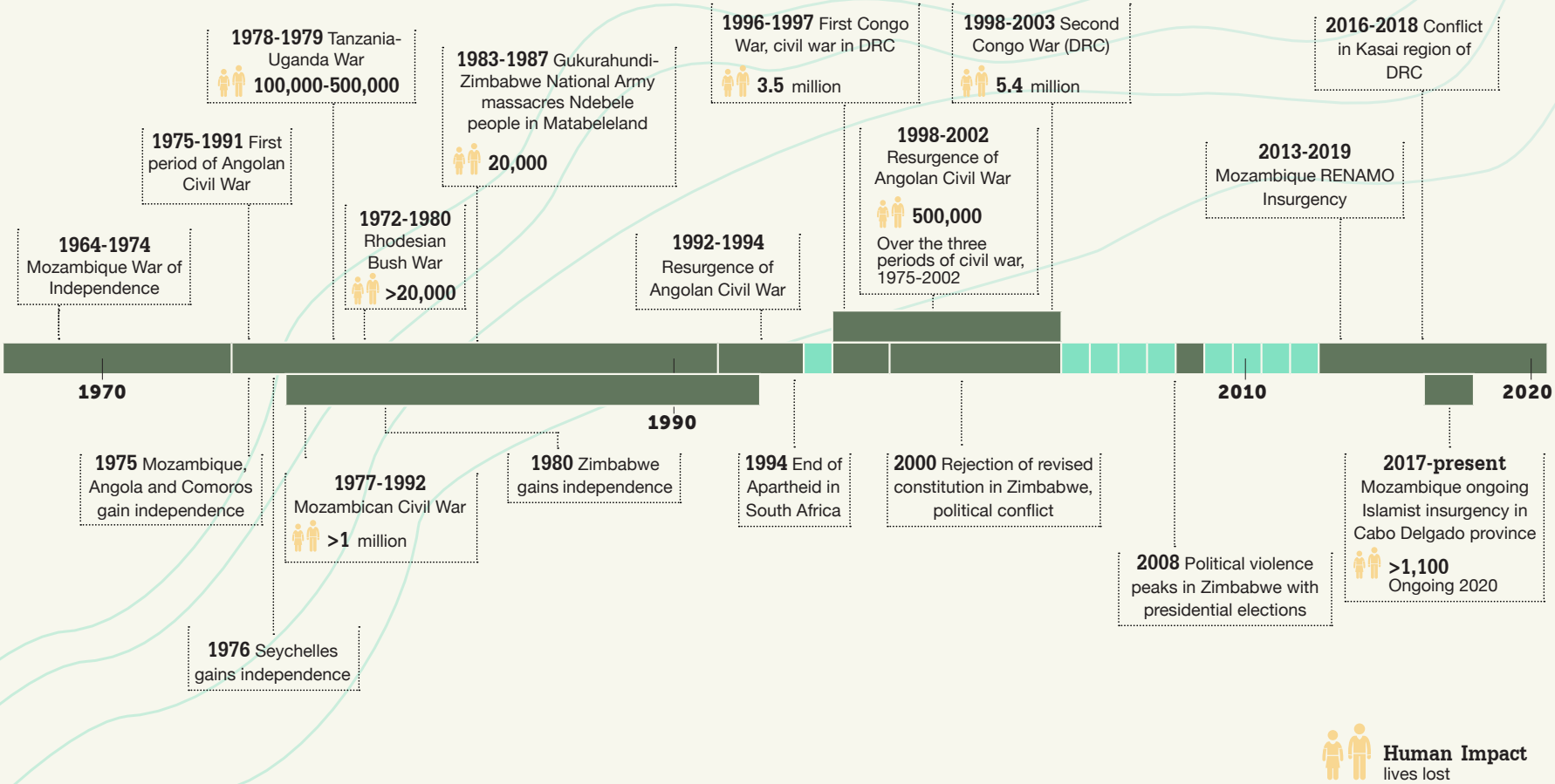
The historic timeline shows that **drought has been a common occurrence in Southern Africa and the SADC region** in particular, over the past 50 years. In comparison with the cyclones and flooding timeline, drought appears to impact larger areas, often affecting whole regions or multiple countries at a time.



Political Past and Conflict

Africa's politics are famous for instability with military coups, genocides, and civil wars. **Agricultural production tends to drop substantially in regions affected by conflict**, due to adverse effects on labour supply, access to land and access to credit and/or direct effects on capital such as theft and destruction. On the other hand, food shortages and price increases are often perceived as due to poor governance and can result in a breakdown of state authority (Martin-Shields & Wolfgang, 2018).

The political past and conflict timeline shows that conflict has been a reoccurring issue in Angola, Zimbabwe, Mozambique, and the Democratic Republic of Congo (DRC).

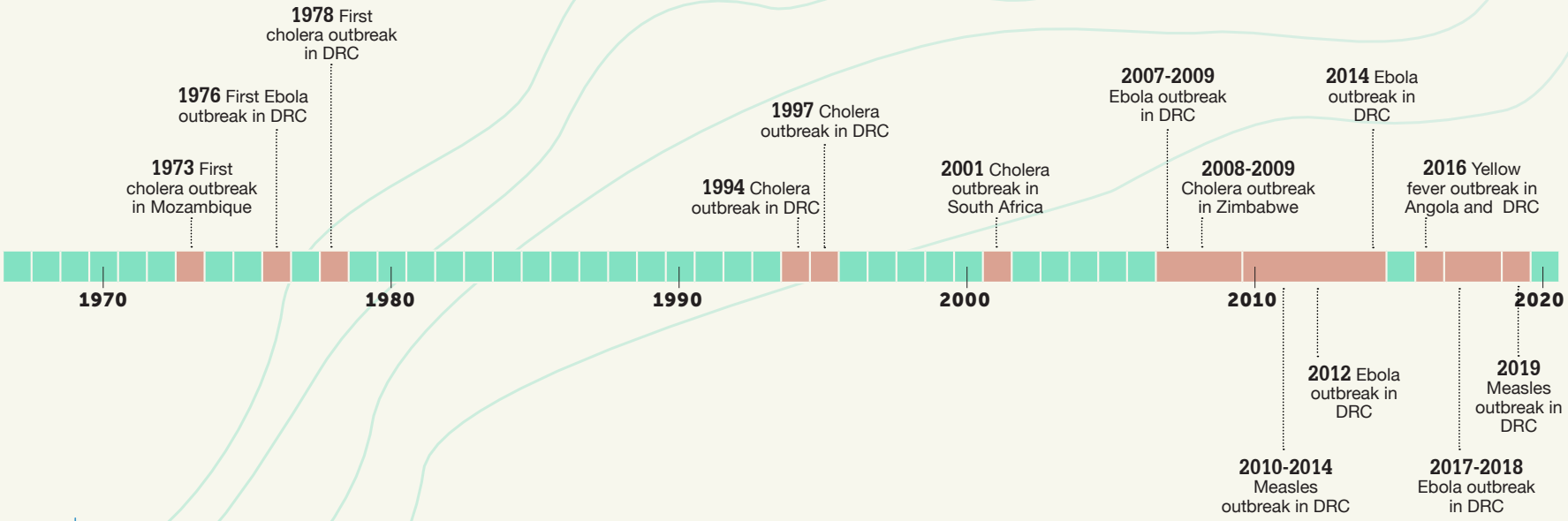


Human Health

Climate change has both direct and indirect impacts on human health. Flooding provides breeding grounds for insects and causes water contamination, leading to the spread of vector-borne and diarrheal diseases such as cholera. Furthermore, droughts and floods affect crop yields resulting in food insecurity and malnutrition thereby lowering immunity and enhancing the vulnerability of affected communities. Studies have shown that people suffering from food insecurity are at a higher risk for infectious and noncommunicable diseases and have poorer health outcomes (Kelly et al., 2018).

Food shortages can force poverty-stricken people to consume alternative foods such as bushmeat. According to USAID, 'nearly 75% of all new, emerging, or re-emerging diseases affecting humans at the beginning of the 21st Century are zoonotic', meaning they originate in animals. Such diseases include AIDS, SARS, H5N1 avian flu, H1N1 flu and presently, COVID-19.

The human health timeline shows that the DRC is a hotspot for communicable disease outbreaks, this trend may also be linked to the reoccurring issue of conflict.



Learning

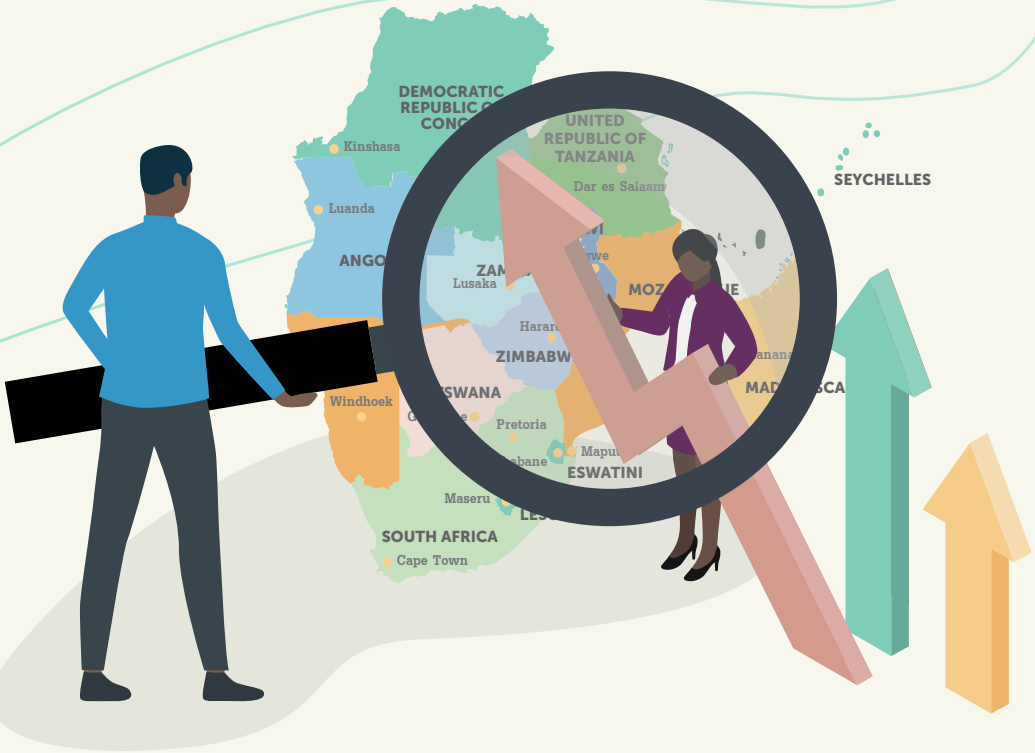
Historical analysis through building timelines enables you to see if there are emerging patterns or signals of change. The patterns and signals provide 'tips' on where the system is heading.

Reviewing Existing Data

For this key step, think back to when you **defined the scope**, the context of the issue at hand and what could influence it. Here you want to **gather information on how the drivers that are influencing your system** are changing it i.e. the trends.

How are the drivers that are influencing the system in question changing it?

Much of the information needed to carry out this step comes from existing data or published reports but may also require interviews. **It is important that information and data gathered comes from reliable sources**. The topic of trends will be explained in more detail in the section on horizon scanning.



Horizon Scanning

Horizon scanning is still within the analysis stage of the foresight framework. **Horizon scanning is essentially a process of pulling together information from a variety of reliable sources** (e.g. literature reviews, online surveys, quantitative models, or expert opinions) to identify potential signals of change and future impacts resulting from identified trends. The information gathered should be summarised into major categories to help facilitate understanding of how drivers may impact outcomes.

What is the method?

- It requires undertaking a **rigorous analysis** of trends to explore their impacts.
- It is a process of **examining diverse information** sources to identify potential signals of change and future impacts from trends identified.
- It explores how **trends** and developments might combine and what impacts they might have.

Why apply it?

- It is **complementary to trends analysis as a method** and deepens a trends analysis to scan horizons for emerging issues and analyses their potential impacts

Two key steps for undertaking horizon scanning are provided below, these are just two of many methods that could be used.

Key Steps for Horizon Scanning

Summarise trends into major categories; and

Analyse key questions.

Step 01 Summarise Trends into Major Categories

Horizon scanning information is summarised into major categories to help facilitate the understanding of how drivers may impact outcomes. Categorising trends in accordance with given themes forces us to consider unfamiliar areas and cover all bases. It ensures that we think beyond our subject of specialty or interest. A commonly used categorisation method is 'STEEP' which denotes Social, Technological, Economic, Ecological/Environmental, and Political. It is possible that some trends will fit into more than one category, this is normal.

S Social

T Technology

E Economic

E Ecological / Environmental

P Political

Questions & Answers

Do you have to consider all the categories or just those that apply to your question?

Yes, as you may not be aware that a category does apply. There are other categorisation systems slightly different to STEEP that may be more relevant to your theme. Whichever you choose to use, the purpose is to assist you in thinking out of the box. Go through all the categories at least once, you may discover something you had not thought of previously.

Learning Exercise

Write STEEP vertically on a piece of paper. What trends can you think of that are relevant to your theme that fit into these categories?

Are there trends which fall into **more than one category**?

Thinking of the categories, which one are you **most likely to omit when thinking of the future**?

Application in the Context of Climate Resilient Agri-Food Systems in the SADC Region

Here we explore **megatrends relevant to consider in the context of building plans and investments to support climate resilient livelihoods in the Southern African region**. Megatrends are associated with driving appreciable change, whether through attitudinal, behavioural, economic, or environmental mechanisms. Megatrends influence a wide range of activities, processes, and perceptions, both in government and in society, over long time periods (Forward Thinking Platform, 2014). For detailed information on this topic refer to the supplementary course report, namely 'Megatrends in the Southern African Region'.

What are some of the drivers, trends and megatrends impacting the agricultural sector in the SADC region?

According to Davis-Reddy and Vincent (2017), factors affecting the agricultural sector in Southern Africa include:

- **The demand for food** - including population growth, changes in consumption patterns, and urbanisation;
- **Environmental factors** - including climate change and environmental degradation; and
- **External or governance factors** - including agricultural support, trade policies, and conflict.

Using the STEEP categories, let us now unpack some these factors. (Climate change and risk is excluded here as it is covered in detail later in the module.)

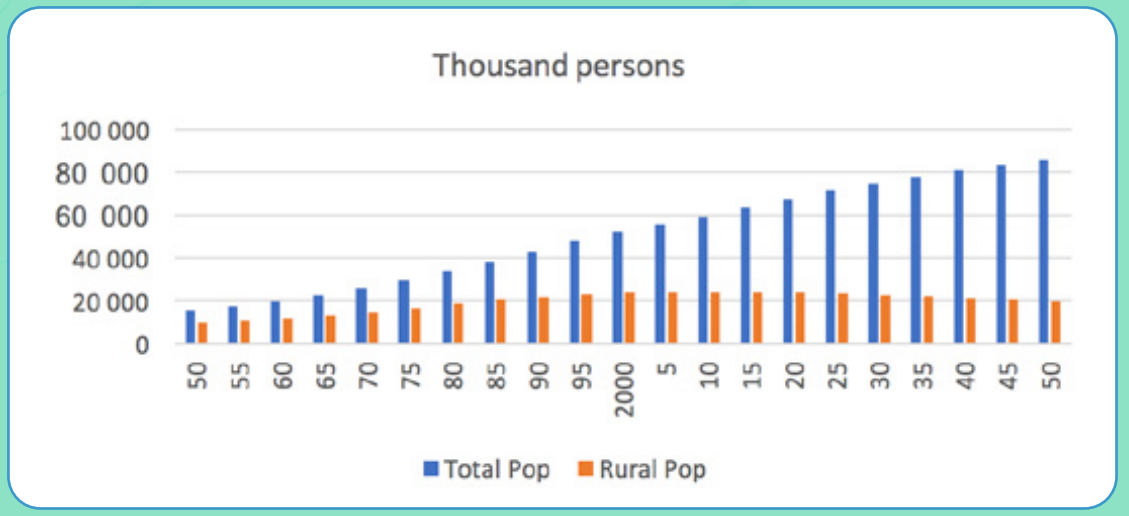
Social Category

For the purposes of this training manual the **indicators analysed within the social category include population demographics, urbanisation, and poverty**. Other social indicators that would be important to consider in the context of climate resilient agricultural development in the SADC region (as covered in the supplementary report on megatrends in the southern African region) are dietary transition, health and food security, land distribution, gender issues and education and skills development.

Population Demographics

Sub-Saharan Africa (SSA) is expected to experience the highest rate of population growth globally in the coming decades, although there is considerable range in the level of projected increase, depending particularly on changes in total fertility rate.

According to the projection below, the population growth rate in the Southern African Region[2] is expected to increase at a decreasing rate from around 2035, arriving at a total over 80 million by 2050. The population in rural areas is expected to decline slightly to just under 20 million by 2050.

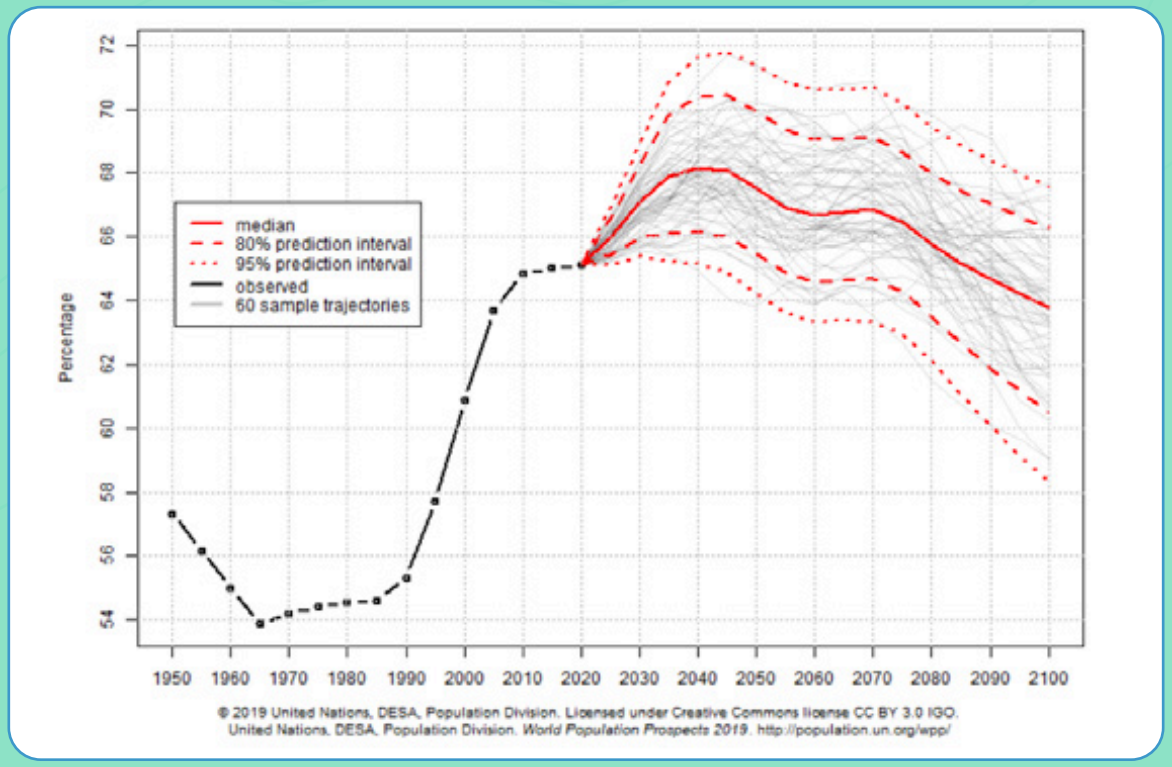


Total and rural population projections to 2050: Southern African Region, from (United Nations, DESA, Population Division, 2019)

[2]Includes: Botswana, Eswatini, Lesotho, Namibia, South Africa, Zimbabwe


Photo: E.W Cordon (ILRI)

Projections of the percentage of population of working age or labour force for the Southern African region can be seen on the right. The median projection indicates high increases up to 2040 with a gradual decline thereafter. Although there is some uncertainty in the level of growth, there is clearly an expansion of youth into the labour force in the next 10 to 20 years.



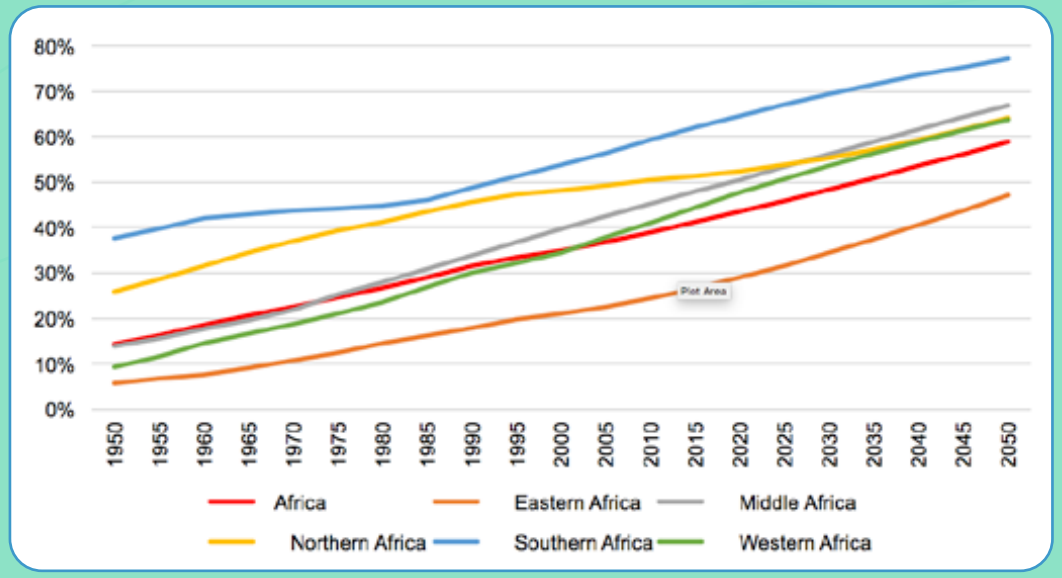
Percentage of population aged 15-64 years: Southern African Region, from (United Nations, DESA, Population Division, 2019)

Urbanisation

Africa's urban population is projected to expand around three-fold from 360 million in 2015 to 1,137 million by 2050 (Jayne et al., 2017). Around 55 % of the continent's population will live in urban areas by the middle of the century (Cleland & Machiyama, 2016). Most of this growth is from urban population growth rather than migration, or areas that were previously considered rural being reclassified as urban as population densities increased (Jayne et al., 2017).

In the SADC region, the overall trend has been towards increasing urbanisation of the population in most countries except for Mauritius and Swaziland, which exhibit de-urbanising trends. However, in contrast to the situation in other areas of Sub-Saharan Africa, in-migration to urban areas is a major source of urban population growth in the SADC region (SADC, 2013).

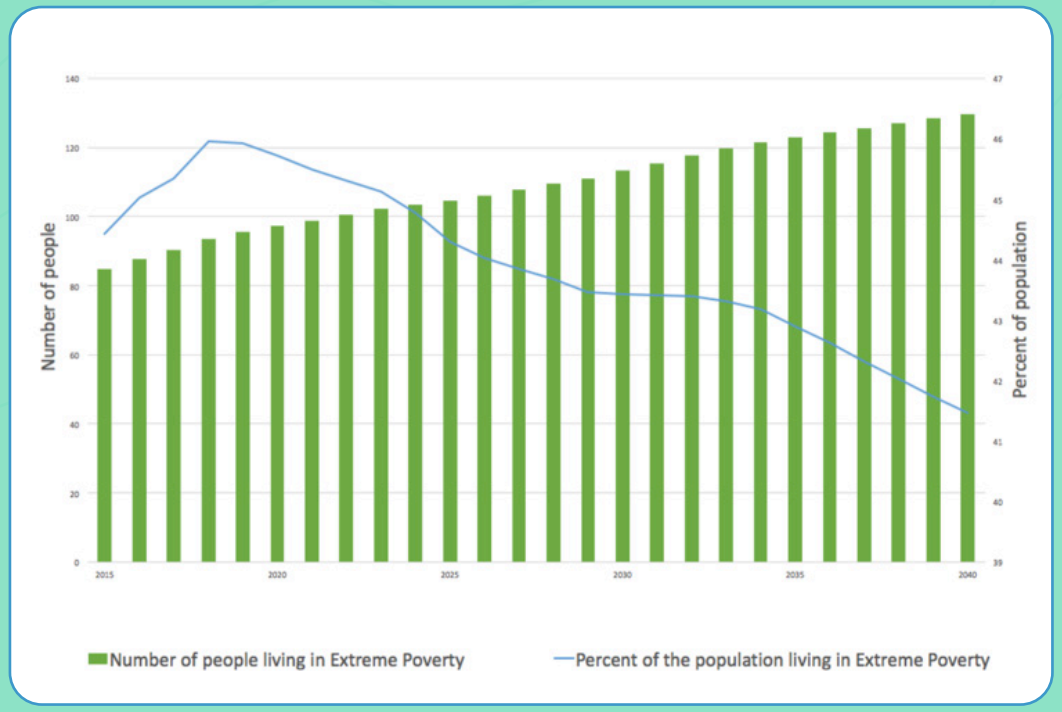
The graph on the right shows projected urbanisation rates for the United Nations (UN) designated Southern African Region. It indicates that the level of population living in urban areas is higher in the Southern African Region compared with all other African regions, and it is projected to remain so up to 2050.



Urbanisation rates 1950-2050: All African regions, from (United Nations, DESA, Population Division, 2018)

Poverty

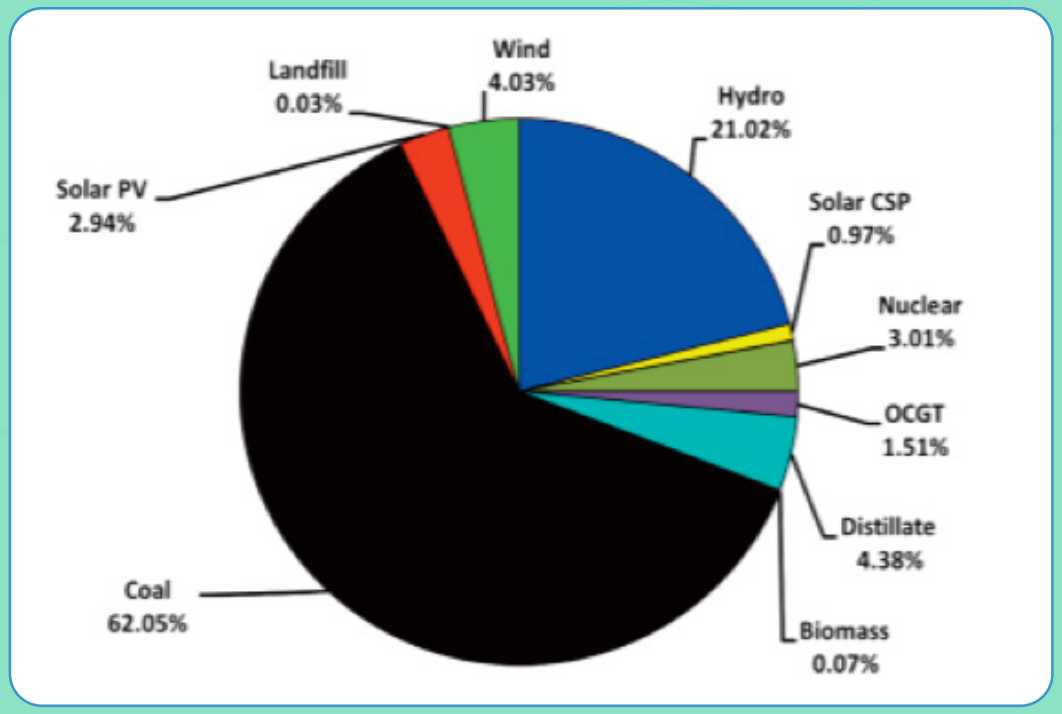
Southern Africa has a heavy burden of extreme poverty (measured as living on less than USD 1.90/day). A drop in the percentage of the population living in extreme poverty from 45% in 2017 to 41% by 2040 is expected (Porter, 2017). However, the absolute number of people living in extreme poverty is expected to increase to nearly 130 million (an addition of 40 million people), as is evident in the graph below. The reasons for this increase in number are population growth, high inequality, and slow growth in the agricultural sector (on which most poor people rely for their livelihoods). It should be noted that this projection was conducted prior to the COVID-19 pandemic which is expected to worsen poverty levels in Africa.



Extreme Poverty Forecast for Southern Africa (2015-2040) (Porter, 2017)

Technological Category

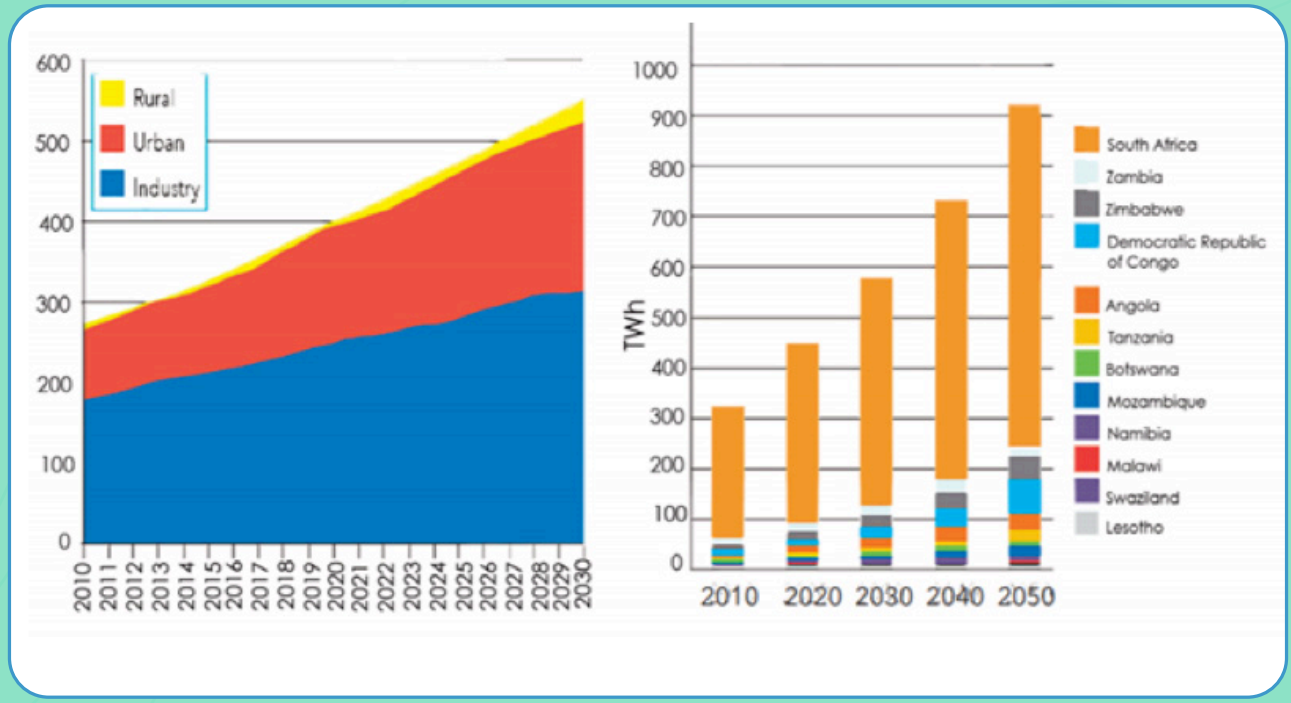
Within the technological category, the indicator 'energy production' is considered, as it is a key developmental sector. The pie chart shows that the Southern African Power Pool (SAPP) (which includes the power utilities of several SADC countries) relies heavily on coal but that there is also a large share of power generated by renewables such as hydropower (21.02%) and wind (4.03%). When taking into account the commissioned capacity, hydropower in the form of conventional and pumped storage accounted for 43 %, gas 24 %, solar systems (photovoltaics (PVs) and concentrated solar power) 11 %, wind 10 % and coal occupied only 7 % (SADC, 2018). The pie chart provides a snapshot of the situation. Trends cannot be determined from it.



Southern African Power Producers (SAPP) Installed Generation Mix 2017 (SADC, 2018)

The energy mix may change rapidly, due to the decline in prices of renewable energy systems. Solar power is essentially on par with the costs of hydropower and are increasingly cheaper than any fossil fuel form of electricity generation.

Access to energy in the SADC region is still highly constrained, particularly in rural areas where electricity is accessible to only 34% of the population (SADC, 2018). The projected increase in energy demand in the SADC region up to 2050 is shown in the chart below. The projection indicates that there will be a large increase in energy demand, most of which will be due to industrialisation. Based on the existing pattern of limited access to electricity in rural areas and existing policy frameworks, it is unlikely that the demand in these areas will be met in the future. The projection is based on expected economic development in different sectors of the region, which may or may not unfold in the future.



Energy Demand Projections for 12 SADC Countries (2010-2050) (Mutanga & Simelane, 2016)

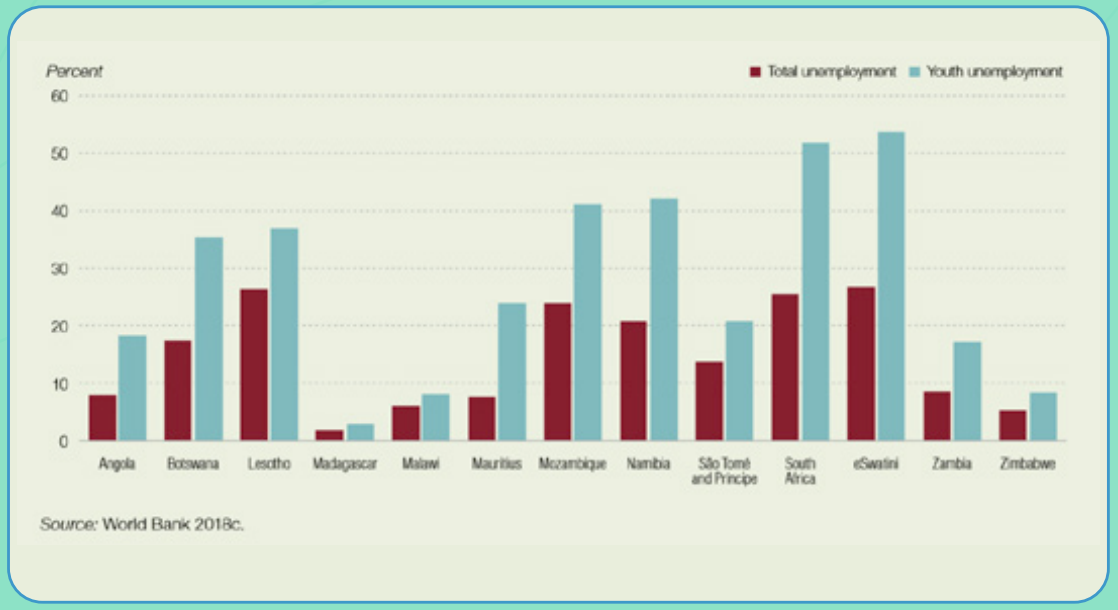
Economic Category

Within the economic category and the context of the foresight exercise, indicators important to **consider include economic growth, employment, and food prices in the SADC region**. The focus of this section is on employment. A key question to consider here is:

Will wage employment in the agricultural sector meet the job demand of the rapidly increasing population?

Unemployment continues to be a major challenge in Southern Africa. Root causes of unemployment include slow economic growth, poor skills of the labour force, weak institutions, and low labour absorption capacity in industries. Essentially there has not been sufficient importance given to employment growth in development policies.

The graph below shows high rates of unemployment (>10%) in seven of the countries (six of which fall within the SADC region) and higher rates of youth unemployment (blue columns) in all countries considered (SADC, 2019). As the graph is a snapshot of the period 2010-2018, trends cannot be deduced. However, according to Jayne et al. (2017), even under the most optimistic growth scenario, employment opportunities are unlikely to be available for more than a small fraction of the rapidly expanding labour force. Furthermore, it is expected that the COVID-19 pandemic will exacerbate unemployment in the hardest hit sectors such as tourism and hospitality, entertainment, retail and trade and agriculture, where most of the people in the region are employed.



Urbanisation rates 1950-2050: All African regions, from (United Nations, DESA, Population Division, 2018)

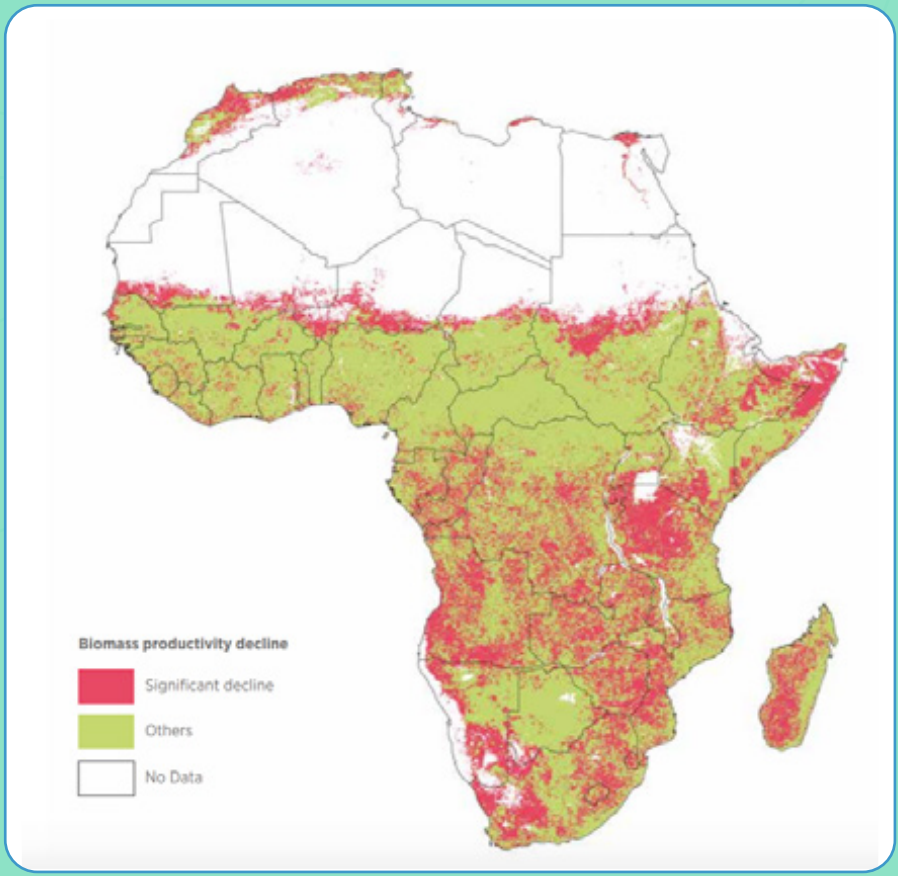
Ecological/Environmental Category

In the ecological/environmental category we consider the indicators of land degradation and agricultural productivity.

Land Degradation

The issue of land degradation is a fundamental issue in achieving resilient livelihoods in Southern Africa. Land degradation is associated with poverty, given the importance of agriculture to the livelihoods of Africa's poor. A report by the Montpellier Panel published in 2014, indicates that around 65% of arable land in Sub-Saharan Africa is already degraded, which is costing more than 180 million smallholder farmers around USD 68 million in lost income annually (Montpellier Panel, 2014).

A map of land degradation hotspots based on biomass productivity indicates considerable degradation in Southern Africa, particularly in the SADC region. The degradation is due in large to increasing population pressures leading to a reduction in fallows and continuous cropping without inputs. Soil fertility decline has led to a reduction in crop yields across the region (Vanlauwe et al., 2015). Again, as this map provides a snapshot of a point in time, we cannot determine trends from it.



Decline in Biomass Productivity in Africa (Le et al., 2014

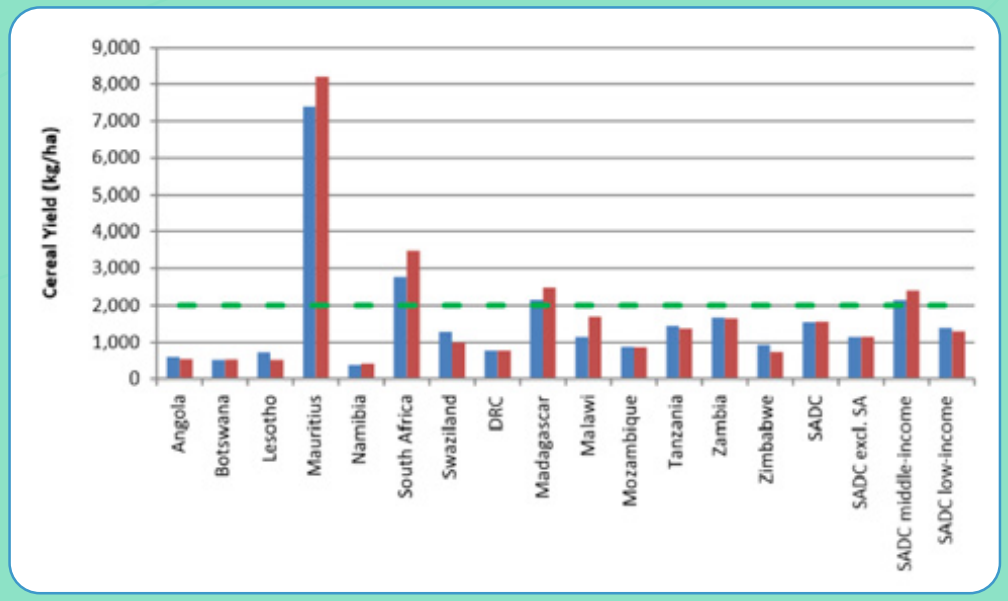
Agricultural Productivity

Agricultural productivity is linked to land degradation but could also fit under the economic category. As mentioned previously, some indicators and associated trends will fit into more than one **STEEP category** and requires the use of discretion.

Of the total area (986,246,000 ha) covered by the 16 SADC countries, only 6.11% is cultivated (Nhamo et al., 2019). Smallholder farming is the main source of livelihoods in rural areas and is mostly rainfed, relying on increasingly variable patterns of rainfall. Around 20 million hectares of land has irrigation potential, yet only 3.9 million is irrigated (Nhamo et al., 2019).

The graph below shows that cereal yields were stagnant for the SADC region over the period 2000-2010 and below the Regional Indicative Strategic Development Plan (RISDP) target level of 2,000 kg/ha, for most (11 out of 14) countries. The yields of low-income SADC countries fall below the RISDP target and are declining.

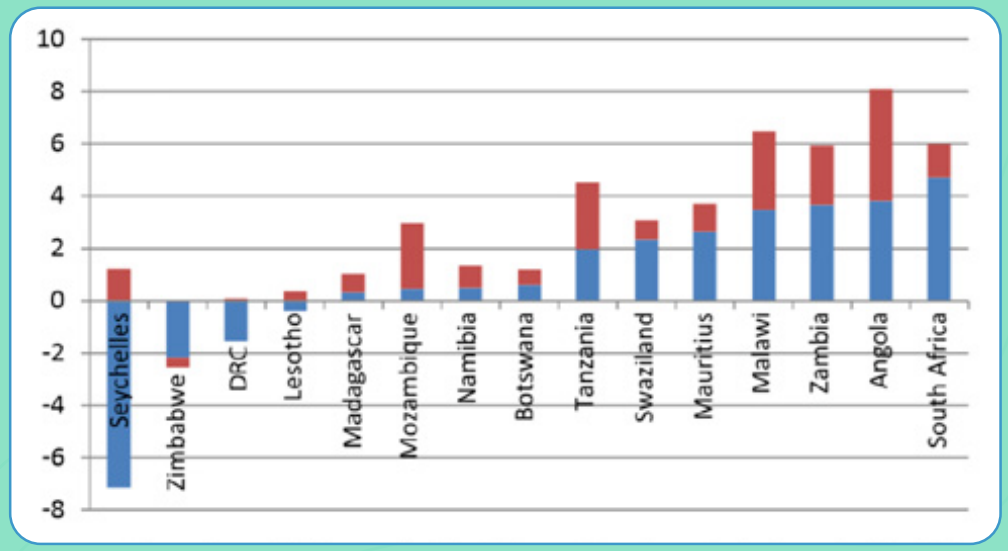
Photo: Georgina Smith (CIAT)



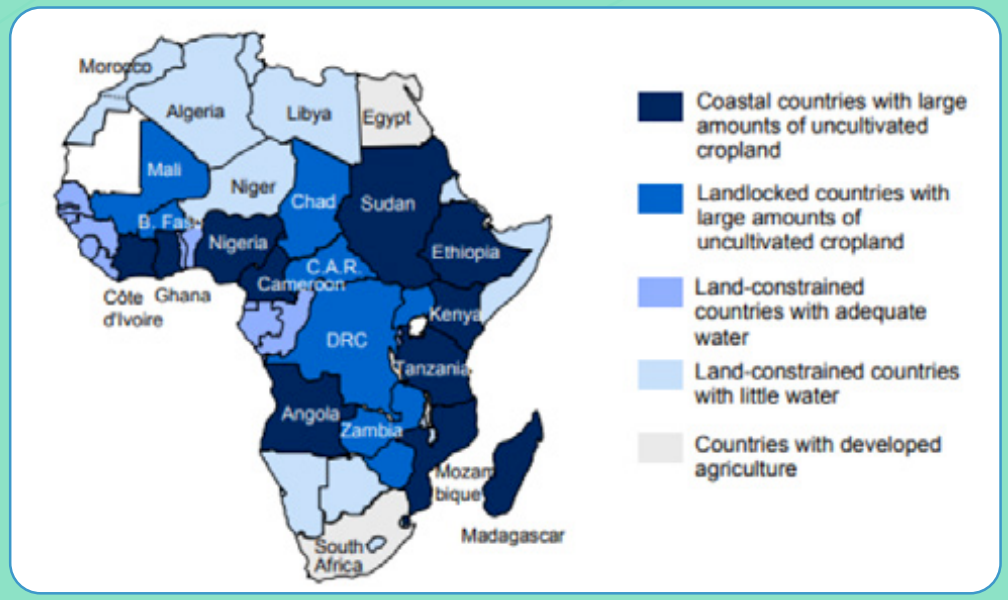
Trends in Cereal Yields in SADC Countries (excluding Comoros and Seychelles), 2000-2010 (Chilonda et al., 2013

The graph to the right provides insights into the type of productivity growth or decline in agricultural cereal yields in the SADC region (excluding Comoros) over the period 2000-2010. There are two types of productivity growth: more cereal per hectare (yield), also known as land productivity; or more cereal per worker, also known as labour productivity. Low-income countries are generally higher on land productivity while mid-income countries are higher on labour productivity. This trend is important to understand as it indicates how profitable a farm in the region may be. From an ecological perspective it is important to consider how much of an increase in production is due to land expansion.

Lastly, the map on the below right provides **evidence of the great potential for increasing agricultural productivity in the northern SADC** countries in the future, as determined by the amount of uncultivated land and water available.



Labour and Land Productivity Growth Rates in SADC Countries (annual average 2000-2010 (Chilonda et al., 2013)



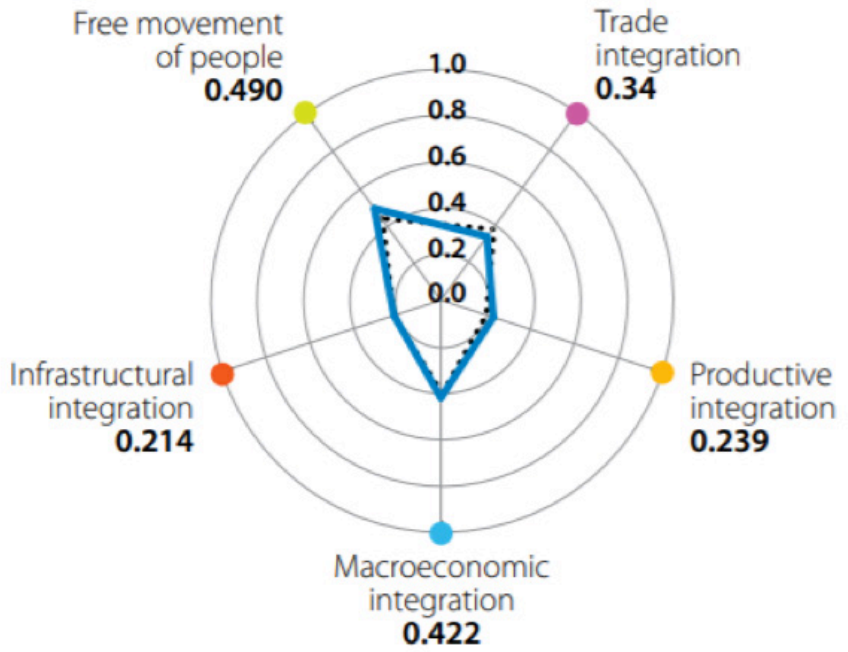
Africa Agricultural Growth Potential by Region

Political Category

The indicator chosen for the political category is the effectiveness of regional integration, as it is a key gauge of governance. Regional integration has historically constituted an integral part of development strategies in Africa. It has been viewed as a means to achieve sustained economic growth and development and to overcome the region's structural problems such as political fragmentation, lower per capita incomes, and small intra-regional markets.

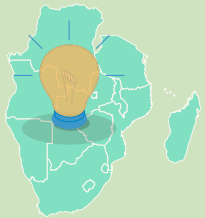
The SADC region scored the lowest points (0.337) in an assessment of the level of integration across the continent's regional economic communities. The region's main weakness is identified as regional infrastructure and its strength is the free movement of people. As the chart represents a set point in time, no trends can be determined.

Average score	0.337
Strongest dimension	Free movement of people
Weakest dimension	Infrastructural integration



Dotted line represents Africa's scores.

Scores on Five Dimensions of Regional Integration for the SADC Region (African Development Bank; African Union; United Nations Economic Commission for Africa, 2020)



Summary of SADC Megatrends Findings

Based on the evidence analysed, the following trends in the context of climate resilient agricultural development in the SADC region were identified:

Social

- A large increase in population is expected, with many youths entering the job market; and
- Poverty levels in the region are high and the number of affected people is projected to increase.

Technological

- Access to energy in rural areas is generally quite low and likely to remain that way, although potential for use of renewable energy is high.

Economic

- Unemployment rates are high, particularly for the youth population, and unlikely to change given existing policy frameworks and the impact of COVID-19 on various sectors of the economy.

Environmental/Ecological

- There is considerable land degradation in the region; and
- Agricultural productivity is low and declining.

Political

- SADC's regional integration is low and could be enhanced with improved regional infrastructure.

In summary, the SADC region is one with considerable potential and achievements relative to other areas in Sub-Saharan Africa, but also one that is facing major challenges in terms of poverty reduction and climate change impacts. The overall picture that emerges from the direction of trends at this point is that of increasing inequality with rising poverty and food insecurity in rural areas.

Learning

You should now be able to **categorise trends according to STEEP** and have a better understanding of the information, data, and evidence you need to collect to identify trends and patterns within your theme. You should also be able to determine future impacts resulting from the identified trends and patterns.

Step 02 Analyse Key Questions

The next step in the **horizon scanning method is to analyse key questions**. This step is essentially a process of interpreting the information from the trends analysis and horizon scanning activities conducted thus far and identifying where there may be gaps. To do this we need to ask the following three questions:

What questions are important to respond to?
What do we think we know (known knowns)?
What do we still need to find out (known unknowns)?

Learning Exercise

Think about these key questions in the **context of your theme**. What are the most important questions you need to consider when thinking of the patterns and trends you have identified as relevant to your theme?

What do you need to know about answering the questions i.e. **what information or evidence have you gathered**?

What is still missing from your analysis, what else would you still like to know?

Brainstorm the questions and document your answers on a piece of paper

Application in the Context of Climate Resilient Agri-Food Systems in the SADC Region

As the theme chosen for the purposes of this foresight exercise is climate resilient agri-food systems in the SADC region and land degradation was previously identified as a problematic trend, we will take a closer look at it by answering the three key questions:

What questions are important to respond to?

1. Is land degradation reversible? Are there examples in the region where it has occurred?
2. Will increased population growth in rural areas generate higher levels of land degradation?
3. Is the rate of land degradation increasing?
4. Is land degradation higher/greater on poor farmers land?

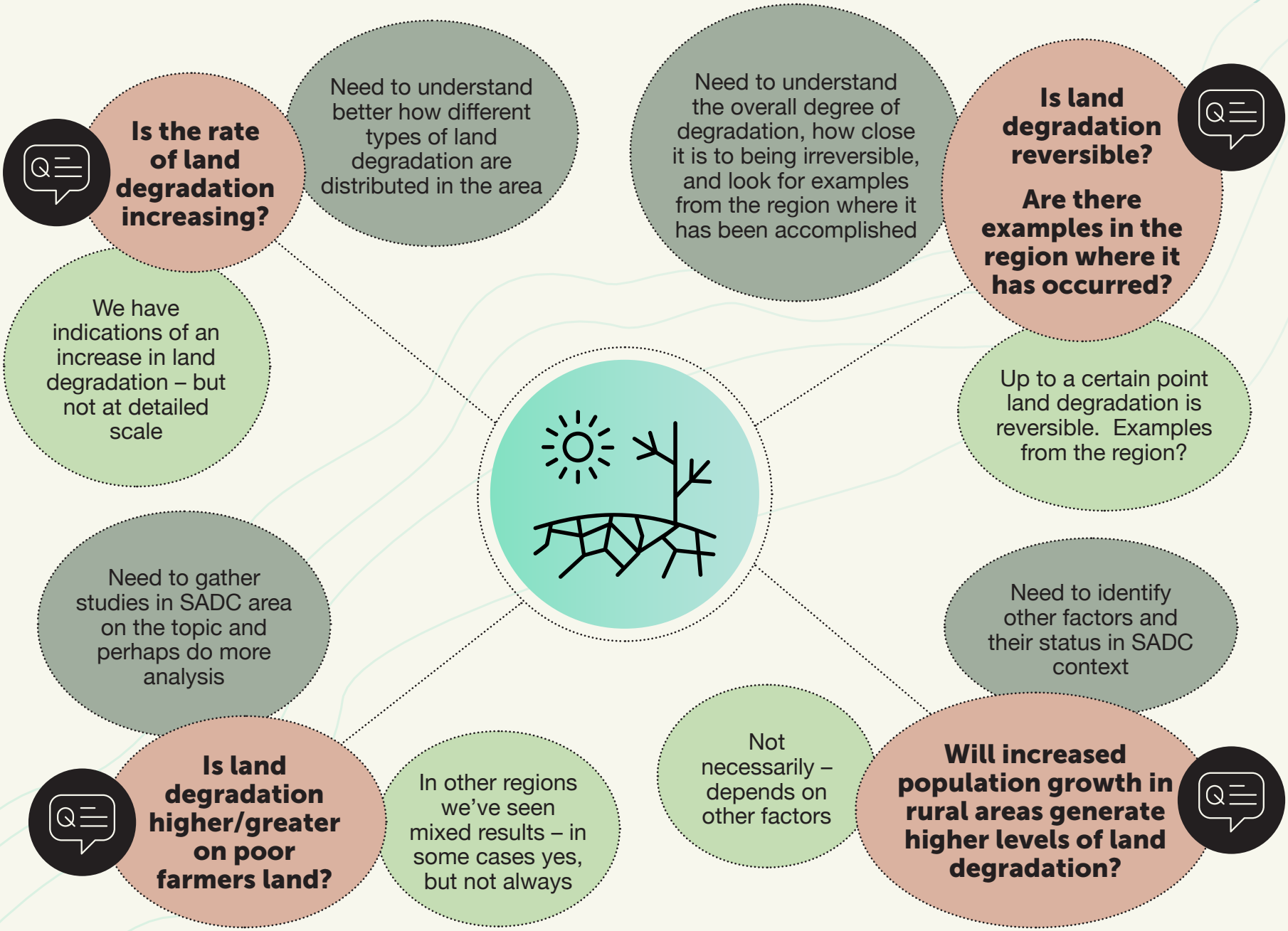
What do we think we know (known knowns)? I.e. what do we know about land degradation in the SADC region?

1. We have indications of an increase in land degradation, but not at a detailed scale.
2. Land degradation is not necessarily linked to the income of the farmer.
3. An increased rural population will not necessarily cause land degradation, it depends on other factors too.
4. Land degradation is reversible up to a threshold.

What do we still need to find out (known unknowns)? What do we do we still need to know about land degradation in SADC region in developing plans for climate resilient agricultural livelihoods?

1. Need to better understand how different types of land degradation are distributed in the area.
2. Need to gather studies in the SADC area on the topic and perhaps undertake further analysis.
3. Need to identify other factors and their statuses in the SADC context.
4. Need to understand the overall degree of degradation, how close it is to being irreversible, and look for examples from the region where it has been accomplished.

Mind mapping is a useful tool to visually organise information. The mind map below illustrates how you could use the tool to document your answers to the three questions.



Learning Exercise

Horizon Scanning

In this exercise we will **consider two megatrends in the SADC region** and will practice the three horizon scanning questions. Responses to the questions by participants of the SADC Futures Webinar Series (Webinar 2) are provided below to guide your thinking.

What questions are important to respond to?

Let us consider the megatrends of agriculture production. Currently, agricultural productivity is very low for poor farmers in the SADC region. What do you want to know in working towards improving the situation? What do you need to know about agricultural production to plan for a climate resilient future? For example, how do we improve women's productivity? Jot down your answers on a piece of paper. You could use the following topics to guide you: youth, gender, environmental issues, political situation.

Photo: World Agroforestry

What do we think we know (known knowns)?

We now want to know how much do we know about the productivity of poor farmers in the SADC region? Can you share two things that you feel confident that you know a lot about?

'Low technology adoption among the older small-scale farmers leading to lower use of technology in the small-scale farming areas, which ends up not attracting the youth. How do we change that?

'Environmental changes and fluctuations will affect agricultural production in SADC countries...'

Photo: World Agroforestry

What do we still need to find out (known unknowns)?

What do we not know that we need to know? Where are the knowledge gaps? Give an example of a knowledge gap, e.g. we do not know the impact of technology on women's engagement in agriculture.

Photo: Wilsan - Unsplash

Learning

Using the three key horizon scanning questions you should now be able to **interpret information obtained from trends analysis and horizon scanning activities** and identify where there may be gaps.

Bringing in Evidence

Still within the analysis stage, we move on to the next method where we draw upon knowledge sources to provide evidence.

What is evidence?

Evidence - is the integration of raw data constituting numbers, words, images, and insights emerging from diverse knowledge sources (SHARED The Decision Hub, n.d.).

What is the method?

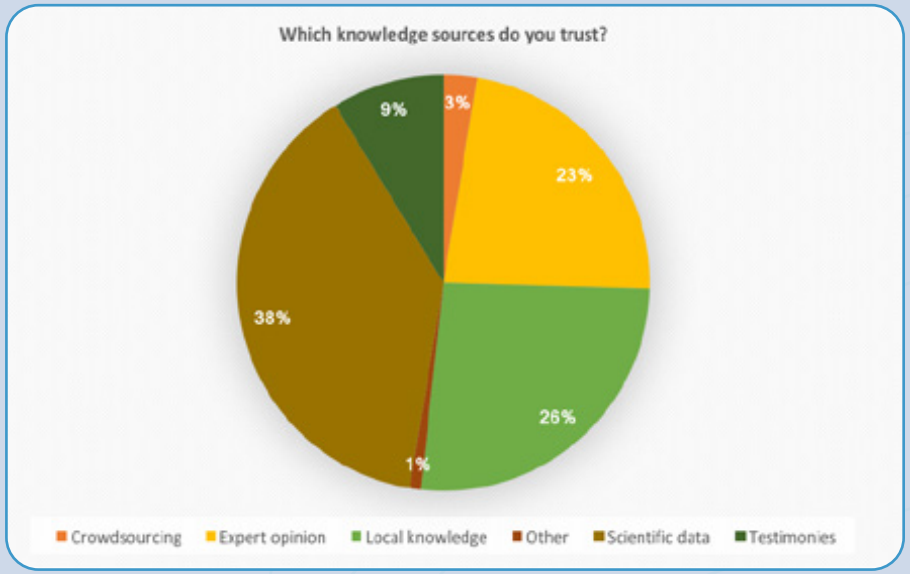
- **Integrating information** (e.g. raw data) gathered on a common theme from a variety of reliable sources (e.g. literature reviews, online surveys, the use of quantitative models or expert opinion).

Why apply it?

- To **develop a holistic, unbiased understanding of a topic** and to identify common patterns and trends.

A key question to ask when gathering information to provide evidence is: Which knowledge sources do I trust?

This question was posed to the participants of the SADC Futures Webinar Series. **The top three trusted sources were deemed to be scientific data (38%), followed by local knowledge (26%), and expert opinion (23%).**



As noted above, the **second most trustworthy data source given by the attendees was local knowledge (26%)**. Local or indigenous knowledge is commonly overlooked but provides a valuable source of information.

'Often we miss out on how local people are responding to climate challenges and resilience because of over reliance on science. We need to capture lived experiences.'

'Local knowledge from indigenous people is usually proven as it has been practiced for many years.'

'Local or indigenous knowledge is based on proven practices over time. Information is passed from one generation to the next.'

A key question to consider here is:
How do we include local knowledge when undertaking a foresight process?

The following methods can be used to incorporate local knowledge:

- **Consultation processes using participatory tools** - hold dedicated meetings in local languages using tools that are suited to low literacy levels, as required; and
- **Capture and integrate local knowledge** - formalise input from a participatory consultation process into stakeholder engagement meetings - e.g. grazing routes mapped onto spatial development plans.

Learning Exercise

Which of these **knowledge sources are relevant to your theme**: crowdsourcing, expert opinion, local knowledge, scientific data, testimonies, or other?

Which of the knowledge sources would you trust?

Accessing data can prove problematic, as was found through discussions with the SADC Futures Webinar participants:

'Accessing data locally is a hustle due to protocols and it is also not up to date.'

'Data in the national agriculture research institutions is very scanty. We can't analyse and come up with reliable recommendations for future directions and planning.'

A key question to consider here is: How do we manage data gaps when undertaking a foresight process?

Reliable data is an issue not just in Africa but globally. The following methods can be used to improve data gathering for a foresight exercise:

- **Establishing a data focal point** - this requires a dedicated person in your team who can track down and undertake personal interactions to obtain data;
- **Value of evidence and addressing protocols** - it is important to think about what evidence you need to obtain and to understand the protocols for data sharing and how to address them; and
- **Data inclusion and creating a sharing culture** - this requires a combination of lobbying and advocacy around evidence, clarity of attribution of data and prompting data sharing through sharing.

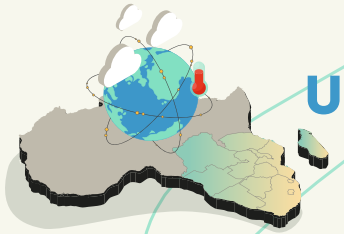
Questions & Answers

Climate events can have a high impact but data availability is poor, how do we manage this?

In the context of **climate data, the number of ground level weather stations has declined globally**. Fortunately, with advances in technology there are new data gathering methods. For example, remote sensing and other big data sources can be used in combination with existing ground level weather data (where available) to fill the gaps. Furthermore, some websites pull together household datasets such as from household weather stations around Sub-Saharan Africa.

Photo: Curioso Photography

Application in the Context of Climate Resilient Agri-Food Systems in the SADC Region



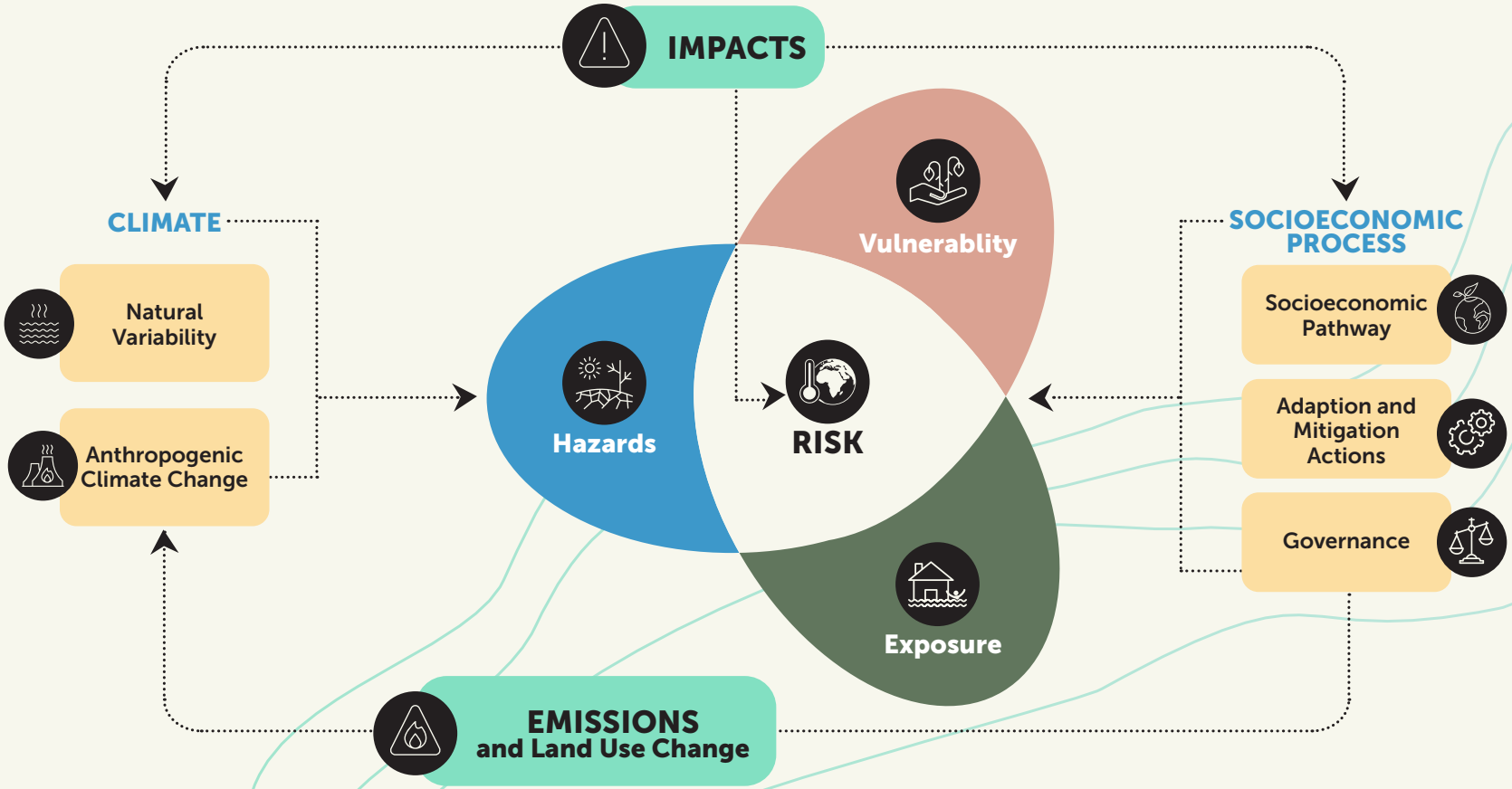
Understanding Climate Risks

In the context of climate resilient agricultural development in the SADC region, evidence on future requires investigation. The supplementary course report 'Rapid Climate Risk Assessment for the SADC Region' provides detailed information on this topic.

Climate risk - is the intersection of hazards, exposure and vulnerability associated with climate.

Climate risk is not solely a result of the hazard, it also requires consideration of the socio-ecological system i.e. exposure to the hazard and vulnerability of the system to the effects of the hazard.

The International Panel on Climate Change (IPCC) developed a framework for understanding climate risk. It shows that natural variability and climate change create climate hazards. Socio-economic processes influence exposure and vulnerability to these hazards. The natural and social systems result in climate change impacts on society and on the other hand, activities within social systems such as those that generate emissions and land-use change result in impacts on the climate.



Climate Risk Framework (Oppenheimer et al., 2014)

Questions & Answers

Does the IPCC framework work at different scales and coverage?

The framework can work at different scales/coverage, but it would likely require different indicators or climate parameters specific to the scale/coverage in question.

Photo: USAID

Climate Hazards

Hazard- a possible, future occurrence of natural or human induced physical events that may have adverse effects on vulnerable and exposed elements (Cardona, et al., 2012).

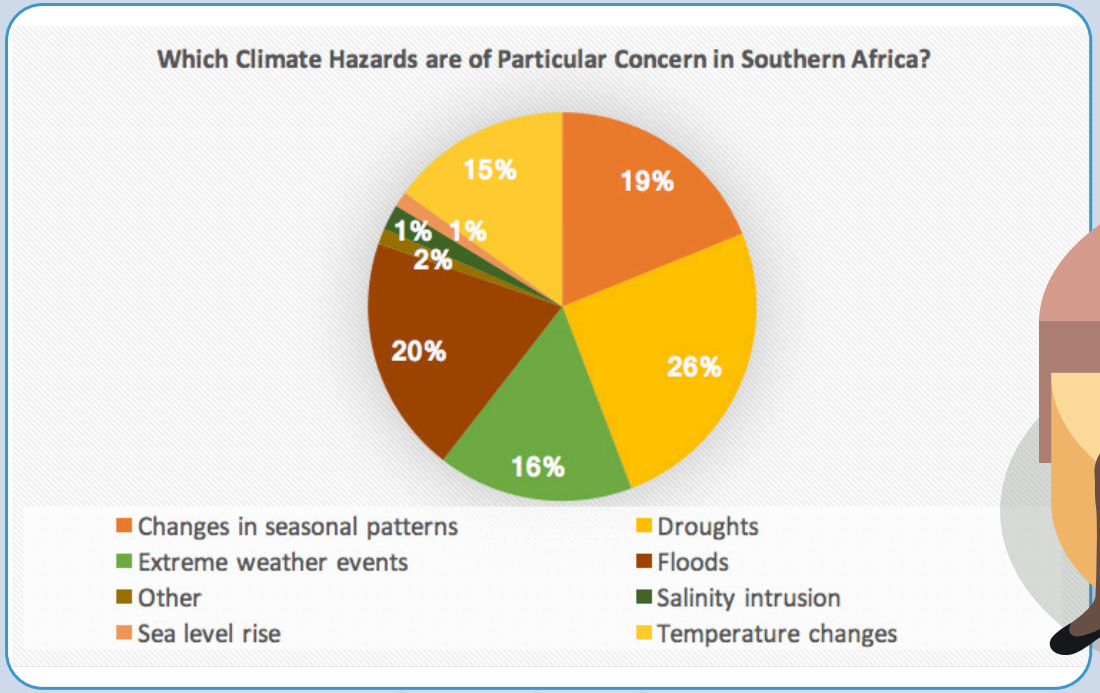
Essentially, a climate hazard has a negative effect that has the potential to cause harm or loss.

Climate hazards identified by GIZ[3] in their Adaptation to Climate Change in Rural Areas in Southern Africa (ACCRA) programme include:

- **Droughts;**
- **Floods;**
- **Extreme weather events;**
- **Salinity intrusion;**
- **Sea level rise;**
- **Temperature changes; and**
- **Changes to seasonal patterns.**

When questioned on hazards of particular concern in Southern Africa, the SADC Futures webinar series participants mentioned drought most frequently (26%), followed by floods (20%) and changes in seasonal patterns (19%). Climate hazards that were deemed to be of least concern were salinity intrusion (1%) and sea level rise (1%).

[3]Deutsche Gesellschaft für Internationale Zusammenarbeit

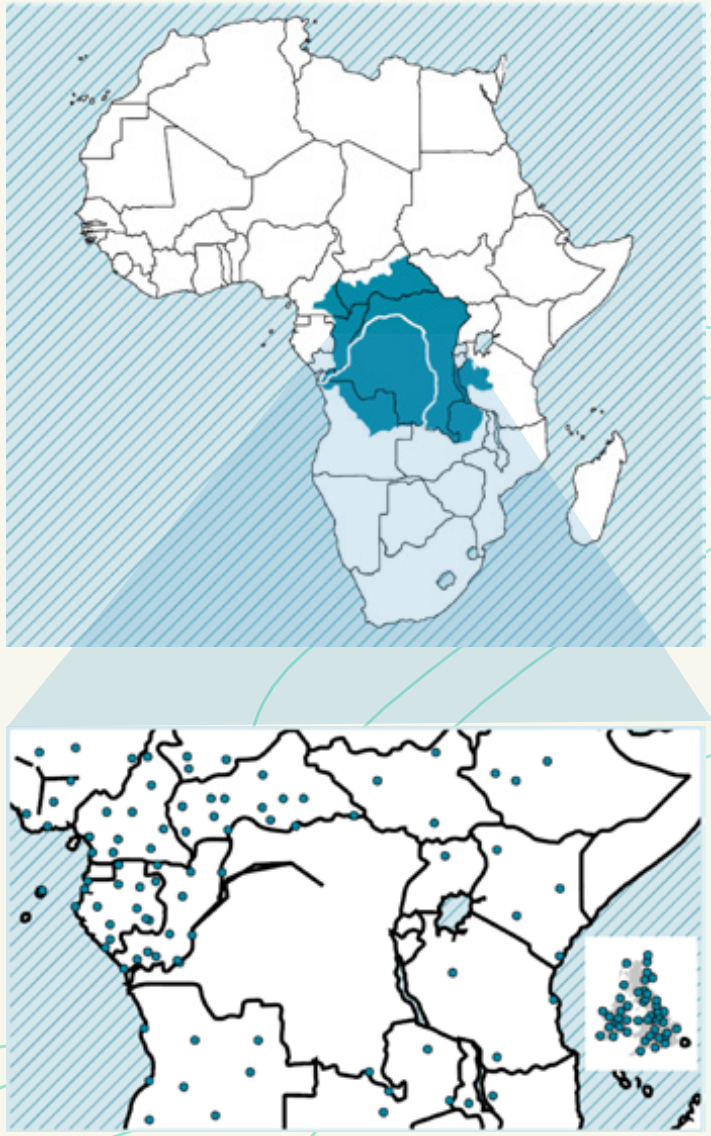


When considering these hazards, it is important to contemplate their magnitude (size), extent (area) and rate of change (speed). So, let us consider the following question:

What do we know about the future of climate change in Southern Africa?

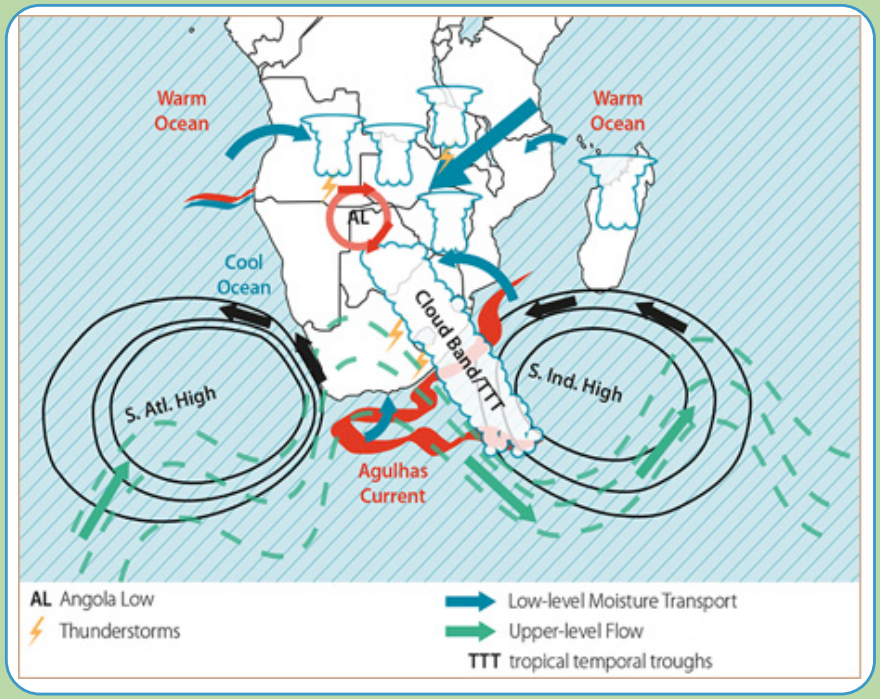
Evidence suggests that Central Africa, the Congo River catchment in particular, affects the global climate system. However, the climate in the area is severely under recorded and studied. There are very few weather stations in the DRC, this is made apparent when comparing the country's collection points with evidence of those in the rest of Africa and the United Kingdom. This provides a good example of a knowledge gap.

Severely Understanding with a Lack of Current Climate Information

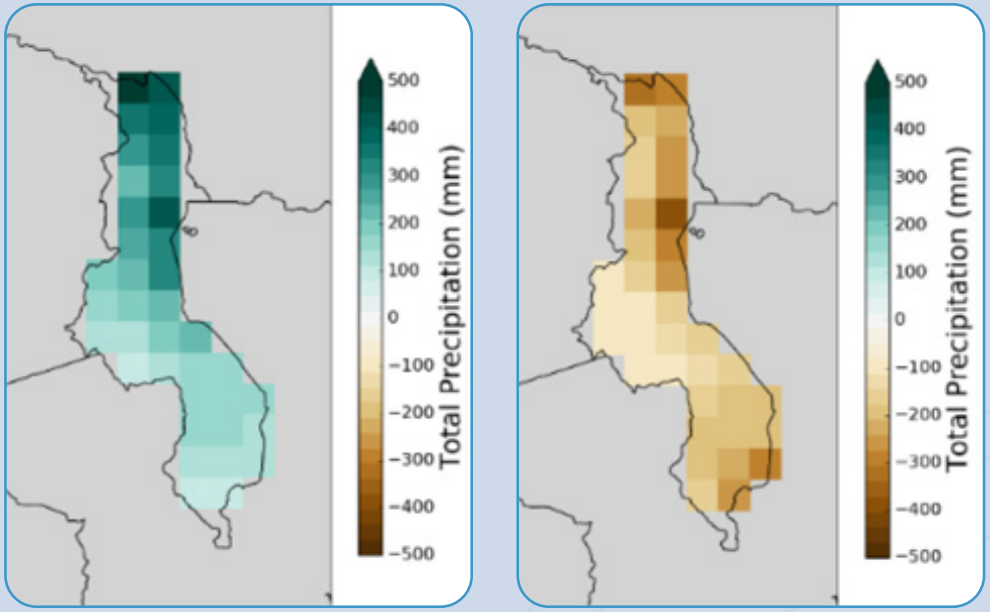


Severely understudied with a lack of current climate information

Climate in Southern Africa is subject to complex atmospheric and oceanic interactions such as the Southern Atlantic High Pressure System, the Southern Indian High Pressure System, the Angola Low Pressure System, tropical temporal troughs, the Agulhas current, the warm Mozambiquan current and the cool Benguela current. This creates uncertainty in projections.



Atmospheric and Oceanic Drivers of Climate in Southern Africa (UMFULA, 2019)



Model: IPSL-CM5A-LR

Model: HadGEM2-ES

Disparity Between Precipitation Model Results for Malawi for the Year 2100 (Future Climate for Africa, 2020)

Here are two different model outputs for Malawi for the year 2100. The one on the left projects an increase in rainfall and the one on the right projects a decrease.

The Malawian precipitation model results further highlight that the evidence gathered may present uncertainties. In foresight planning we need to consider gaps and uncertainties in data.

How do we deal with knowledge gaps and uncertainty in evidence during foresight planning?

In the case of the Malawian precipitation models, it would be important to use an ensemble of models to balance out the uncertainty.

Questions & Answers

Does a lack of data affect our understanding of climate risk?

Yes, our understanding is constrained by data gaps for example, gender inequality is an important component of vulnerability and therefore risk but without data to map the inequality it cannot be built into a climate risk assessment.

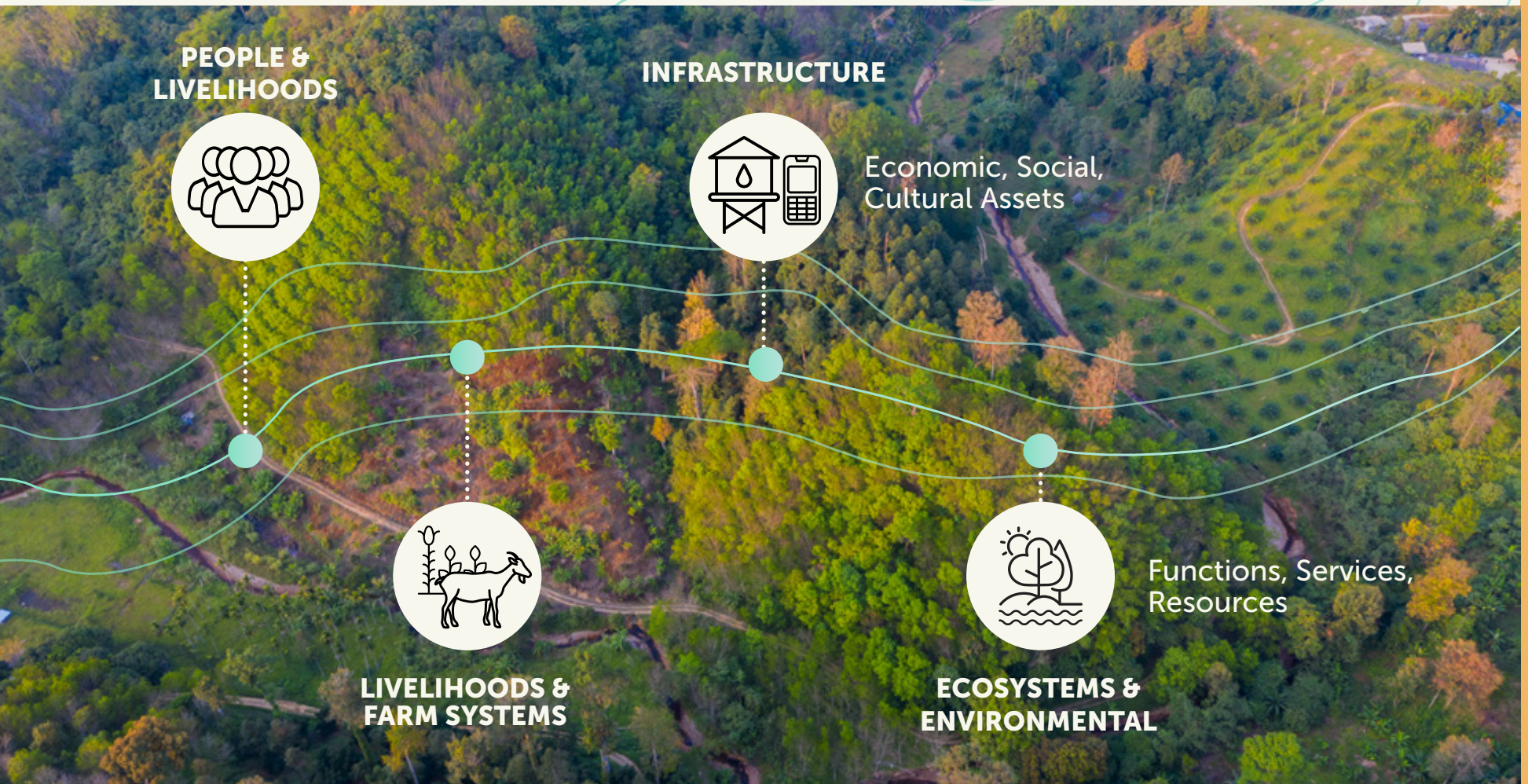
Exposure

The next section of the IPCC climate framework to consider is ‘exposure’.

Exposure - refers to the inventory of elements in an area in which hazard events may occur.

In the case of climate resilient agri-food systems in the SADC region, these elements could include people and livelihoods, ecosystems and environmental functions, services, and natural resources, infrastructure (economic, social, and cultural assets) as well as agro-ecological systems.

Unpacking Climate Exposure



Vulnerability

Climate risk is not focused solely on the climate hazard, it also includes the socio-ecological system i.e. the exposure of the elements to the hazard and the vulnerability of the system to the effects of the hazard.

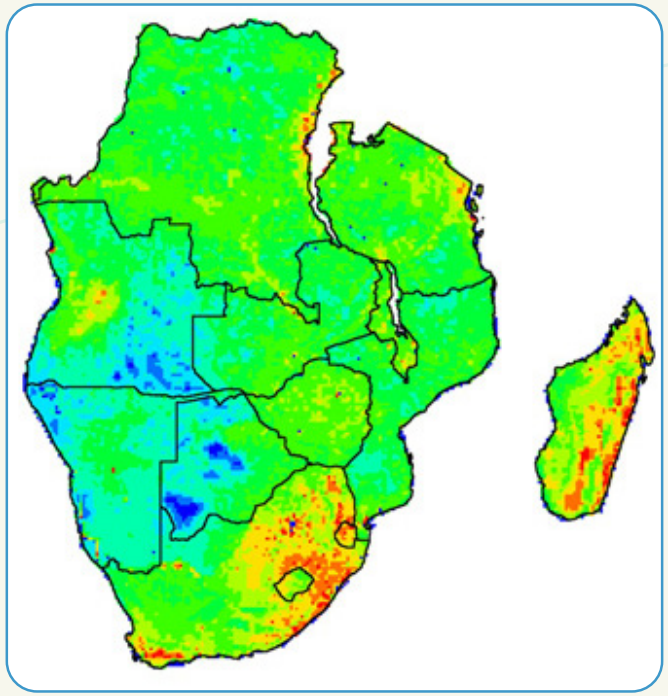
- **Vulnerability** - the propensity or predisposition of a system to be adversely affected by an event (Oppenheimer, et al., 2014).
- **Sensitivity** - is the degree (magnitude) to which a system is affected adversely or beneficially by climate variability or change.

What does this mean in the context of the theme?

Some systems or assets can absorb large impacts and continue to function whilst others are sensitive to even minor changes e.g. some plant species are very sensitive to temperature changes and become locally extinct, whereas others are more tolerant. This can be described as the 'adaptive capacity' of a system or element.

- **Adaptive capacity** - in this context is the ability of systems, institutions, humans, and other organisms to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.

Some biophysical elements that are vulnerable to climate change include soils, ecosystems, habitats, and species. Some ecological systems are vulnerable because they require quite a narrow range of conditions and lack the capacity to adapt as conditions change. This vulnerability has been mapped for the SADC region. The blue areas on the map denote low biophysical vulnerability, the red areas are more susceptible such as fynbos vegetation in South Africa or the eastern forests of Madagascar.



Biophysical Pressure Vulnerability in Southern Africa (Abson et al., 2012

Climate change vulnerability also includes social elements i.e. people and social systems. The level of vulnerability depends on a range of characteristics such as interactions, institutions, and systems of cultural values. Examples of social vulnerability to flooding are given below.

- Demographic
- Health
- Coping Capacity
- Neighbouring Characteristics
- Risk Perception
- Socio-Economic
- Land Tenure

Questions & Answers

Some climate risk models indicate both drought and flooding occurrence in the same area- how do we reconcile this?

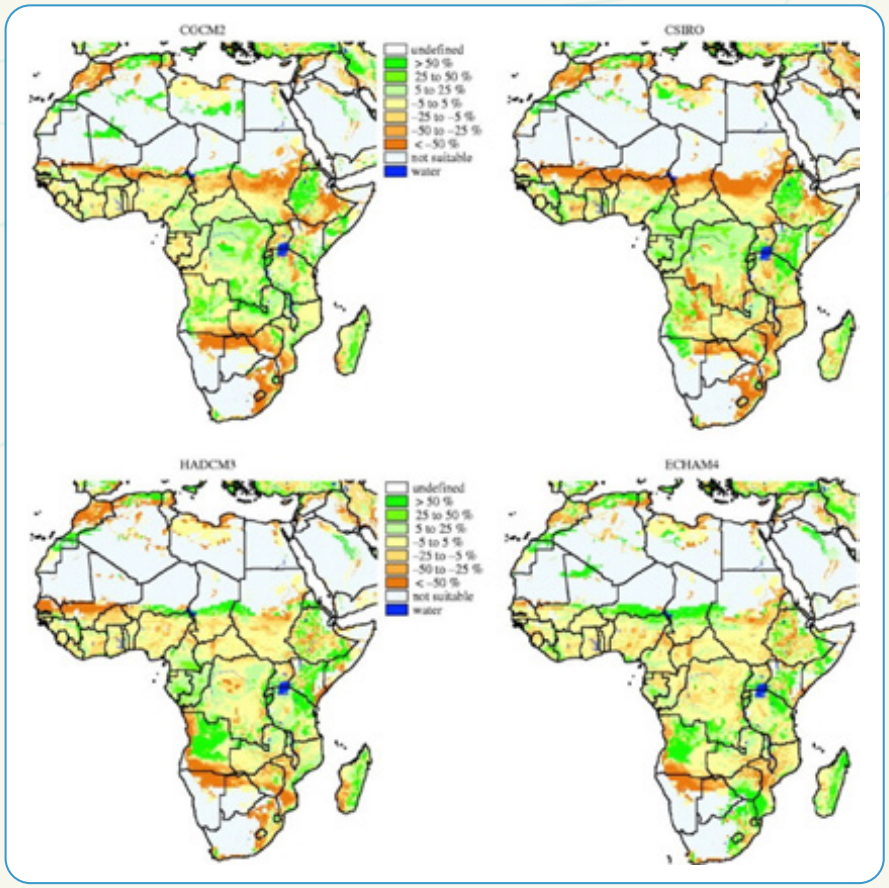
Drought and flooding can occur at the same location. A country or region could experience drought and then when it rains it is in the form of extreme rainfall events which causes flooding. Some areas are exposed to multiple climate hazards. It is important to consider all the hazards in planning.

We have now considered all elements of the climate risk framework. These elements can be used to examine future climate risk in Southern Africa. We now ask ourselves:

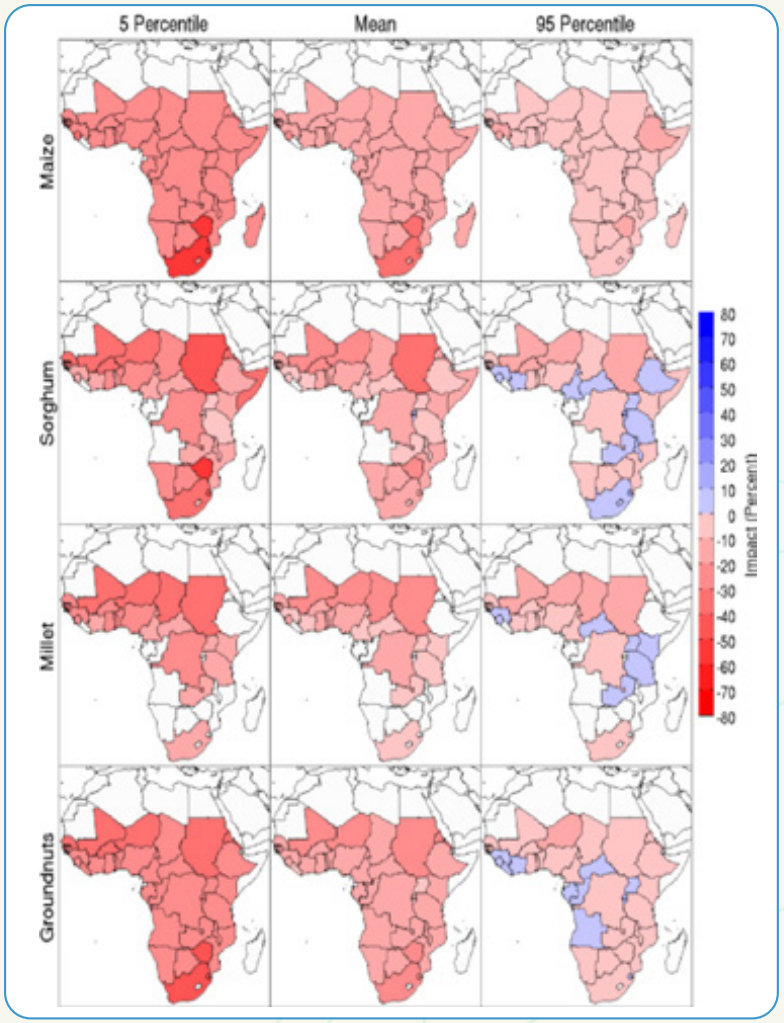
What is happening in Southern Africa in relation to future climate risk?

Myriads of climate risk studies have been conducted for the region. The approach by Fischer et al. (2005) uses climate models, crop models, and trade models to estimate future impacts on crop production. The model results show the spatial heterogeneity of climate impacts on cereal-production capacity, allowing for crop-switching and changes in crop calendars, in the 2080s relative to current climate, for climate projections by different GCMs, under SRES A2. Two important factors arise from aggregating the results. Firstly, the net balance of changes in cereal production potential for Sub-Saharan Africa was projected to be negative, with net losses of up to 12%. Secondly, there will be large variations in outcomes, with up to 40% of Sub-Saharan countries losing significant shares of their agricultural resources.

A study by Schlenker and Lobell (2010) incorporates crop and weather data as well as information from farmers such as switching planting calendars. The maps show the distribution of climate change impacts on yield (%) by country, the impacts are mostly negative (red). It is evident that the yields of four staple crops (sorghum, millet, maize, and groundnuts) in the region are likely to decline.



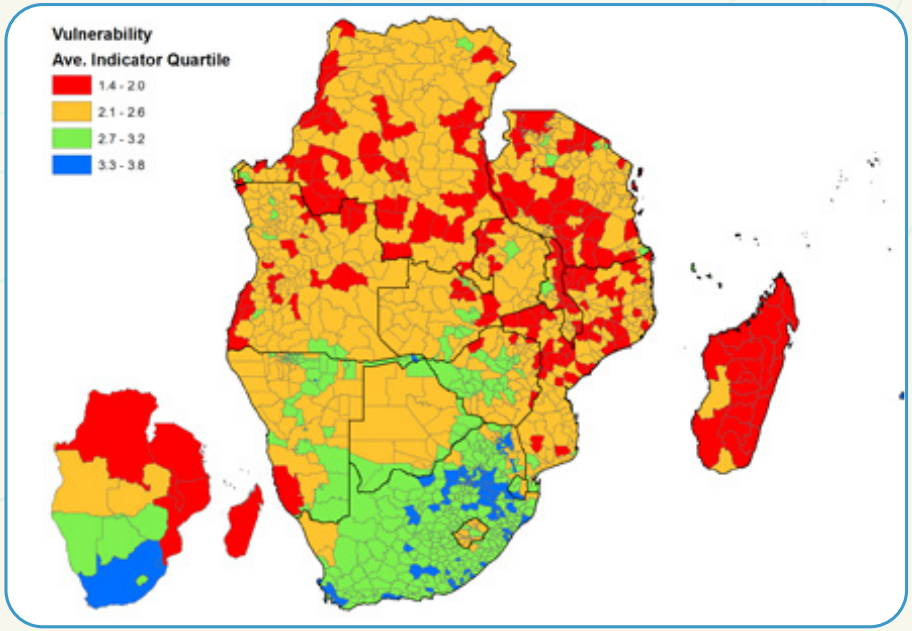
Future Impacts on Cereal Productivity in Africa (Fischer et al., 2005)



Crop Yield Response Models (Schlenker & Lobell, 2010)

More recent modelling of climate risk in Southern Africa by GCRF- AFRICAP[4] researchers looks at equally weighted vulnerability indicators for biophysical (crops and soils), social vulnerability (gender inequality, education, and governance), and economic (GDP) aspects. The study captures exposure as well as vulnerability. The research is based on current measures, not future projections. Data ranges from a regional scale down to district level, although district data proved difficult to access.

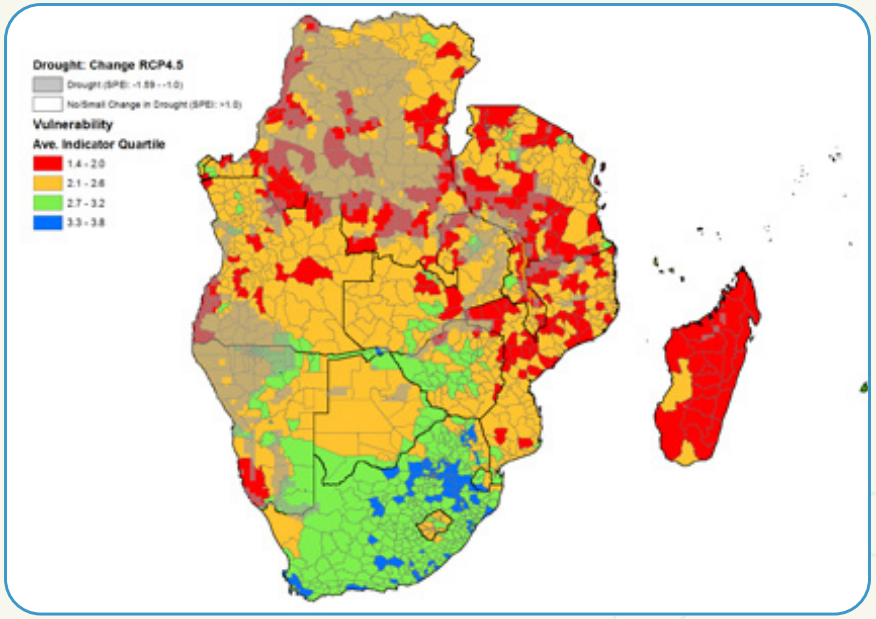
The results show areas of vulnerability and how they will intersect with hazards to create risk hotspots across the SADC region. The red areas indicate those that are most vulnerable, for example because of poor soils or low levels of education. The blue areas are the least vulnerable. The areas of SADC that are particularly vulnerable can be seen to be located to the north of the region, more specifically in Tanzania, DRC, Mozambique, and Madagascar.

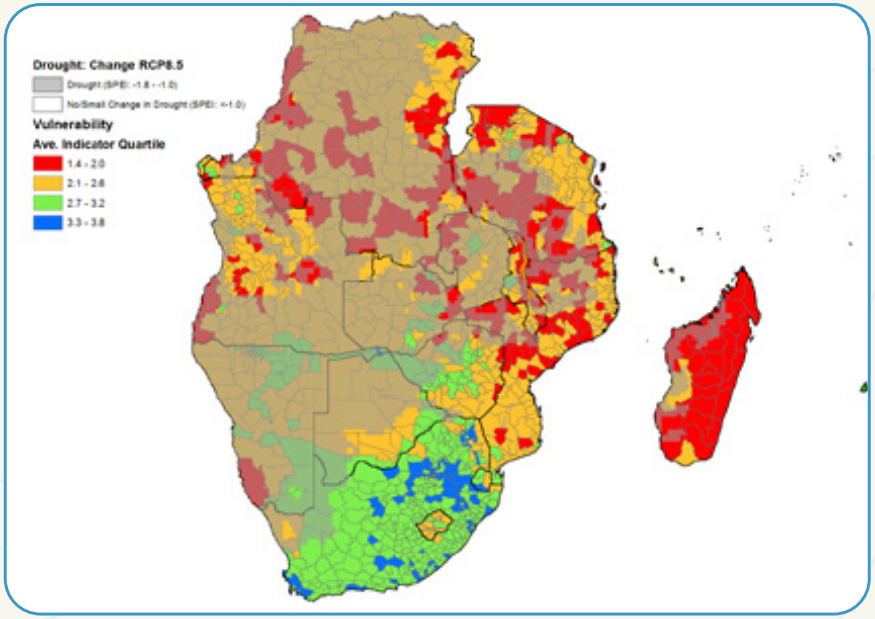


Vulnerability Results for a Climate Risk Model on SADC Region (GCRF-AFRICAP, 2020)

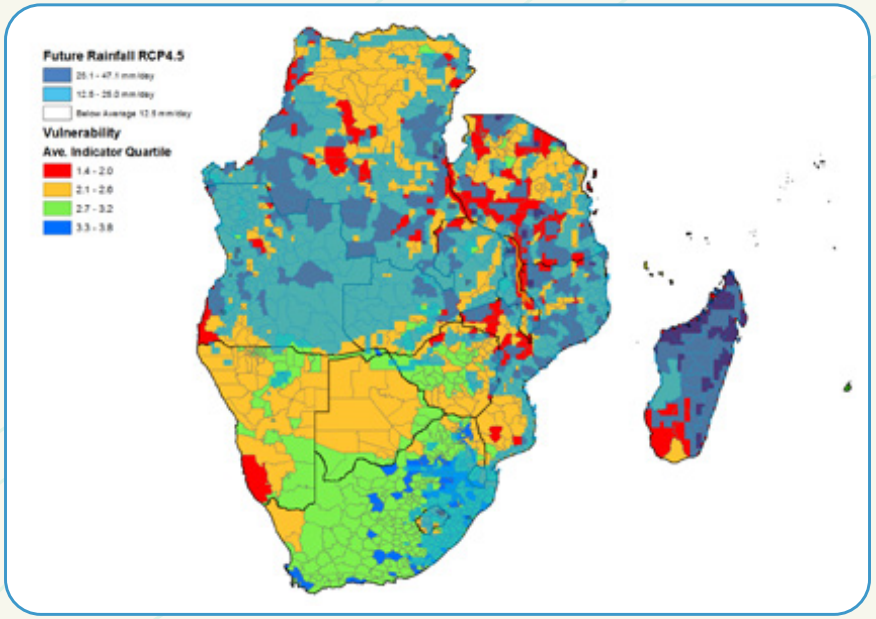
This map was then overlaid with data on drought and rainfall projections for the region. The map on the left illustrates an intermediate climate change scenario of a global temperature increase of 2.4˚C by 2100. The map on the right illustrates a worse-case future scenario with a global temperature increase of ~5˚C by 2100. The greyed areas show the extent of the region that will like experience drought in 2100. As the scenario worsens the area affected by drought expands.

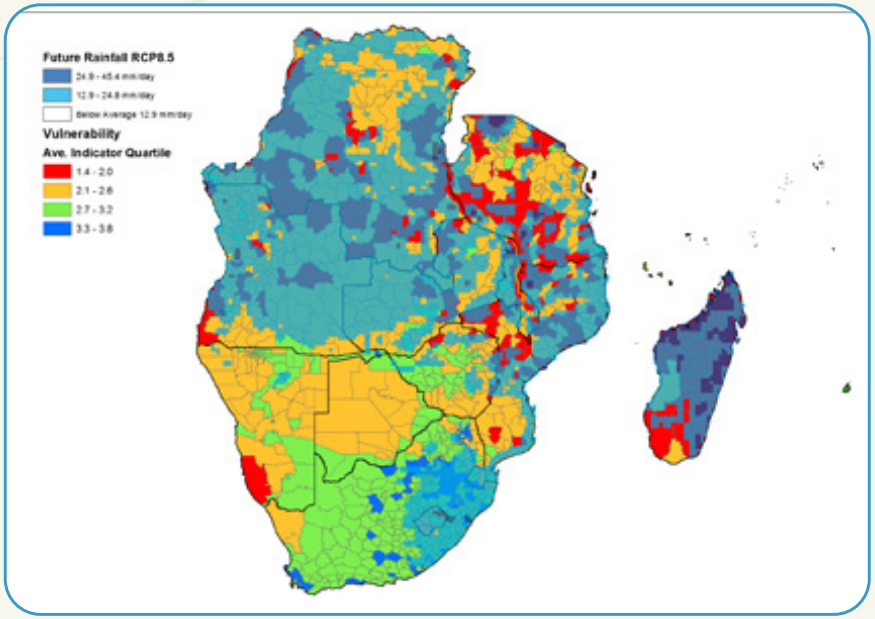
[4]Ongoing research by Global Challenges Research Fund (GCRF)- Agricultural and Food-system Resilience: Increasing Capacity and Advising Policy (AFRICAP).





The map on the left below illustrates areas affected by extreme rainfall events in the SADC region in 2100, assuming the intermediate scenario of a global temperature increase of 2.4˚C. The map on the right shows the areas affected by rainfall events in the SADC region in 2100, should the worse-case scenario of a global temperature increase of ~5˚C be realised. These maps show that the DRC, Angola, Madagascar, and the coast of East Africa will be impacted by extreme rainfall events.





Limitations of the Climate Risk Assessment

Gathering of evidence for understanding climate risk in the region was affected by:

- **The availability of data for vulnerability indices;**
- **Uncertainty surrounding the types of climate modelling used; and**
- **A lack of climate data for Africa.**

The evidence was used to identify hotspots i.e. areas where hazards, vulnerability and exposure intersect. These hotspots will allow for targeted adaptation interventions.

Questions & Answers

How can we plan for weather characteristics such as rainfall onset, cessation and duration for decision making at the community level?

Essentially, you cannot plan for these weather characteristics due to the level of uncertainty, but you can plan for the unknown. Futures work is about understanding that there is more than one version of the future. Furthermore, what you do today affects the future, for example it is important to understand how the weather and its uncertainty affects the decisions you make today and what that means for the future.

Learning

You should now know that **foresight techniques give us a process for considering alternative futures** by assessing trends and drivers and how they may play out. This process allows for medium to long term vision building to inform present-day decisions and actions. Furthermore, you have learnt techniques for dealing with data gaps and data uncertainty.

Interpretation Stage

The interpretation stage follows on from the analysis stage. This is where foresight differs from strategic planning, here we include a 'pause' to understand why something is happening?

INPUT	ANALYSIS	INTERPRETATION	PLAN	PROSPECTION	REFLECTION	STRATEGY
Context	What is happening?	**Why is it happening?**	What do we want to experience in the future? What might get in our way?	What might happen that we have not thought about?	What might we want to do differently?	What will we do differently?
			What might we do to get there?			

- Systems Mapping
- Cross sectoral and multi-stakeholder approaches

A systems approach incorporating systems mapping and cross sectoral and multi-stakeholder linkages is used to answer the key question:

Why is it happening?

Systems Mapping

Systems mapping is a tool that falls within the interpretation stage. Systems, from a global level down to a local level, are shaped by different interacting factors or drivers. Drivers can be direct, in which case they undeniably influence a system, or indirect (underlying), where they alter one or more direct drivers (Forward Thinking Platform, 2014).

What is the method?

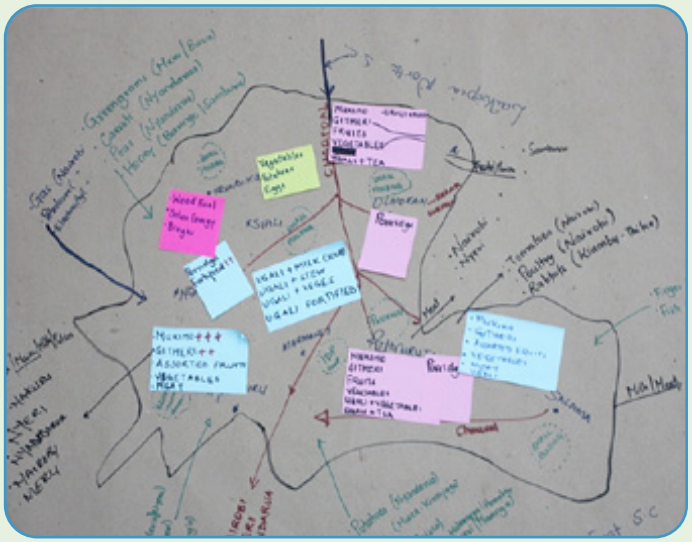
- Systems mapping provides a visual way of exploring the system, its elements, connections, and complexity.

Why apply it?

- Mapping systems can be used as a basis for understanding actors and their relationships, issues, and the influence of trends.

Why do we do systems mapping in foresight?

Systems mapping allows us to look at the elements, actors, and relationships of a system. It serves in getting stakeholders to share their insights, potentially divergent perspectives, and interact and dialogue as the map is developed.



Who does systems mapping?

As much as possible stakeholder representatives within the system of focus should be involved in mapping.

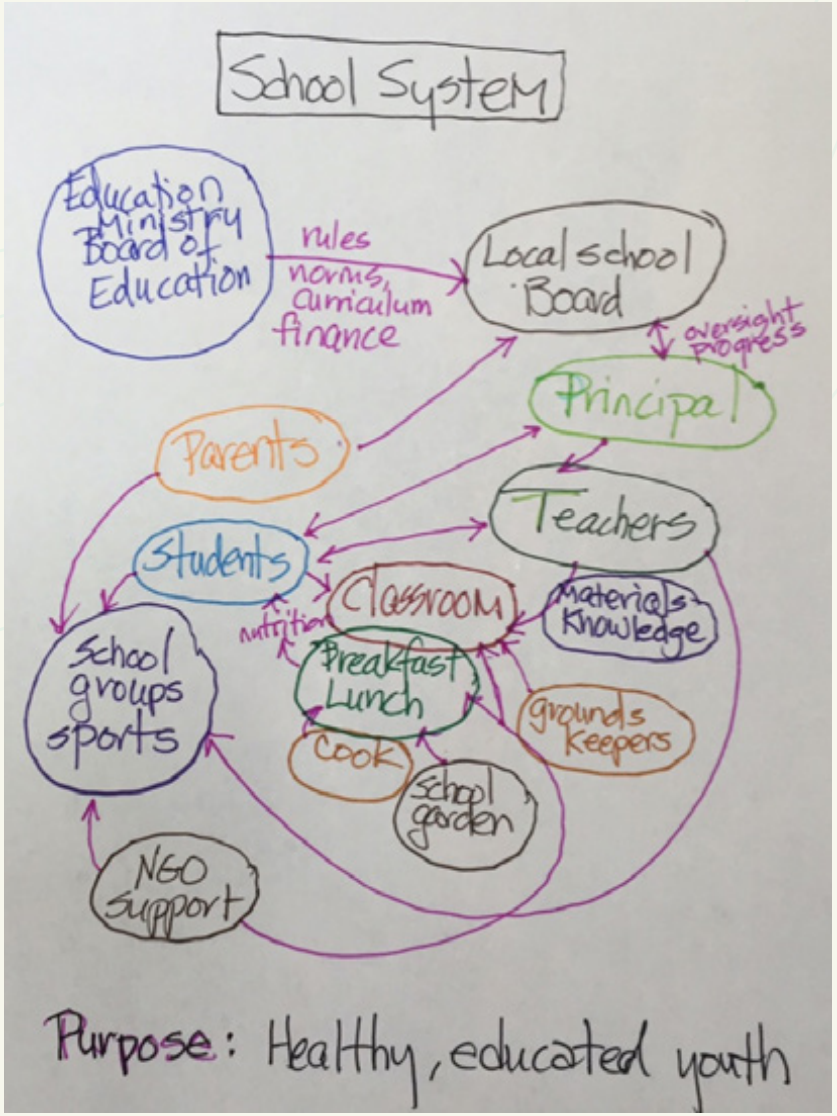
System - is an interconnected set of elements that is coherently organised in a way that achieves something (function and purpose).

Systems view - is an understanding of life as networks of relationships.

Systems thinking - is a mindset, tool and process that is reserved for complex problems.

Learning Exercise

Using the above definition of a system, **think of a school, what elements does it consist of and how are they connected**? What is the purpose of the system? Using different coloured pens and a large piece of paper, map the elements of a school system and their relationships. Does your map look similar to the example on the right?



Systems mapping is carried out following four key steps:

Key Steps for Systems Mapping

- Consider which system is relevant to the scope;
- Visualise the system and understand the stakeholders;
- Identify the drivers that are influencing the system; and
- Build multi-stakeholder and cross-sectoral relationships.

Key terms related to a systems map include:

Elements - the different, discrete elements within the system (e.g. farms, organisations, inputs, and soil).

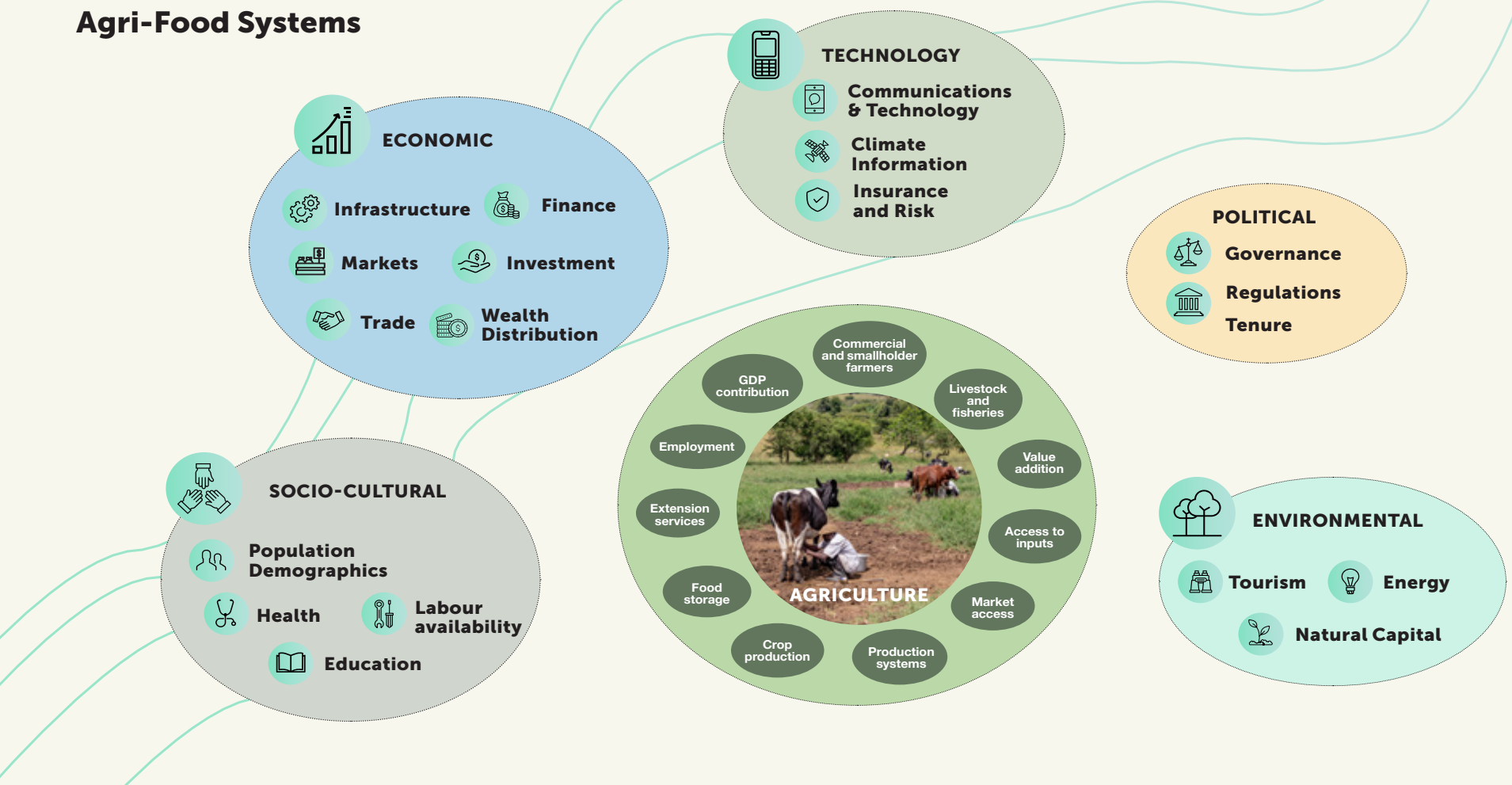
Interconnections - these are the relationships that connect the elements (e.g. rules, ideas, funding or service relationships, among others).

Function and purpose - the purpose of the system is around the outcomes the system is meant to achieve (e.g. food security outcomes and increased livelihood streams).

Step 01 Consider Which System is Relevant to the Scope

Using the scope method, we unpacked agri-food systems. The core agricultural theme was found to be complex, constituting numerous different elements such as production systems, employment, and food storage. Furthermore, the agri-food systems sit within and amongst other ecological, social, political, and economic systems. These interconnected systems and sectors affect outcomes such as production and food security in the region. (For detailed information on this topic refer to the SADC Futures knowledge series supplementary report, 'Systems Analysis and Sectoral Linkages Impacting Climate Resilient Development in the SADC Region'.)

Agri-Food Systems



Learning Exercise

When setting your theme using the scope method, you wrote down your thoughts on what makes up, affects, or is affected by, the system at the core of your theme and grouped the external systems and drivers of change according to categories. Use this as a base for completing the systems mapping steps to follow.

Step 02 Visualise the System and Understand the Stakeholders

Step 2 of 'systems mapping' is to **create a detailed diagram of the system**; this can be split into three activities:

- Establish the related elements and stakeholders;
- Make connections to show the relationships; and
- Show the outcome or the purpose of the system.

Establish the Related Elements and Stakeholders

Key questions to consider for this activity are:

Who works together?
Who needs to work together?

Learning Exercise

Consider the school system map. Who are the key role players and who works together?

Who would **benefit from working together** with other stakeholders? Key stakeholders would likely include the principal, teachers, and students.

The principal and teachers work together to provide education to the students. To assist the students with achieving good results, it could be beneficial for the teachers and the students' parents to work together e.g. encouraging a set time for homework. Now consider the questions in the context of your chosen theme. Document your findings on a piece of paper.

Photo: Alex Fassio (CIFOR)

Application in the Context of Climate Resilient Agri-Food Systems in the SADC Region

In the context of climate-resilient agri-food systems in the SADC region, the system in question could include the following related elements and stakeholders: the **farm, the residents, elements of production such as livestock, crops, trees, and aquaculture**. The farmer makes management decisions which affect the land and productivity. The family or labourers need to work with the farmer to implement the decisions to realise the preferred outcome.

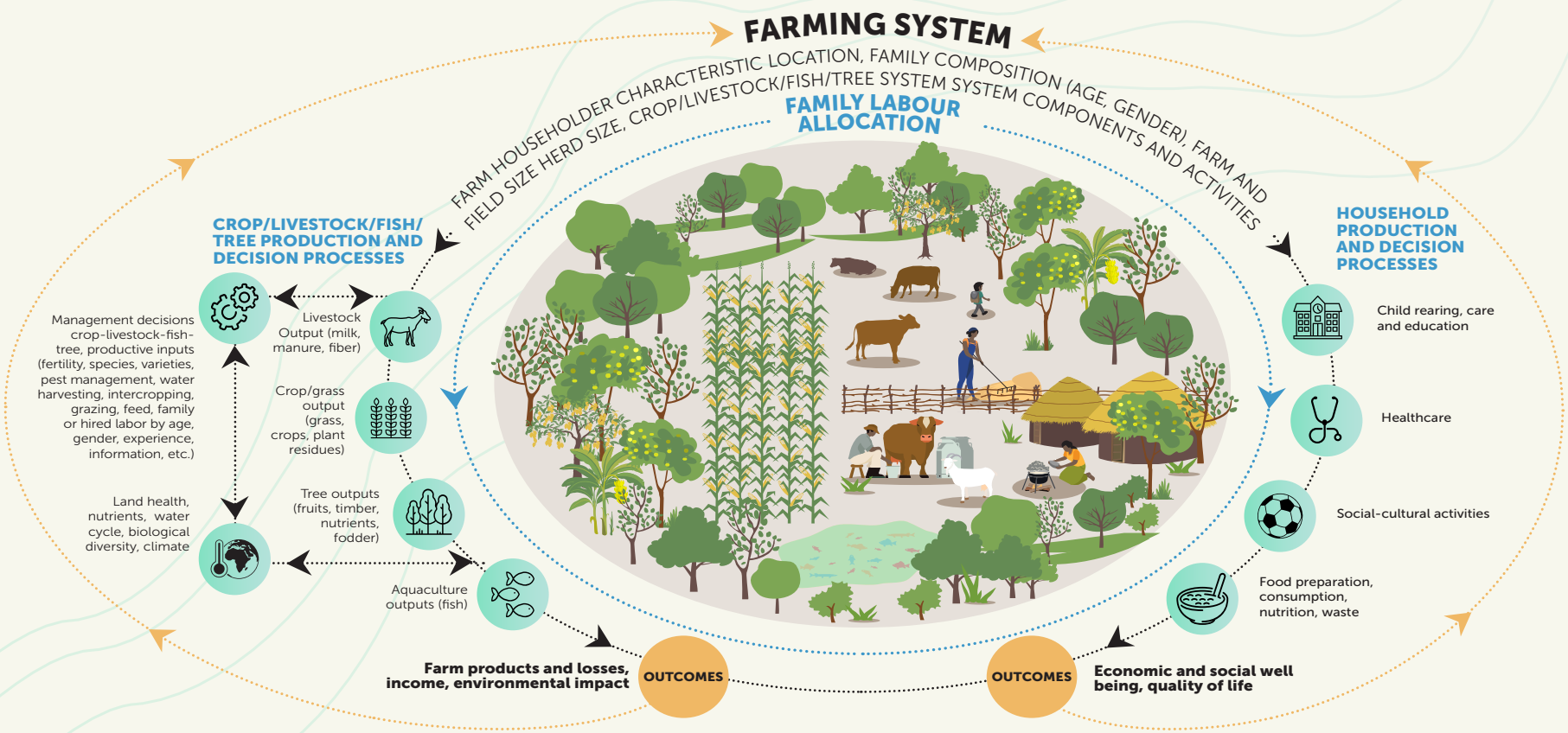


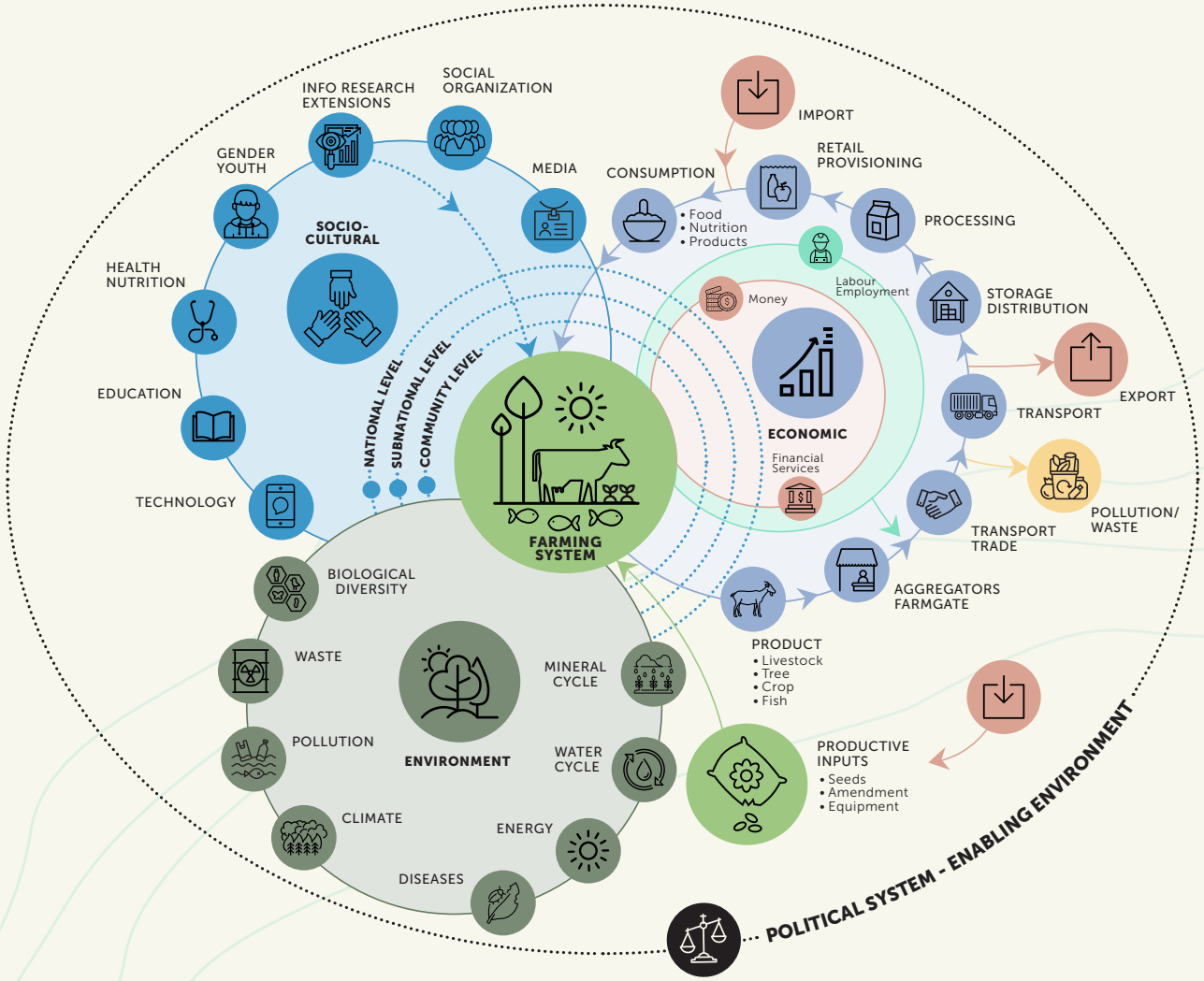

Photo: Neil Palmer (CIAT)

Making Connections and Showing Relationships

Farming systems do not occur in isolation, there are other dimensions that either influence or are influenced by the farming system. It is important to show these connections and relationships to fully understand the system. For example, the diagram below shows that there is a connected environmental dimension which includes biodiversity, energy, and water. There is also a connected economic dimension which includes value chains for the products, exports, imports, consumption, labour, finances, and waste. The relationships between the different dimensions and the farming system are shown with connecting lines, arrows, and spheres.

Learning Exercise

Think of the **socio-cultural dimension in relation to the farming system**, unpack the elements and determine the connections. What are the socio-cultural inputs and outputs? Think of the **STEEP categories**, what is missing? Use the diagram below to guide you.



Show the Outcome or the Purpose of the System

The purpose of an agri-food system could be to produce food products in return for financial gains. The outcomes of an agri-food system (can be positive or negative) include:

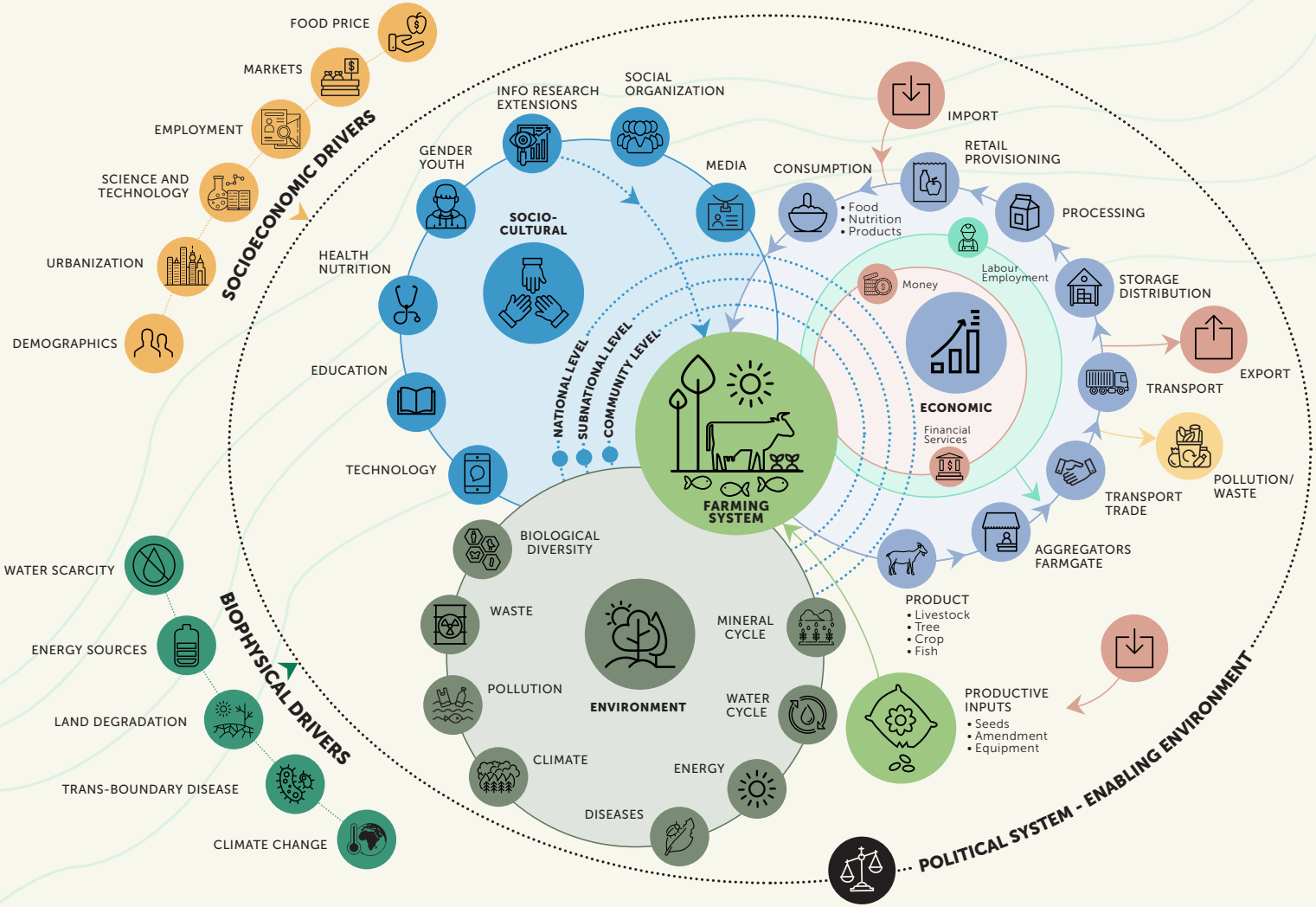
- **Food and nutritional security** e.g. cereal and dairy products;
- **Socio-economic outcomes** e.g. employment; and
- **Environmental outcomes** e.g. land degradation and water scarcity.

Learning Exercise

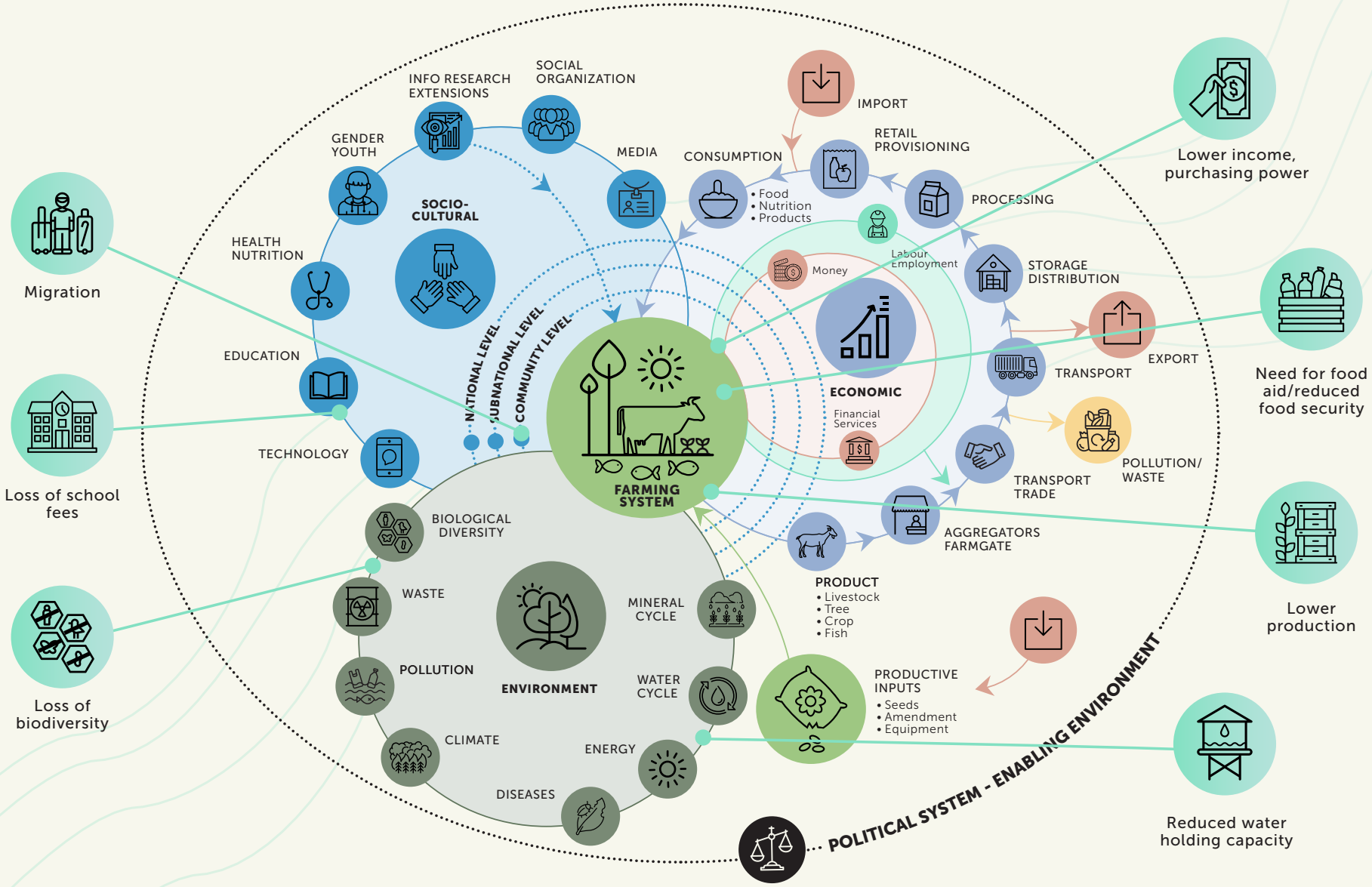
When developing your systems map, you would gather your foresight group for a brainstorming session. Using a white board or a large piece of paper and a multitude of coloured pens. **Group the dimensions that influence or are influenced by your system in question according to the STEEP categories explained previously**. Show the relationships and connections between them using arrows, connector lines and overlapping spheres. A hand drawn example of a farming systems map, that could be produced in a workshop, is provided below.

Step 03 Identify the Drivers that are Influencing the System

The systems map can also be used to **document drivers of the system.** For example, as part of the agri-food systems there are socio-economic drivers such as employment, science and technology, markets, urbanisation, demographics, and food prices or biophysical drivers such as water scarcity, energy sources, land degradation, transboundary disease, and climate change. See the annotated drivers in the diagram below.

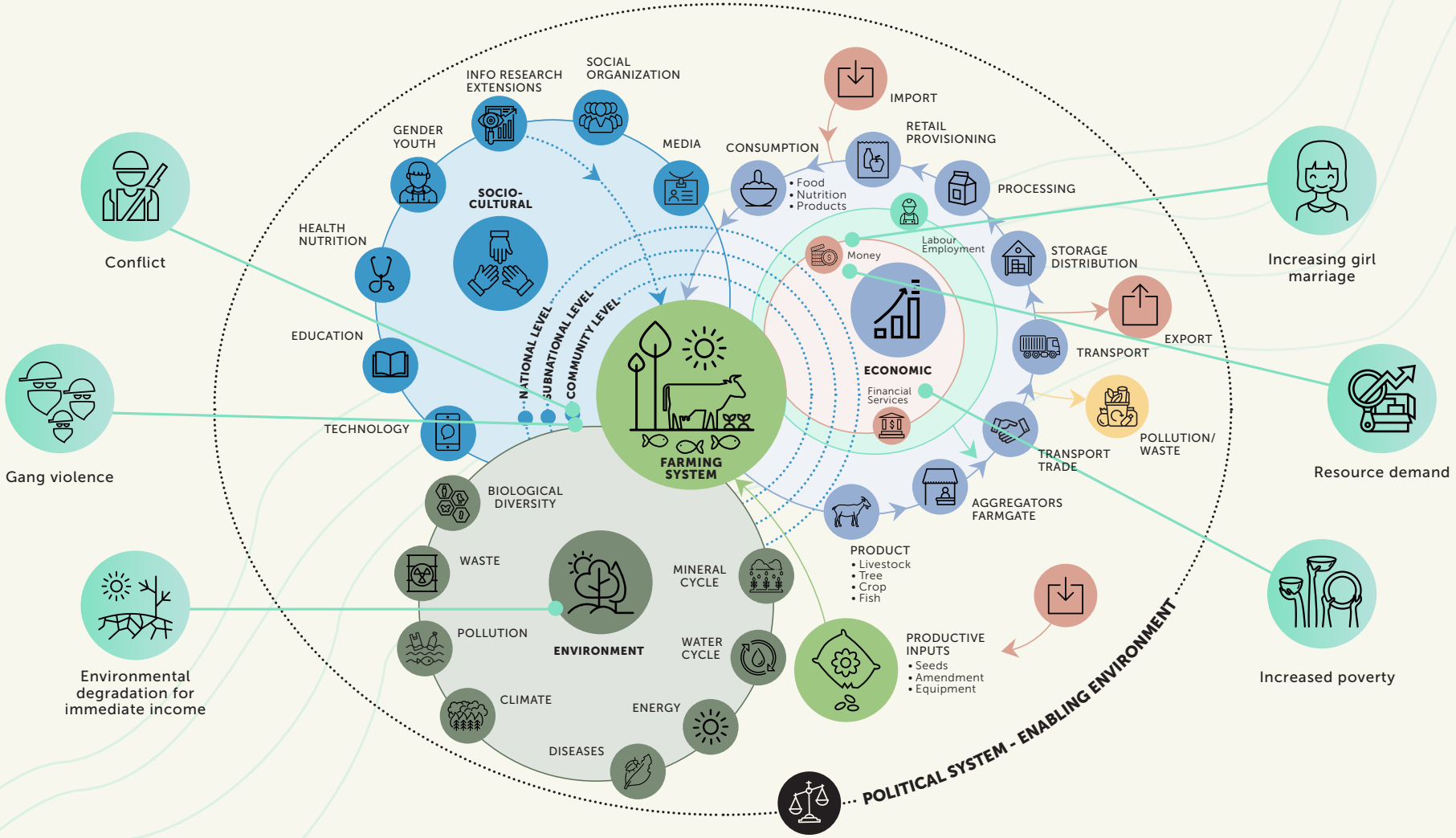


Once the systems map and drivers are complete it is important to **consider the drivers carefully and understand their implications**. For example, the driver 'land degradation' could result in negative outcomes such as lower income, reduced food security, lower production, reduced water holding capacity, migration, loss of school fees, and loss of biodiversity. See the diagram below for the possible outcomes of land degradation and how to map them.



Learning Exercise

Take a moment to consider what the outcomes of the **social driver youth unemployment** would be? How would **youth unemployment affect the farming system**? See the diagram below for some examples of outcomes.



It is important to recognise that a **driver will likely affect multiple dimensions of a system**. For example, as shown in the diagram above, youth unemployment impacts on the environmental, socio-cultural, and economic dimensions of the farming system.

Step 04 Build Multi-Stakeholder and Cross-Sectoral Relationships

As mentioned previously, the **foresight tools and methods learnt can be applied across multiple stages in the foresight framework**. In this light, the next step is to build multi-stakeholder and cross-sectoral relationships.

- **Multi-Stakeholder Collaboration** - consists of a mix of representatives or stakeholders from public, civil, and private domains of society.
- **Cross-Sectoral Coordination** - the engagement, management, planning and implementation of activities conducted across different thematic sectors to deliver development outcomes (e.g. food security, nutrition, sustainable landscapes, and agriculture).

Learning Exercise

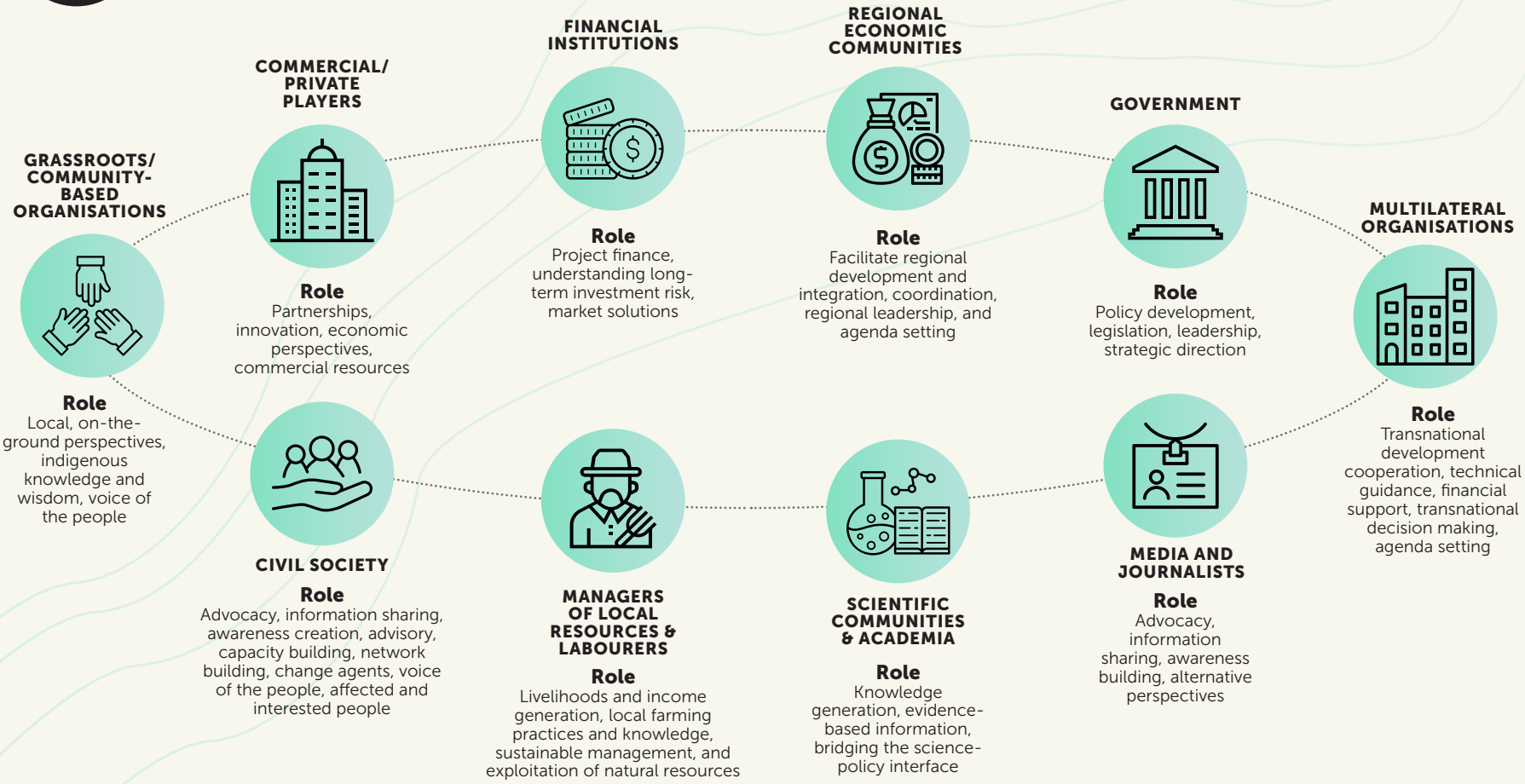
In defining the scope, you identified and listed stakeholders relevant to your theme. You drew a basic stakeholder map showing the relationships between key stakeholders. Use this work as a base for carrying out the steps that follow.

Application in the Context of Climate Resilient Agri-Food Systems in the SADC Region

For the purposes of the **climate-resilient agri-food systems theme, multi-stakeholder collaboration consists of a mix of representatives or stakeholders from public, civil, and private domains of society**. Cross-sectoral refers to the different themes and for the purposes of the context of this foresight exercise, predominantly those associated with government sectors.

Multi-Stakeholder Collaboration

The **stakeholder groups** that would be important to include for the purposes of climate-resilient agri-food systems in the SADC region are provided in the figure below.



Key questions to consider when identifying stakeholder groups core to your theme include:

Who is at the table when you are planning your foresight process? Who is at the table when you are conducting the foresight exercise?

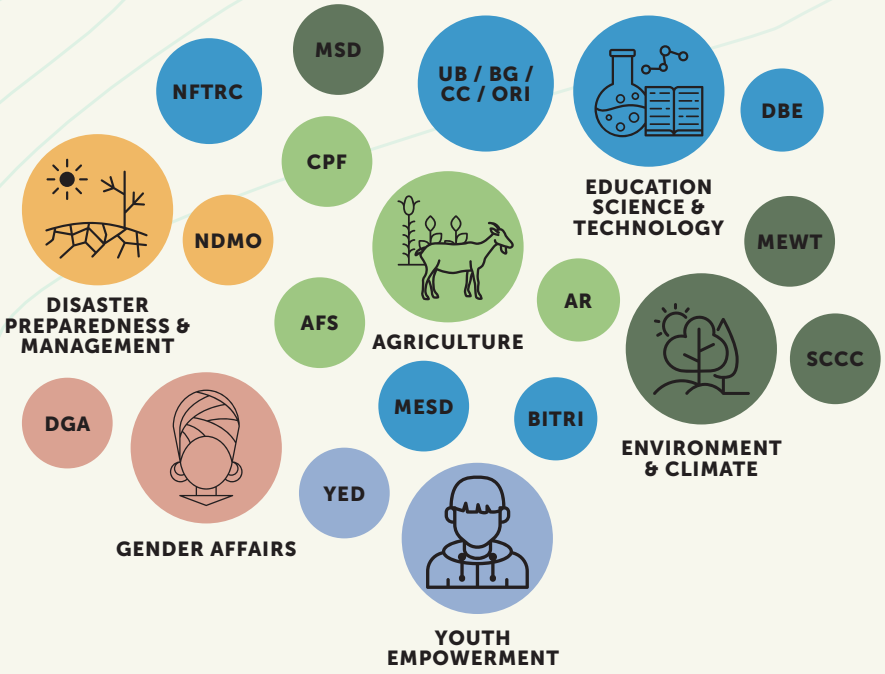
Questions & Answers

Should systems mapping incorporate both interested and affected stakeholders?

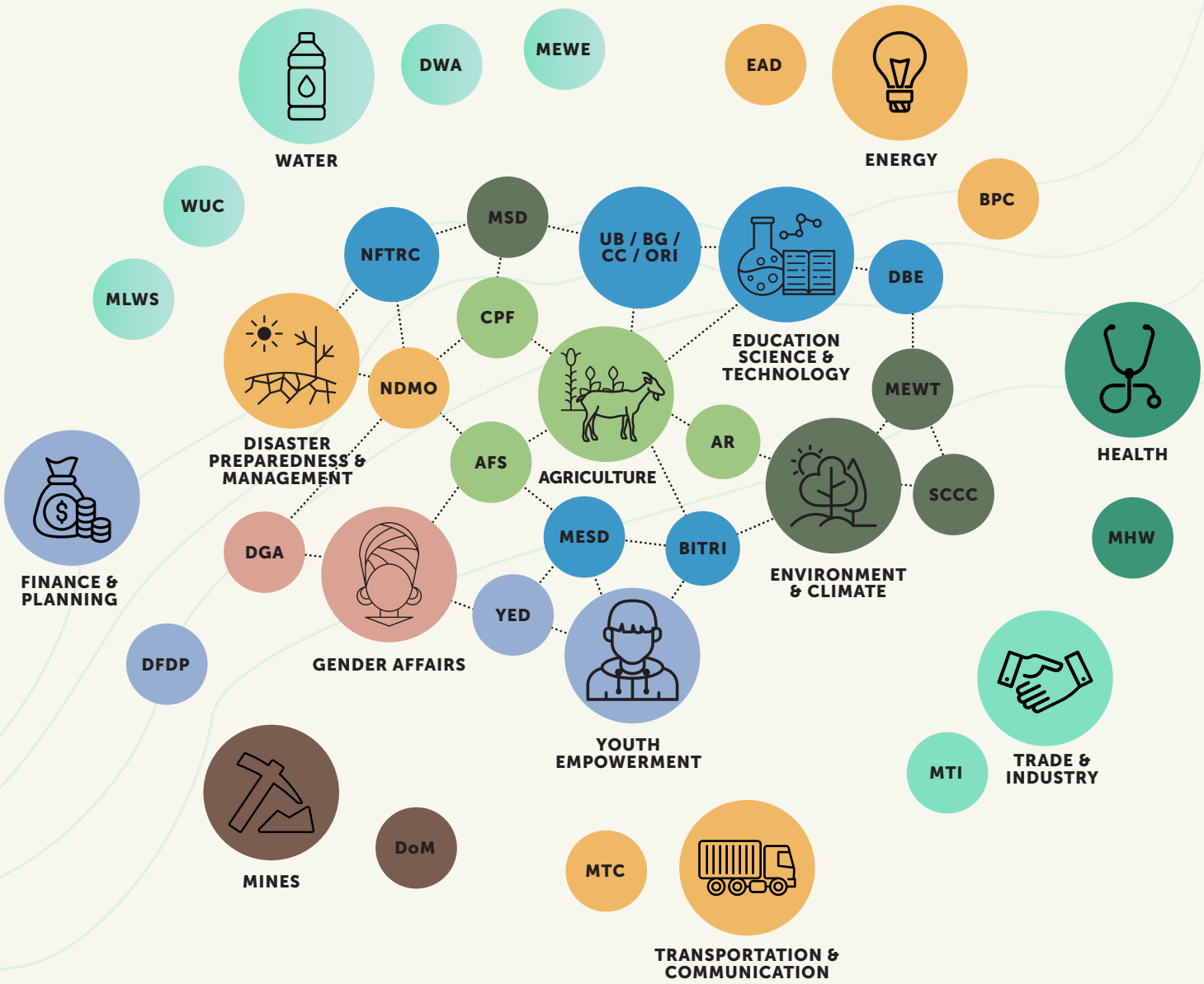
Yes, it is important to use an integrated approach to systems mapping that incorporates interested, affected and influential stakeholders.

Cross-Sectoral Collaboration

For the purposes of the chosen theme it is important to look at the **'government' stakeholder group** in more detail. Systems mapping can assist with this. Firstly, the focus is narrowed as we consider core ministries and departments working on climate change in Botswana e.g. education, science, and technology; environment and climate; agriculture; disaster preparedness and response; gender affairs and youth empowerment. It is important that the ministries and departments in these different sectors have an integrated approach to climate change in the country. They need to know each other's roles and responsibilities within the context of systems thinking.



There is a much wider **network of ministries and departments across other sectors that would also need to be included due to the nature of climate resilience**, for example, finance and planning, water, energy, and health. These networks and relationships need to be built upon so that the right people are brought to the table.



In an ideal situation you would include stakeholders from all sectors, and they would have a systems view. They would focus on their respective area but understand, respect, and interact with the other stakeholders. The outcome of this would be the ability to talk freely about what stakeholders give and what they get from each other i.e. the different sectors, ministries, and departments, within the given theme.

In summary, **building relationships throughout the foresight exercise is important for enhancing cross-sectoral coordination and stakeholder collaboration** for strategy development and implementation. The end products are transformative strategies for development which are much more inclusive.

Questions & Answers

How can we use systems mapping to better understand climate risk?

The IPCC framework shows the interaction between socio-cultural and environmental processes. This highlights the need for a multi-stakeholder and cross-sectoral approach. Specialists can gather data for in depth assessments within their areas of expertise and bring the evidence to the table for discussion with people from different backgrounds and with different perspectives. They can use systems mapping to identify areas that have not been thought of.

Systems mapping can also be useful in understanding:

- How different stakeholders perceive how the system functions;
- Where knowledge about the system is underdeveloped;
- What evidence is available; and
- What will happen if we intervene in one aspect of the system i.e. what repercussions will the actions have on other areas of the system.

Learning

You should now understand the **importance of multi-stakeholder and cross-sectoral relationship building and engagement in foresight planning**. You know that a systems' understanding among stakeholders is the first step to creating meaningful change in the system and for developing robust strategies through the foresight process.

Photo: Axel Fassio (CIFOR)

References

Abson, D., Dougill, A., & Stringer, L. (2012). Spatial mapping of socio-ecological vulnerability to environmental change in Southern Africa. Sustainability Research Institute, Leeds Unversity.

African Development Bank; African Union; United Nations Economic Commission for Africa. (2020). Africa Regional Integration Index Report 2019. Addis Ababa.

Bourgeois, R. (2012). The state of foresight in food and agriculture and the roads toward improvement. Presented at the Global Conference on Agricultural Research for Development.

Cardona, O., van Aalst, M., Birkmann, J., Fordham, M., McGregor, G., Perez, R., . . . Sinh, B. (2012). Determinants of risk: exposure and vulneraility. In C. Field, V. Barros, T. Stocker, D. Qin, D. Dokken, K. Ebi, . . . P. Midgley, Managing the risks of extreme events and disasters to advance climate change adaptation. (pp. 65-108). Cambridge, UK; New York, USA: Cambridge University Press.

Chilonda, P., Matchaya, G., Chiwaula, L., Kambewa, P., Musaba, E., & Munyamba, C. (2013). Agricultural growth trends and outlook for Southern Africa: Enhancing regional food security through increased agricultural productivity.

Cleland, J., & Machiyama, K. (2016). The challenges posed by demographic change in sub-Saharan Africa: a concise overview. Population and Demographic Review.

Davis-Reddy, C., & Vincent, K. (2017). Climate risk and vulnerability: a handbook for Southern Africa, 2nd ed. . Pretoria: CSIR.

Fischer, G., Shah, M., Tubiello, F., & van Velhuizen, H. (2005). Socio-economic and climate change impacts on agriculture: an integrated assessment, 1990-2080. Philosophical Transactions of the Royal Society, 2067-2083.

Forward Thinking Platform. (2014). A glossary of terms commonly used in future studies.

Future Climate for Africa. (2020). Malawi. Retrieved from Future Climate for Africa: https://futureclimateafrica.org.

GCRF-AFRICAP. (2020). Climate Resilient Development Pathways for Agriculture in the SADC Region. Unpublished.

Jayne, T., Chamberlin, J., Traub, L., Sitko, N., Muyanga, M., Yeboah, F., . . . Kachule, R. (2016). Africa's changing farm size distribution patterns: the rise of medium-scale farms. Agricultural Economics, Vol. 47.

Jayne, T., Meyer, F., & Traub, L. (2014). Africa's evolving food systems: drivers of change and the scope for influencing them. London: IIED Working Paper.

Jayne, T., Yeboah, F., & Henry, C. (2017). The future of work in African agriculture: trends and drivers of change. . ILO Research Department Working Paper.

Kelly, J., Richardson, E., Drasher, M., Barrie, M., Karku, S., Kamara, M., . . . Weiser, S. (2018). Food insecurity as a risk factor for outcomes related to ebola virus disease in Kono District, Sierra Leone: A cross-sectional study. The American Journal of Tropical Medicine and Hygiene, 98(5): 1484-1488.

Le, Q., Nkonya, E., & Mirzabaev, A. (2014). Biomass productivity-based mapping of global land degradation hotspots. Economics of land degradation and improvement- A global assessment for sustainable development.

Martin-Shields, C., & Wolfgang, S. (2018). Food security and conflict: empirical challenges and future opportunities for research and policy making on food security and conflict. FAO Agricultural Development Working Paper.

McKinsey Global Institute. (2010). Lions on the move: the progress and potential of African economies. McKinsey & Company.

Montpellier Panel. (2014). No ordinary matter: conserving, restoring and enhancing Africa's soils. Retrieved from https://ag4impact.org/wpcontent/uploads/2014/12/MP 0106.

Mutanga, S., & Simelane, T. (2016). Electricity Generation: A Driver of SADC Regional Integration?

Nhamo, L., Matchaya, G., Mabhaudhi, T., Nhlengethwa, S., Nhemachena, C., & Mpandeli, S. (2019). Cereal production trends under climate change: impacts and adaptation strategies in Southern Africa. Agriculture, No. 2: 30.

Oppenheimer, M., Campos, M., Warren, R., Birkmann, J., Luber, G., O'Neill, B., & Takahashi, K. (2014). Emergent risks and key vulnerabilities. In: Climate Change 2014: Impacts, Adaptation and Vulnerability. Contribution of the working group to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press.

Porter, A. (2017). Extreme poverty set to rise across Southern Africa . Institute for Security Studies.

SADC. (2013). The review of the twenty years of implementation of the international conference on population and development (ICPD) in the Southern Africa Development Community (SADC).

SADC. (2018). SADC selected economic and social indicators.

SADC. (2018). SADC, SARDC, Energy Monitor 2018 - Enabling Industrialisation and Regional Integration in SADC.

SADC. (2019). Synthesis report on the state of food and nutrition security and vulnerability in Southern Africa. Regional Vulnerability Assessment and Analysis Program (RVAA). SADC 1-4 July .

Saritas, O., & Smith, J. (2011). The big picture- trends, drivers, wild cards, discontinuities and weak signals. Futures, 43, 292-312.

Schlenker, W., & Lobell, D. (2010). Robust negative impacts of climate change on African agriculture. Environmental Research Letters, pp. Vol 5, No. 1.

SHARED The Decision Hub. (n.d.). Retrieved from SHARED The Decision Hub: http://www.worldagroforestry.org/shared.

Thinking Futures. (2020). Foresight Approaches. Retrieved from http://www.adatum.com.

UMFULA. (2019). The current and future climate of central and southern Africa. Whate we have learnt and what it means for decision-making in Malawi and Tanzania. Climate and Development Knowledge Network.

United Nations, DESA, Population Division. (2018). World Urbanization Prospects, 2018. Retrieved from https://population.un.org/wup/DataQuery/.

United Nations, DESA, Population Division. (2019). World Population Prospects, 2019. Retrieved from United Nations Department of Economics and Social Affairs: https://population.un.org/wpp/.

Vanlauwe, B., Six, J., Sanginga, N., & Adesina, A. (2015). Soil fertility decline at the base of rural poverty in Sub-Saharan Africa. Nature Plants.

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SADC Futures

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