digiSoft CIS Based DSTs

Modelling Social and Economic Benefits of Climate Information Services for Water, Energy, Agriculture & DRR

BY Digitron Software

1. B J Garanganga - Agro-Meteorology Expert
2. T Nyakutambwa - CIS Software Expert

digiSoft Climate Information Services Science

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T: +263 242 793691-4
M: +263 772 220330 (WhatsApp)
M: +263 784 996 727 (WhatsApp)

E: bjgaranganga@digitron.co.zw
bjgaranganga@gmail.com
E: trymoren@digitron.co.zw

Format of Presentation

BACKGROUND

- Global Economic Cost of Natural Disasters
- Hydrometeorological Hazards
- Missed Opportunities
- Value for Money Framework
- Nexus Approach
- System Dynamics Modelling
- Rationale of SEBs
- Methodological

RESULTS

SUMMARY

WAY FORWARD

Global Economic Cost Of Disasters

- The reported global cost of natural disasters has risen significantly, with a 15-fold increase between the 1950s and 1990s.

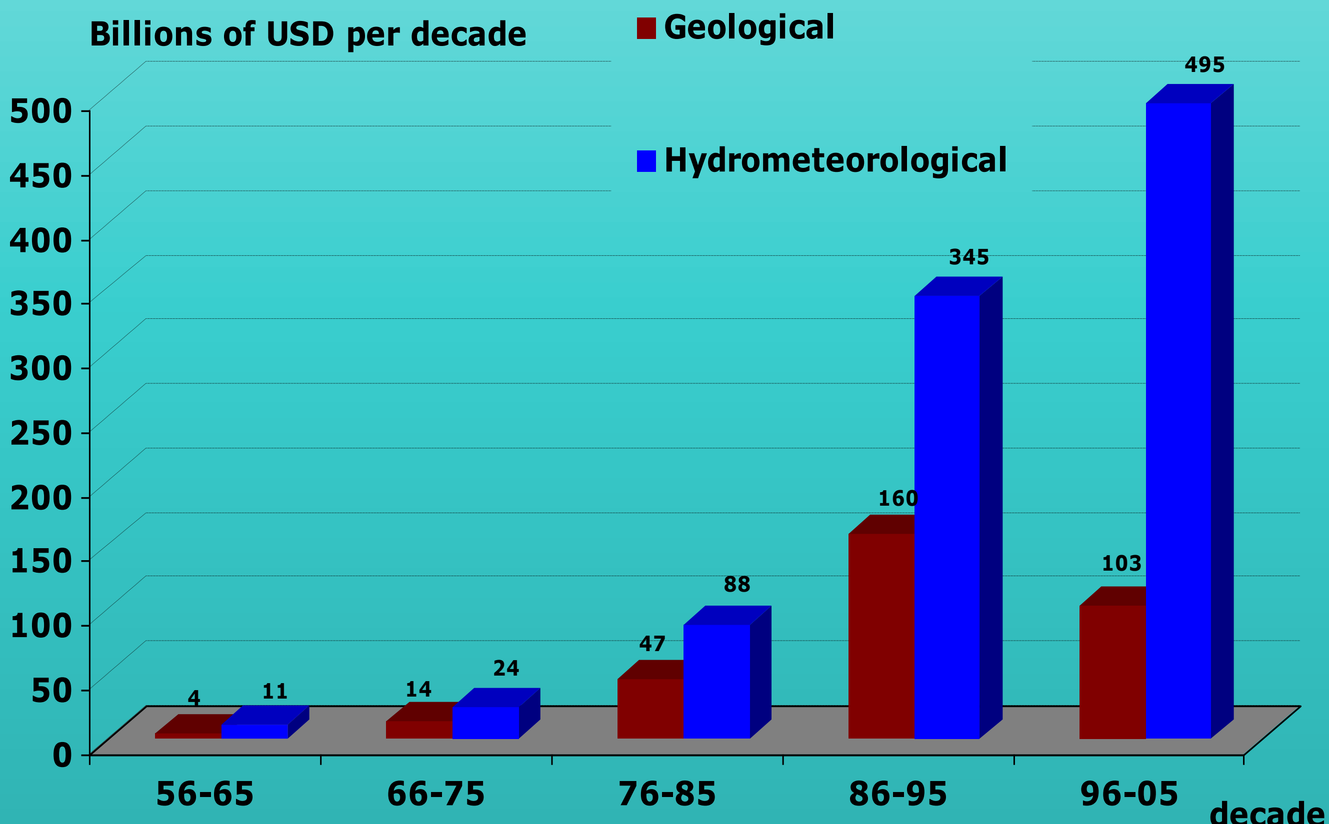
- During the 1990s, major natural catastrophes are reported to
- Have resulted in economic losses averaging an estimated us$66bn per annum (in 2002 prices).

- It is also estimated that in developing nations losses are typically 10-14 % of GDP, Abramovitz, (2001)

- Much closer to Africa!

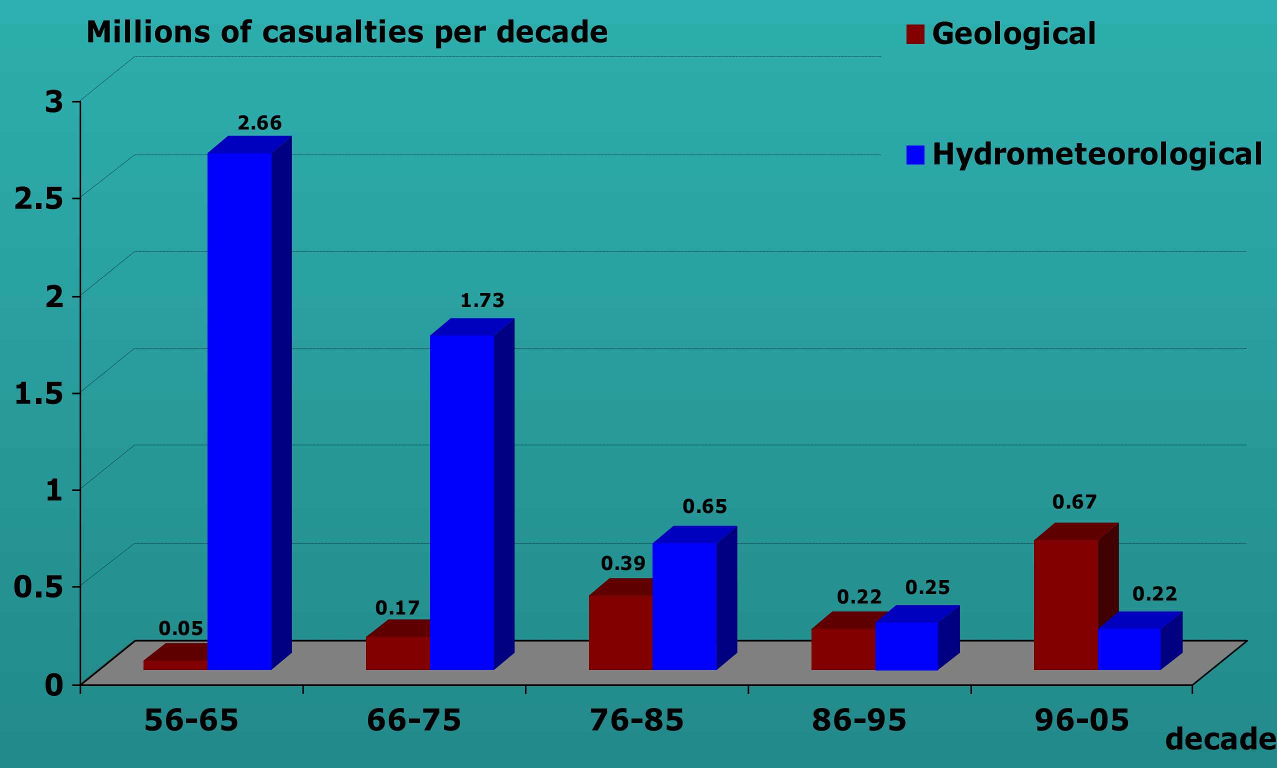
- Predicted 2015/2016 ENSO impacts missed opportunities:---

- Tropical IDAI tragedy:



Economic losses related to disasters are on the way up

While casualties related to hydro-meteorological disasters are decreasing



Source: EM-DAT: The OFDA/CRED International Disaster Database

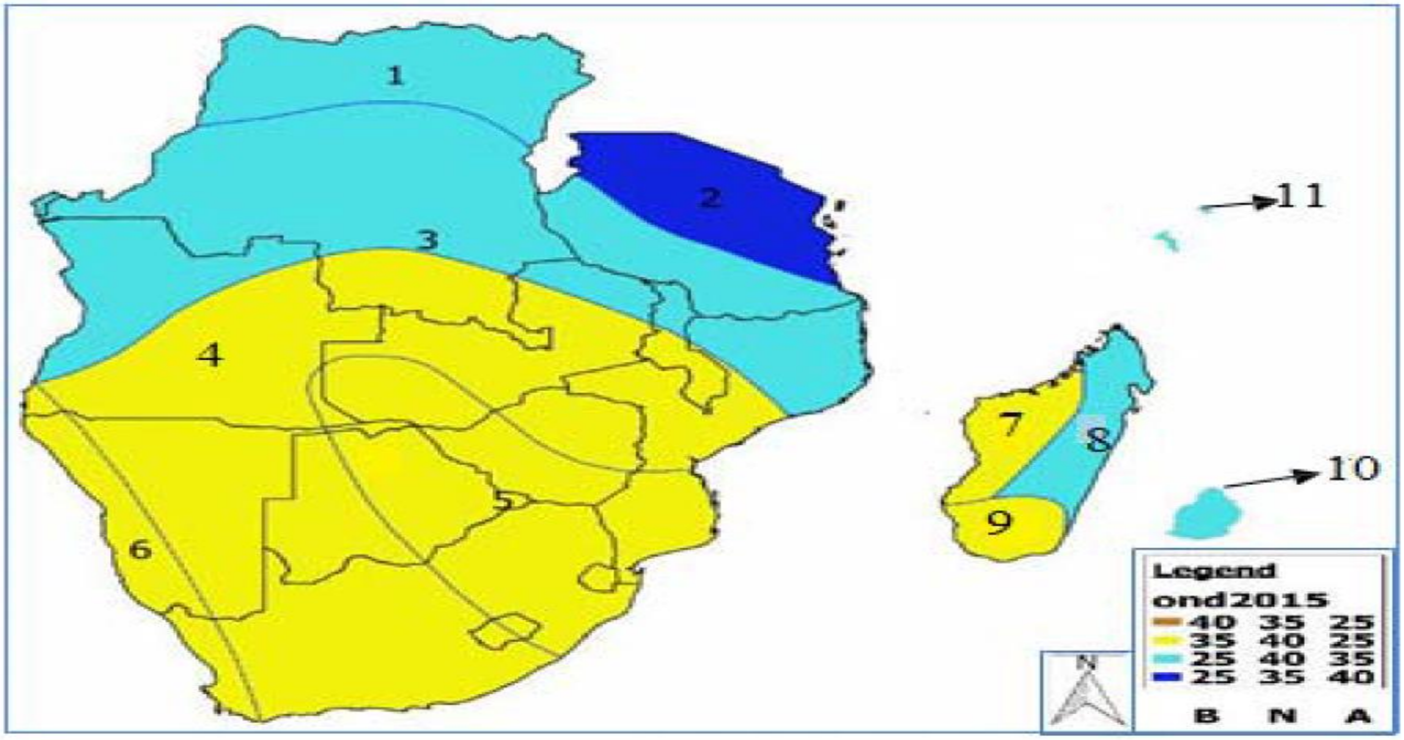


Fig 1: Rainfall forecast for Oct-December 2015

NOVEMBER-DECEMBER 2015-JANUARY 2016

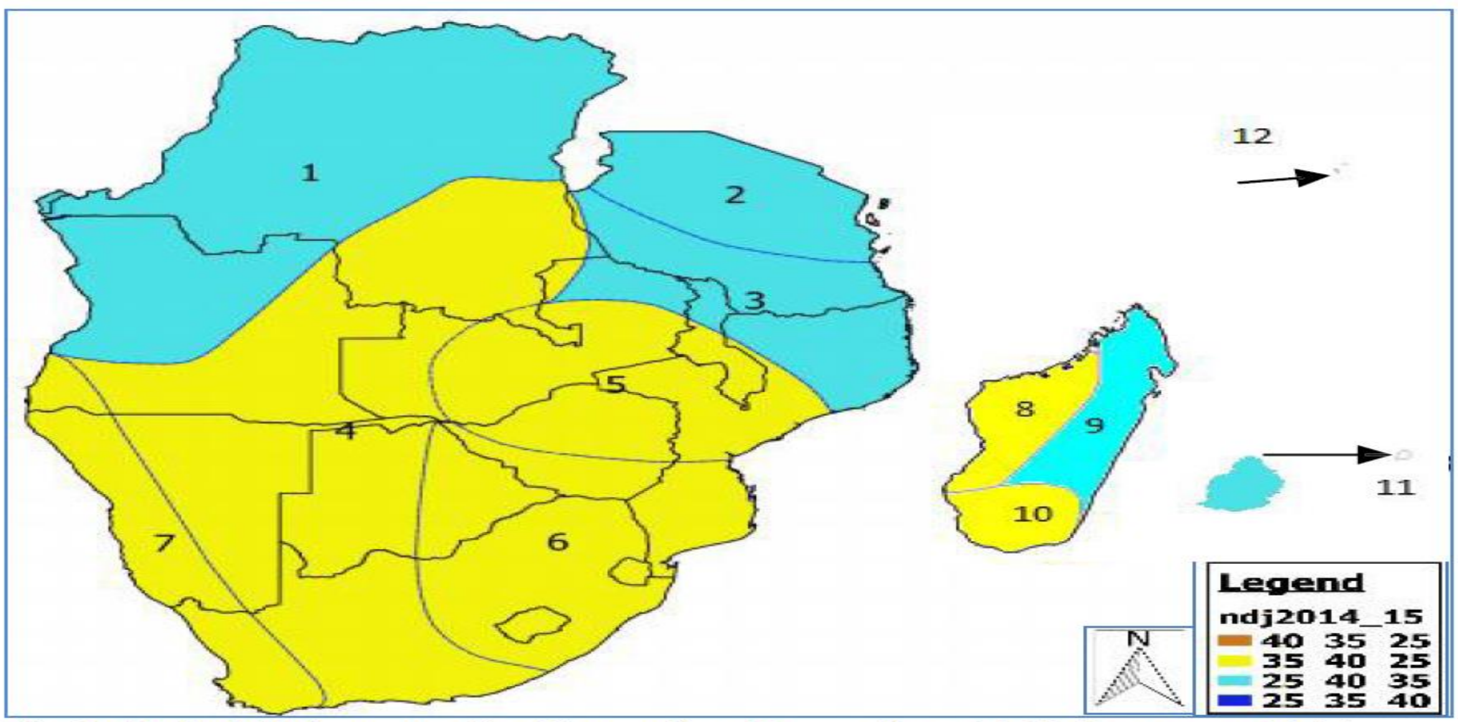
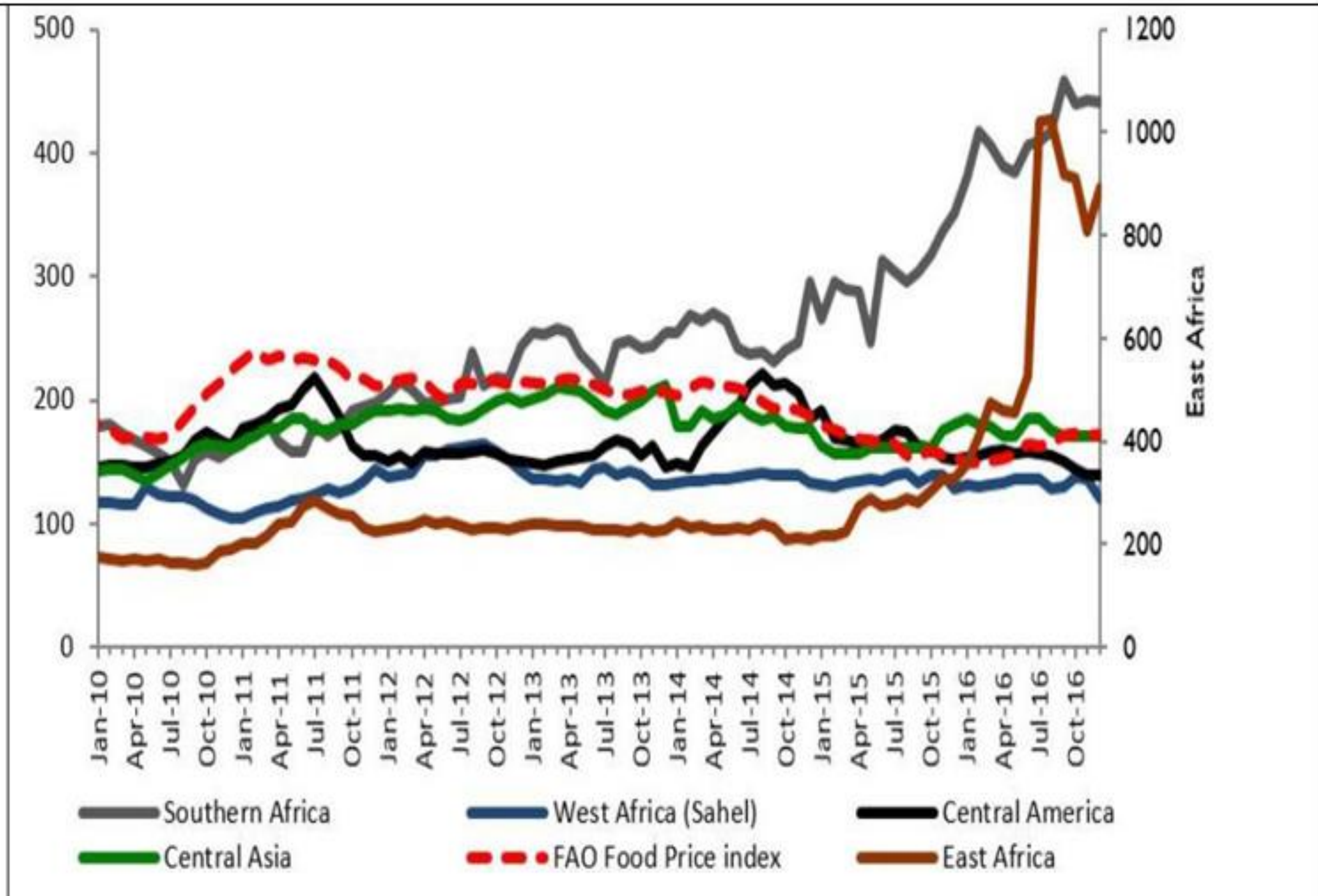


Fig 2: Rainfall forecast for November-December 2015-January 2016

Some missed opportunities

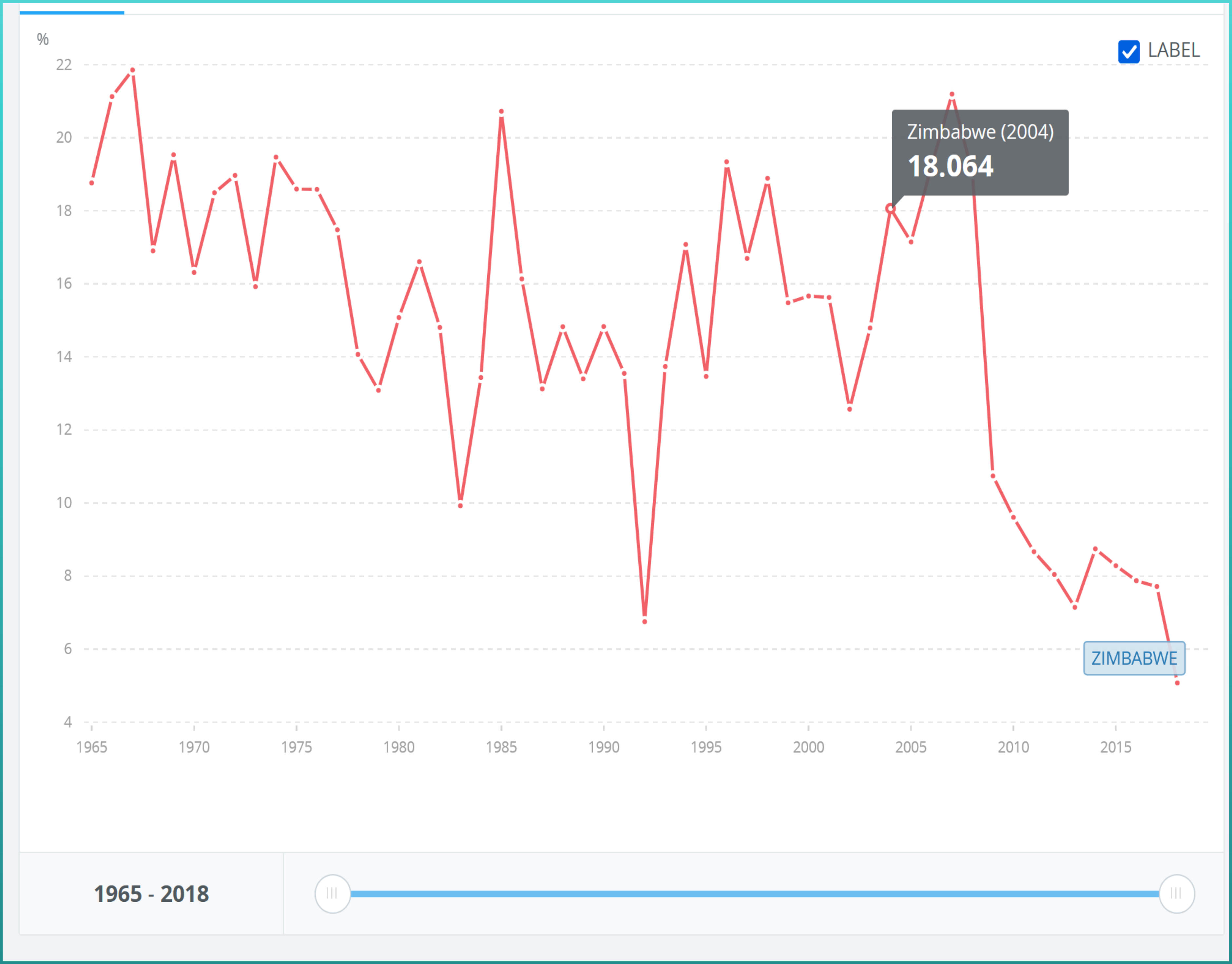
Figure 14.2 FEWSNET regional price indices and FAO Food Price Index, Jan 2010-Dec2016



Source: FAO and FEWS NET.

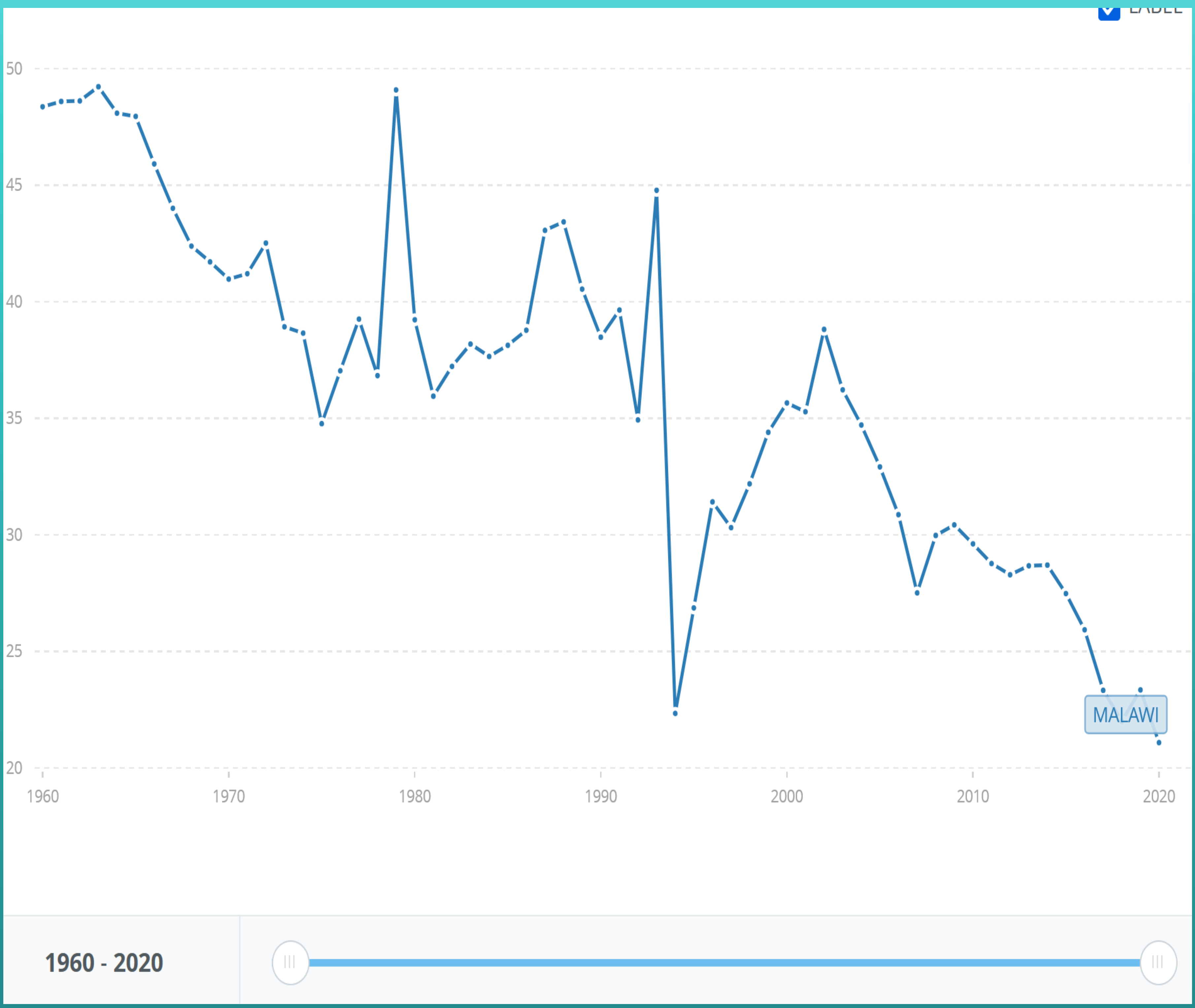
CIS Based DST Software for Socioeconomic Benefit

%ag GDP, Zimbabwe



CIS Based DST Software for Socioeconomic Benefit

%Ag GDP of Malawi



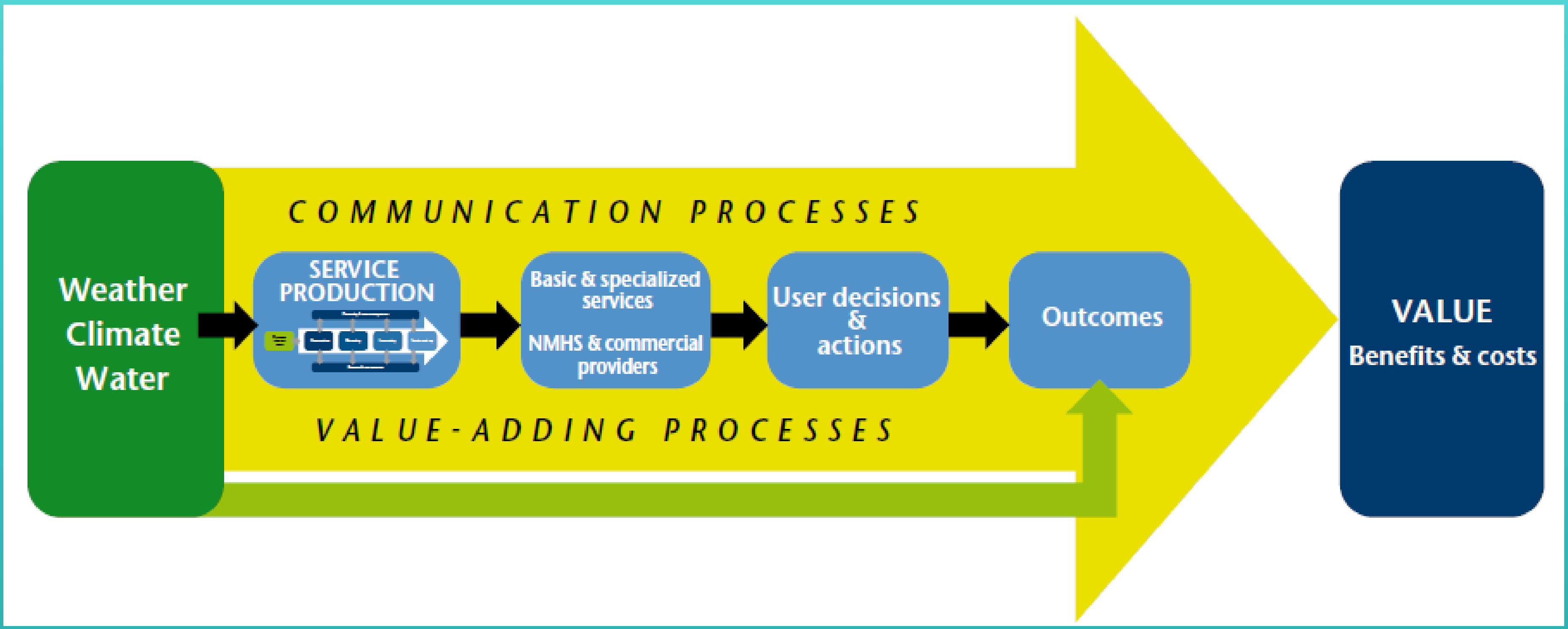
Research project focus area:

- Modelling quantification of Socio-economic Benefits (SEBs) of Climate Information Services (CIS); and
- Mapping climate impacts on crop production

Proposed Framework For Value For Money And The Socio-economic Benefits Appraisal For Wiser

- **The framework is underpinned by the 3 Es:**
  - Economy (spending less)
  - Efficiency (spending well)
  - Effectiveness (spending wisely)
- **The framework has been developed to capture five components:**
  - Value for money;
  - Socio-economic benefits;
  - Transformational impact;
  - ICF indicators and;
  - Monitoring evaluation and learning (MEL).

SEB planning processes



- Policy makers need estimates on the likely impacts of policies and investments.
- This includes as assessment of the dissemination of -and access to- the CIS generated.
- If the benefits, for any given economic actor or economy-wide outweigh the cost, the investment is justified.

Rationale for SEB Analysis

Socio-Economic Benefits

The Socio-Economic Benefits of Climate Information Systems are many and varied:

- Direct (e.g. weather information, rainy days), some
- Indirect (e.g. planning for higher yields)
- Households (e.g. avoided damage to private property),
- Businesses (e.g. avoided supply chain disruption); and
- Government (e.g. reduced infrastructure expenditure).

Socio-Economic Benefits: approach

Investments represent the cost of intervention, across various economic actors which include:

- Capital costs,
- Operation and management costs; and
- Cost of financing.

Methodologies and models

Traditional assessments include:

- **Regression analysis**: assesses the sensitivity to certain sectors/activities to climatic changes.
- **Cost loss models**: compare the cost of protection to a probable climate-related loss. This approach can include social and environmental dimensions (Continuously Forecasting System).
- **End-to-end forecasting**: links a biophysical model (e.g. crop yield) to an economic model (e.g. profit maximizing) to identify optimal adaptation strategies.
- **System Dynamics**: focuses on causality social, economic and environmental indicators to generate "what if" scenarios for policy analysis. It is a "knowledge integrator".

Multidisciplinary approach which involves:

- Macro-economic and physical data collection and analytics;
- Actionable products; and
- Capacity development;

Nexus approach

- ‘Nexus thinking’ is an approach that recognizes the critical interdependence of food, energy and water in an increasingly resource constrained world.
- Understanding and improving how we manage and use these resources is a process full of uncertainty but it is needed, especially in the face of climate change.
- There is a critical need to equip both individuals and institutions with research, capacity building and new

Nexus approach– key concepts

- New methods are needed that address a specific gap:
  - conventional forecasting tools and analyses are often comparatively static (mostly employing linear approaches) and
  - are narrowly focused on a sector or a specific set of thematic indicators.
- A systemic approach is instead required that:
  - considers social, economic and environmental indicators within a sector,
  - and link them across sectors to generate dynamic projections that
  - allow to estimate policy outcomes for all economic actors.

Need to quantify SEBs of CIS

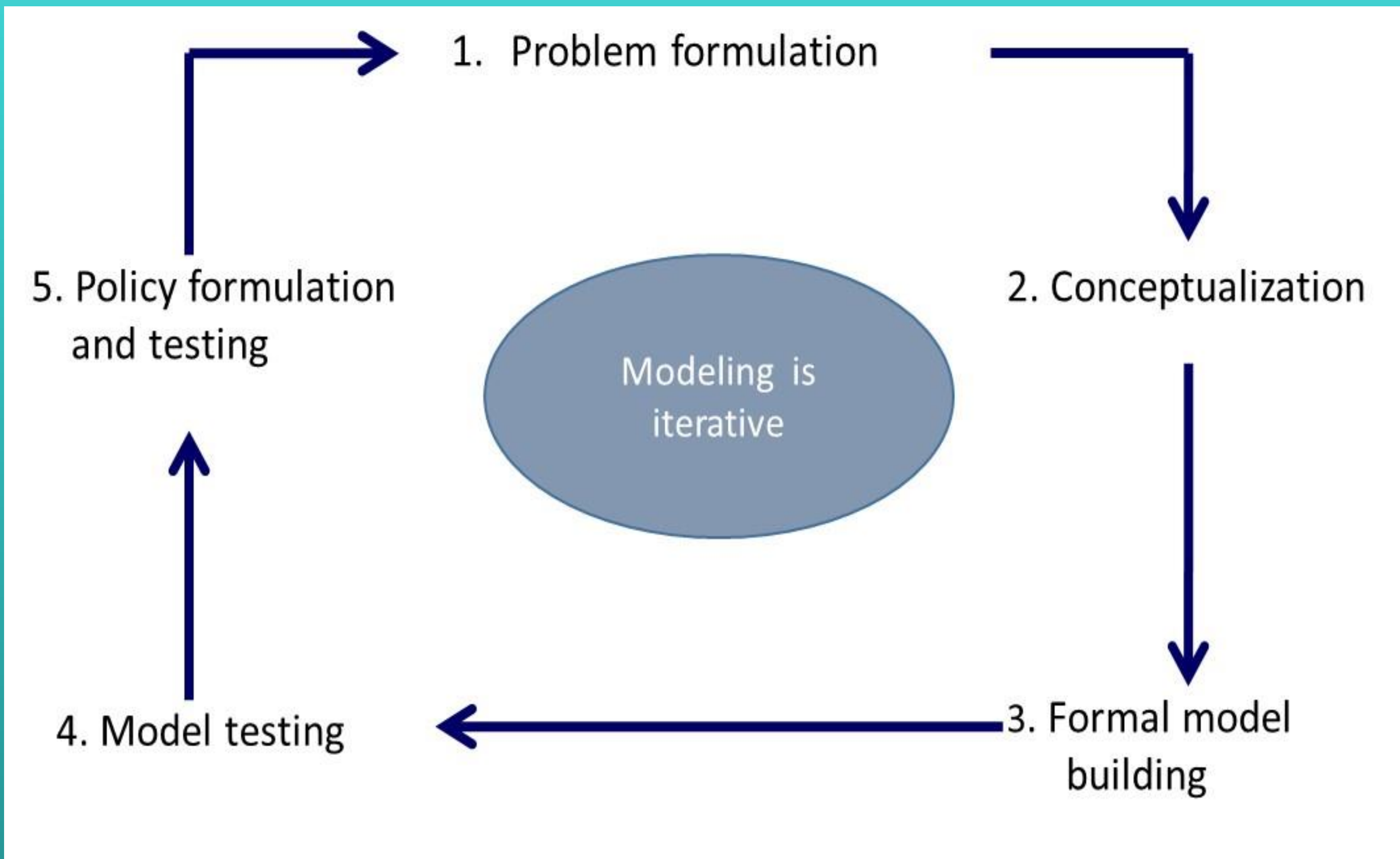
- World Bank study estimated that the **benefits of improving hydro-meteorological services in developing countries** to standards used in developed ones would lead to an increase of **US$30 billion per year in economic productivity** and a decrease of up to **US$ 2 billion per year from reducing asset losses (Hallegatte, 2012).**

- Policy-makers in Africa require that we provide the evidence base of CIS in contributing to improving efficiencies in growing the economies in order to make appropriate investment decisions. So there is need for quantifying SEBs of CIS.

- There is need for capacitation of both producers and users of CIS is important for socio-economic development in climate-sensitive areas; (e.g., energy, water resource management, agriculture, health, etc.).

- So the objective of the study was to help quantify the benefits of CIS to the economic growth and sustainability of societies.

How to proceed?



1- Causal Loop Diagrams (CLD)

- Represent the feedback structure of systems!

- Capture:
  - The hypotheses about the causes of dynamics
  - Mental models of individuals or teams
  - The important feedbacks driving the system
- Critical aspects:
  - Think in terms of cause-and-effect relationships
  - Focus on the feedback linkages among components of a system
  - Determine the appropriate boundaries for defining what is to be included in the CLD

1- Reinforcing Loops

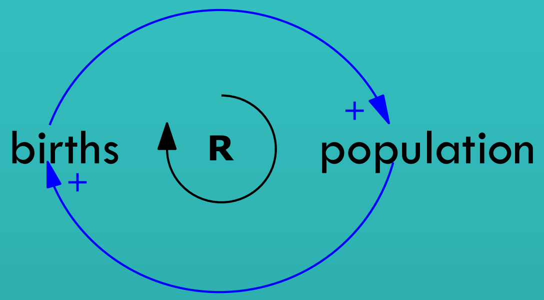
- Reinforcing loops tend to increase and amplify everything happening in the system (i.e. action - reaction).

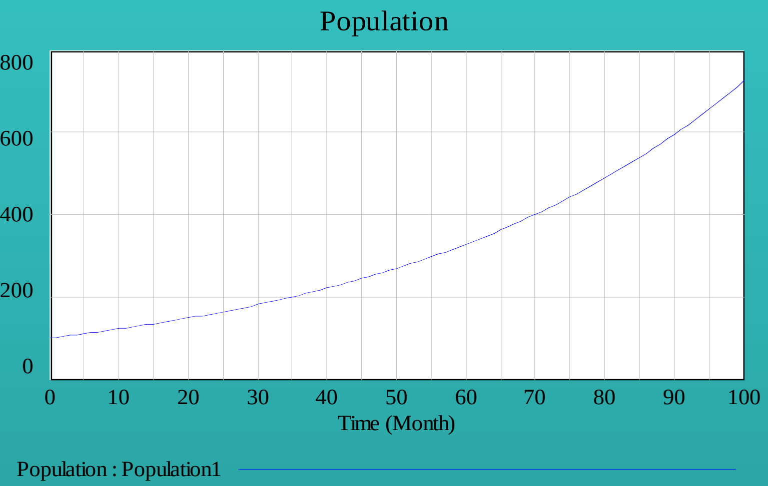
Example:

Fold a paper (0,1 mm) 42 times:

- What would be the final thickness of such paper?
- The result is a thickness larger than the distance between the Earth and the moon = 0,1*2^42 (43,980,465,111 cm = 439,804 Km)

1- Reinforcing Loops





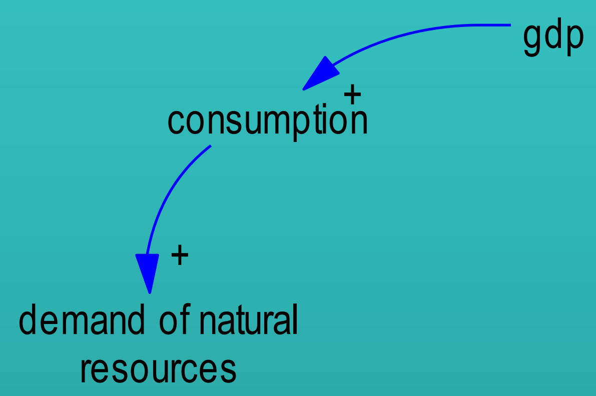
1- Balancing Loops

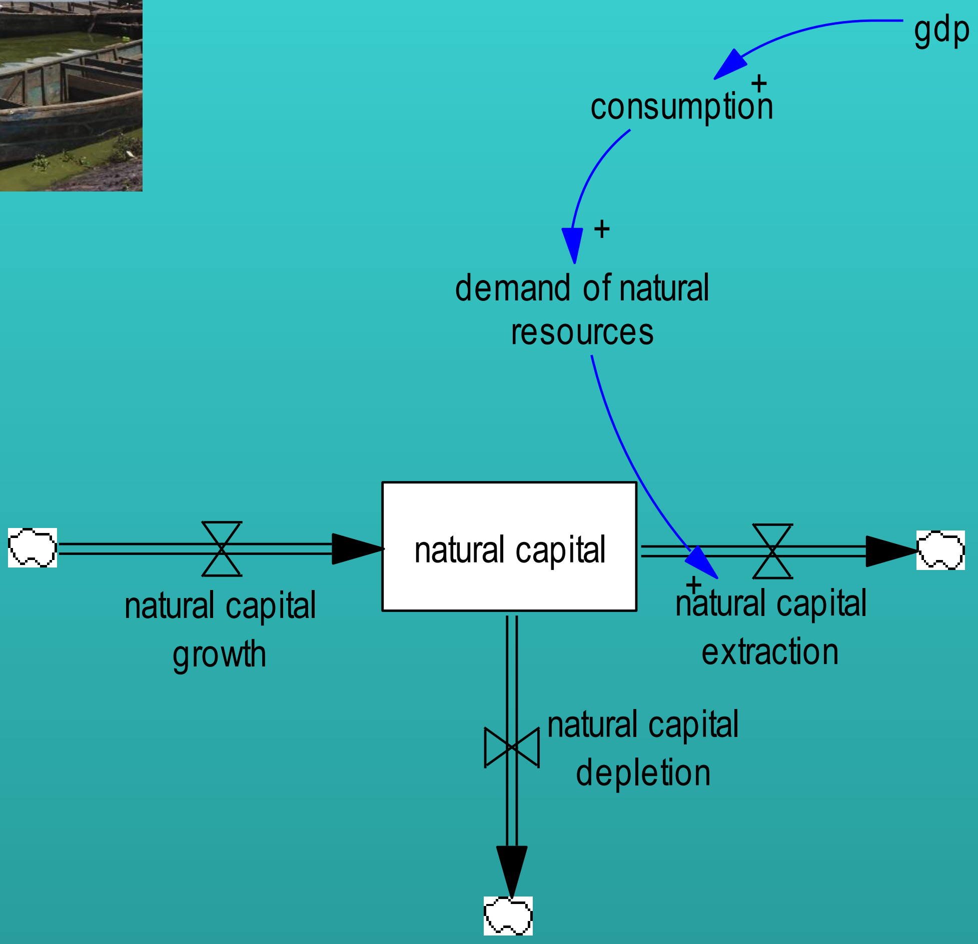
- Negative loops are counteractive and oppose change.
- Balancing loops represent a self limiting process, which aims at finding balance and equilibrium.

Nexus planning and climate adaptation on national level

Using a systemic approach: informed by stakeholders, based on science

gdp


gdp
+
consumption
+
demand of natural resources


gdp
+
consumption
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demand of natural
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natural capital
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natural capital
extraction
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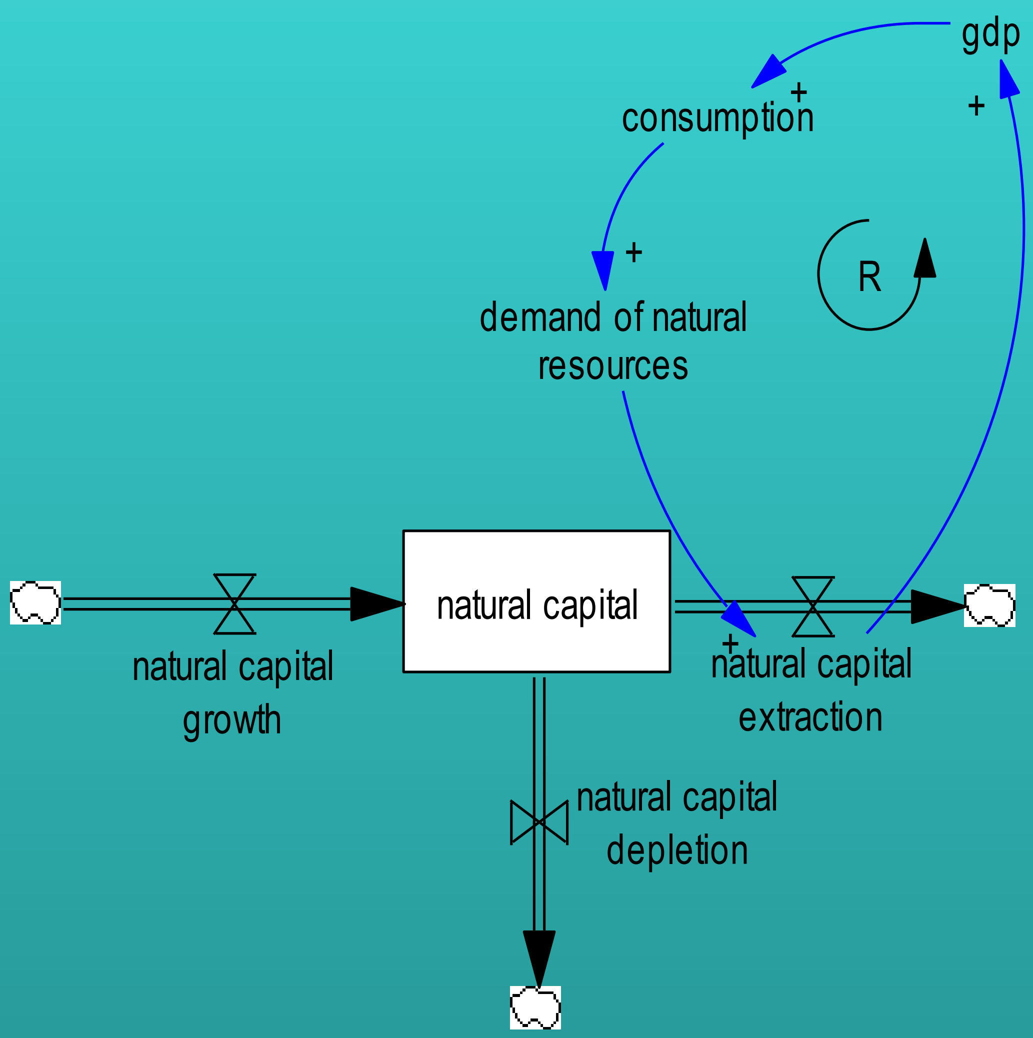
gdp
+
consumption
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demand of natural
resources
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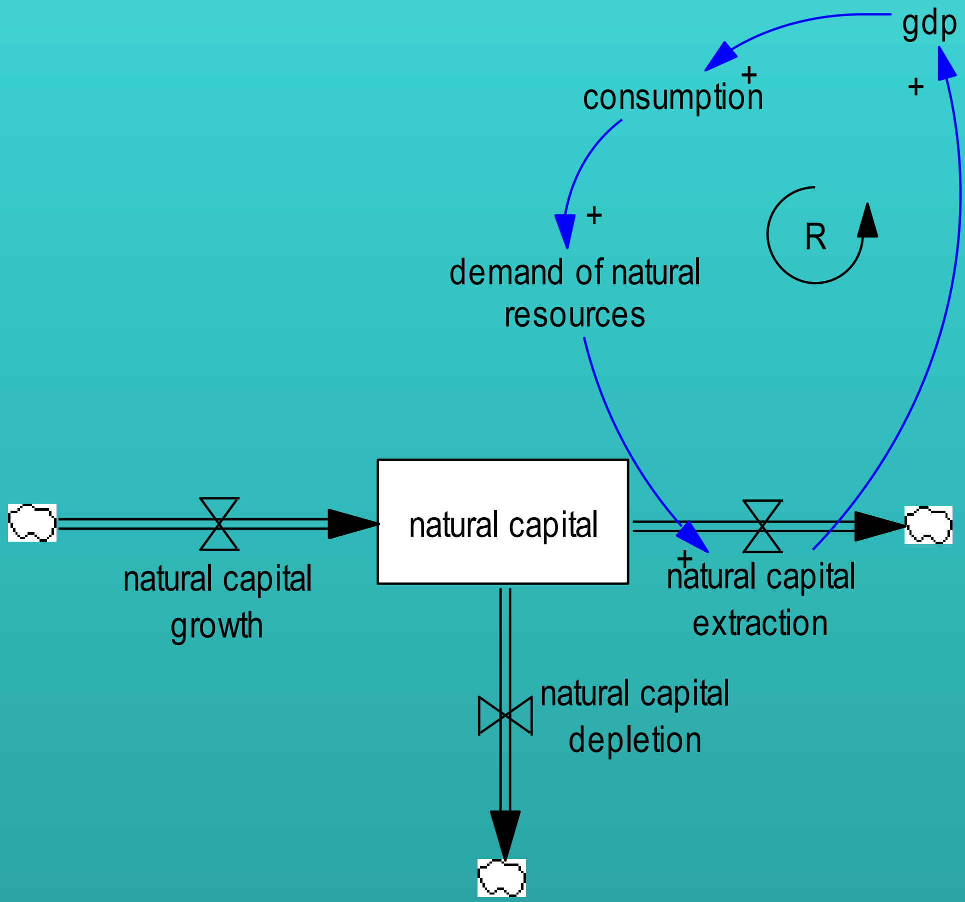
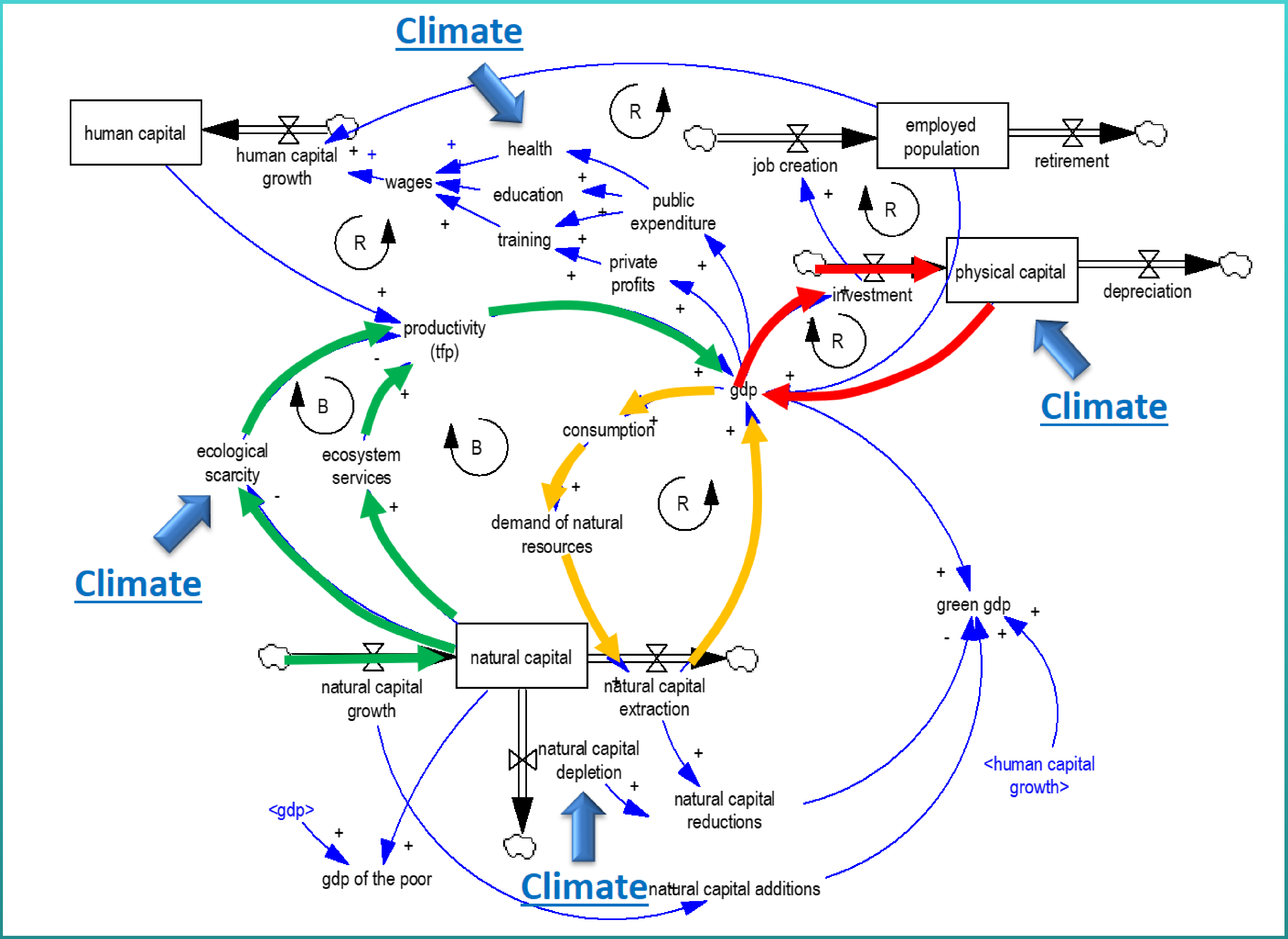
natural capital
natural capital
growth
+
natural capital
extraction
natural capital
depletion


gdp
consumption
demand of natural resources
R
natural capital
natural capital growth
natural capital extraction
natural capital depletion
+
+
+
+


1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE AND JUSTICE STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
THE GLOBAL GOALS
For Sustainable Development

Systems analysis: climate impacts?



Structure In Use to Represent CIS Coverage in the CIS model

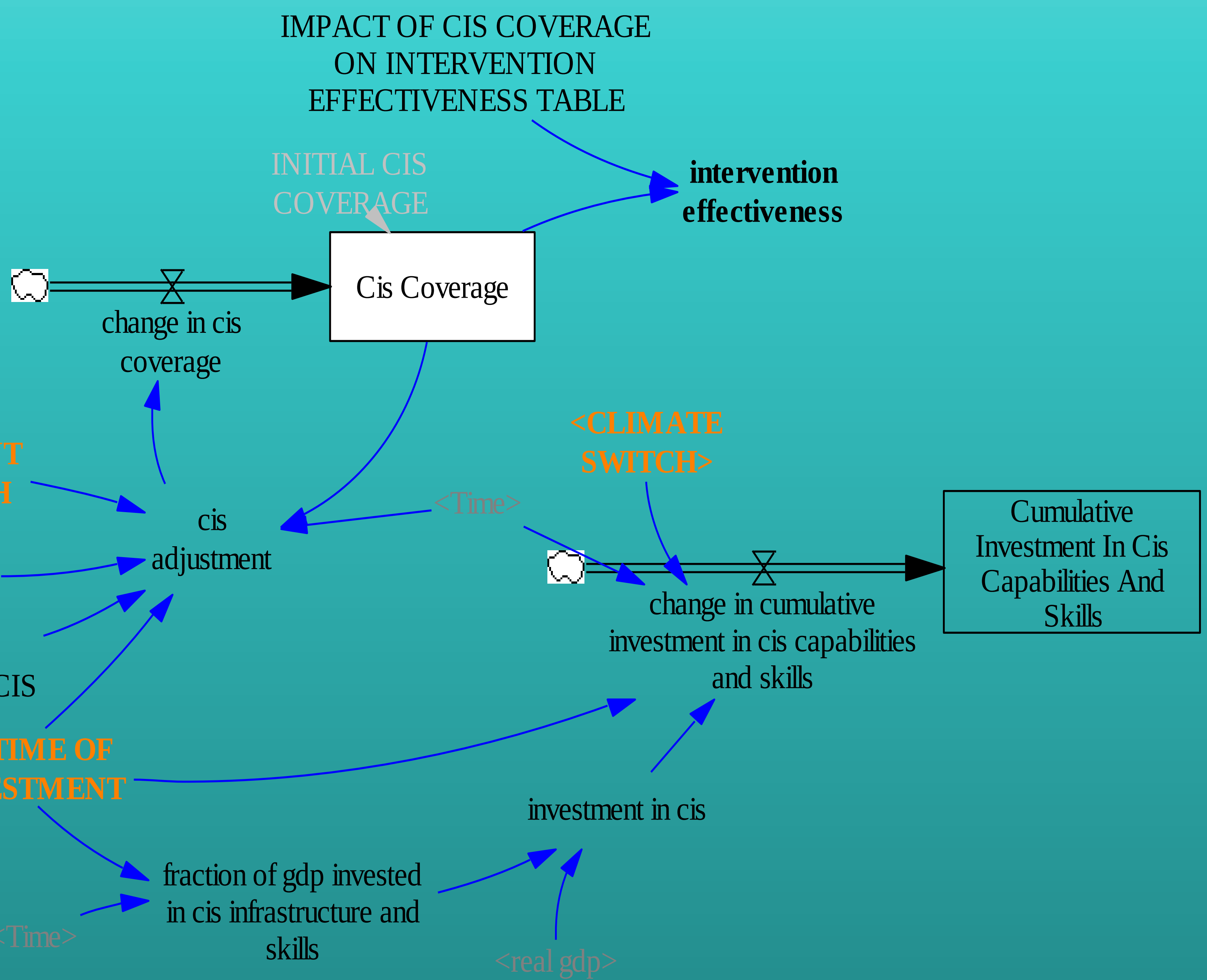


Figure 12.5: Structure in use to represent CIS coverage in the CIS SEB model

Why addressing this challenge is important

- Quantification of SEBs of CIS is necessary to guide decisions for investment in optimum CIS in order to:
- minimize impacts of hydrometeorological hazards; and
- enhance climate-sensitive sectors contribution to sustainable economic growth;
- Tragic events Tropical Cyclone Idai and the inadequacies of the accuracy of seasonal climate outlooks underscore the need to enhance capacities of the generators of CIS and those that apply it; and
- CIS enables society to better adapt to seasonal shifts of rainfall due to Climate Change

What needs to happen

- The negative impacts of hydrometeorological hazards are seen on:
  - Agriculture and food security
  - Water resources & health
  - Energy; infrastructure
- These oftentimes lead to disasters with over 90% of natural disasters in Africa are a consequence of these hazards.
- Appropriate use of climate information service (CIS) can guide decisions for better strategic and tactical planning
- However development and applications of cis are grossly underfunded
- Quantification of socioeconomic benefits (SEBs) of cis will provide important evidence base for justification of much needed funding

Data sources

National Governments, United Nations Agencies.

For instance, UNISDR, the United Nations Office for Disaster Risk Reduction is promoting a global initiative to build:

- national disaster databases with a well defined methodology.
- UNISDR uses for this purpose the DesInventar free, open source methodology and software.
- It permits the homogeneous capture, analysis
- and graphic representation of information on disaster occurrence and loss.
- It has been under continuous development and improvement.

Climate Impacts on Population

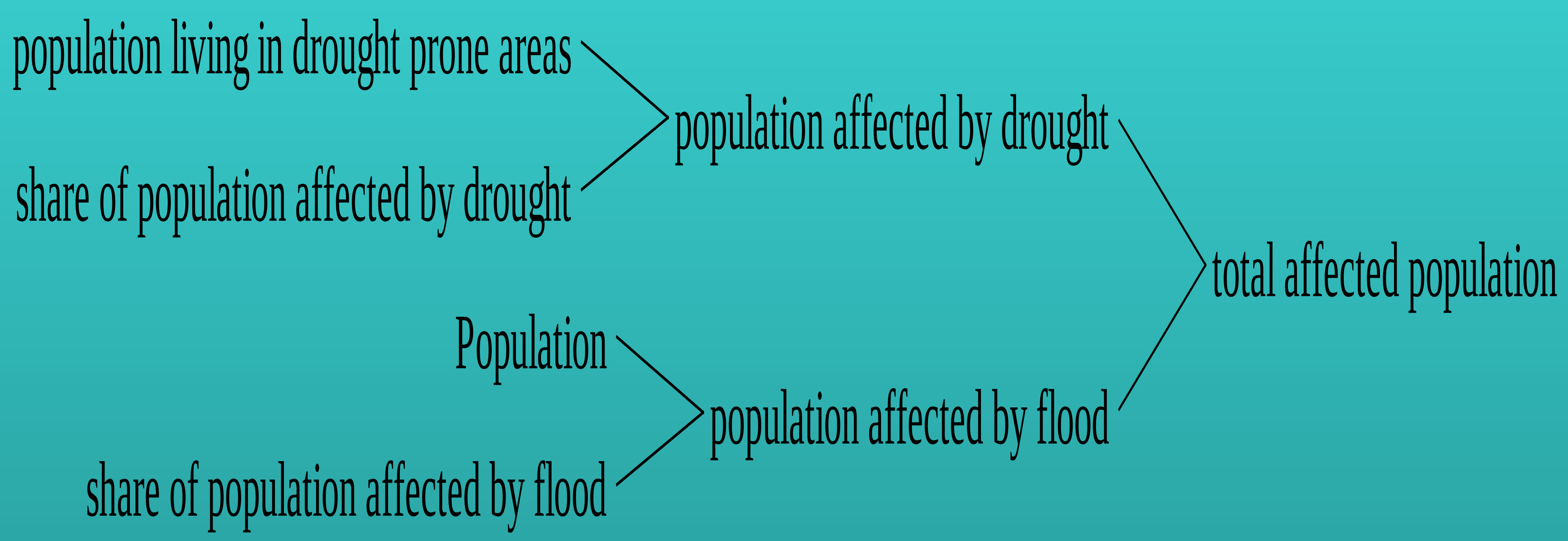


Figure: Climate impacts on population

4 scenarios to quantitatively assess the SEBs of CIS

1) The No Climate Factored

...assumes no climate impacts and no investments, and hence represents the current state of macroeconomic planning models.

2) The Reference (No coverage of CIS)

...assumes 0% coverage throughout the simulation, which implies no anticipation of climate events and hence 100% of damages.

3) The Business as usual (BAU), current coverage

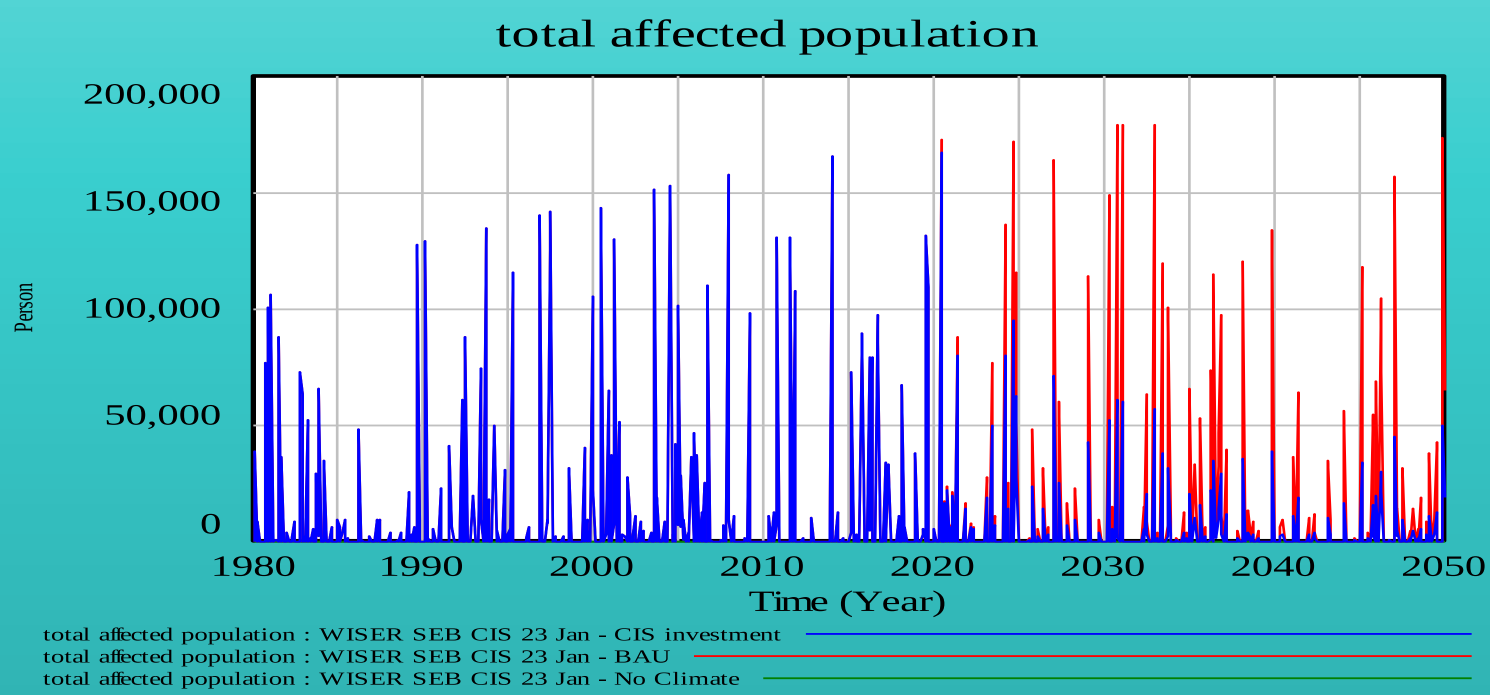
...assumes 30% coverage throughout the simulation, which translates into an intervention effectiveness of only 12%. This means that 88% of the damages occur.

4) Progressive investment for optimum CIS

...assumes an increase in CIS coverage from 30% to 95% between 2020 and 2030, and a further increase from 95% to 100% coverage between 2030 and 2040. This translates into an intervention effectiveness of 68% and 74.5% by 2030 and 2040 respectively, which implies that 74.5% of damages can be avoided by 2040.

CIS Based DST Software for Socioeconomic Benefit

Total Affected Population and Cumulative Population



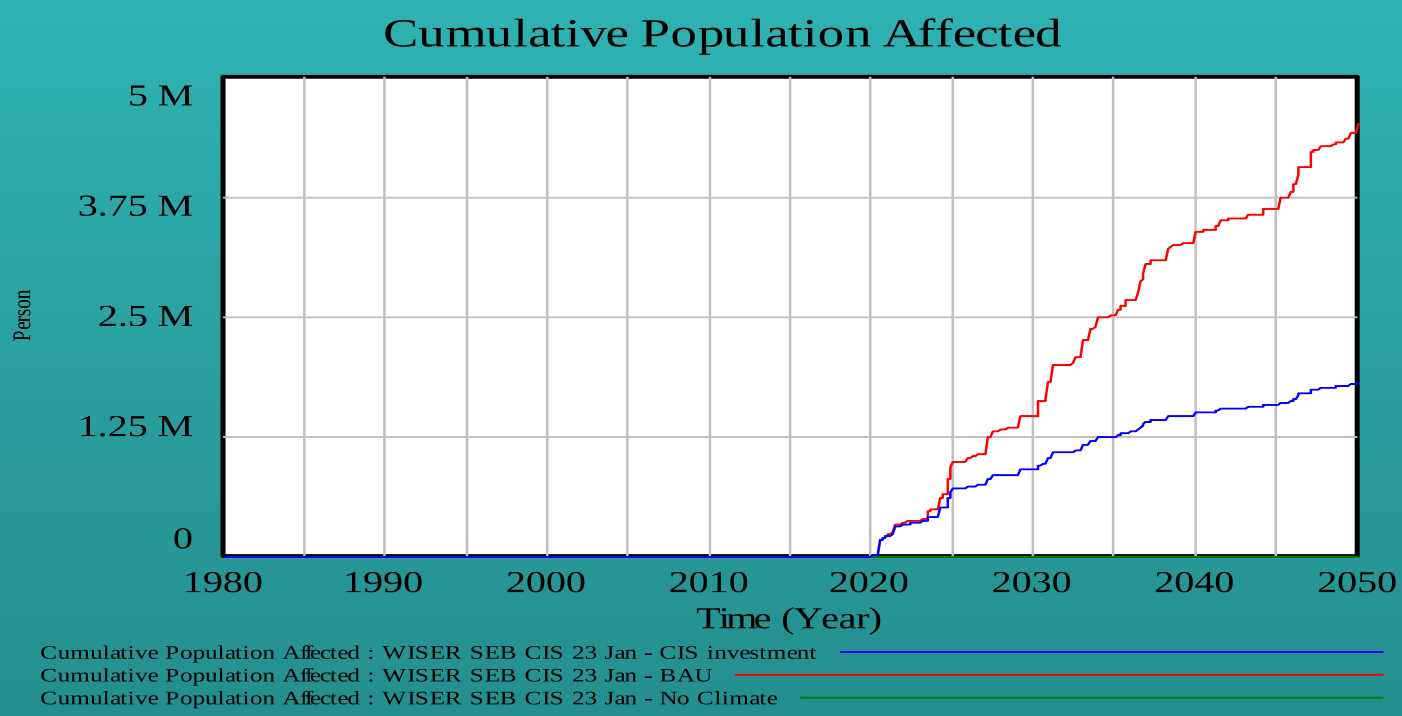
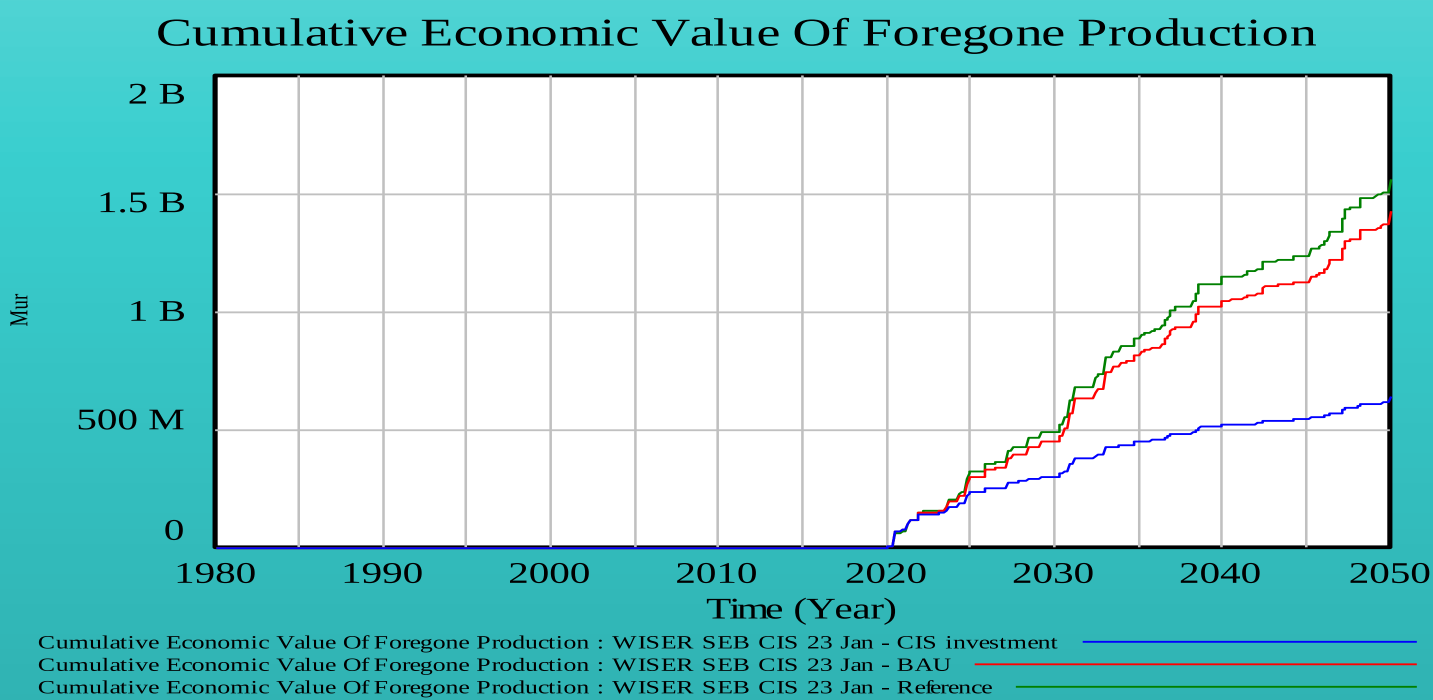


Figure: Total affected population and Cumulative population affected in all scenarios 1980 to 2050

Cumulative Value of Climate Impacts In Agriculture



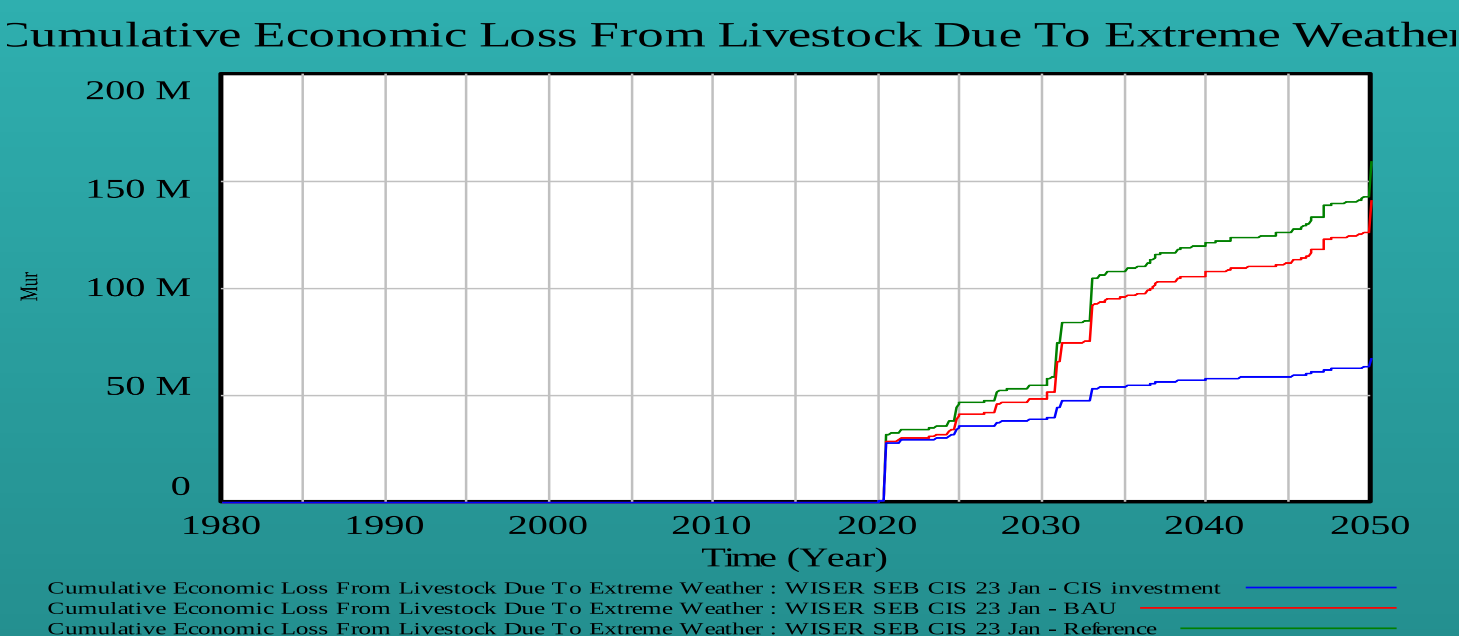
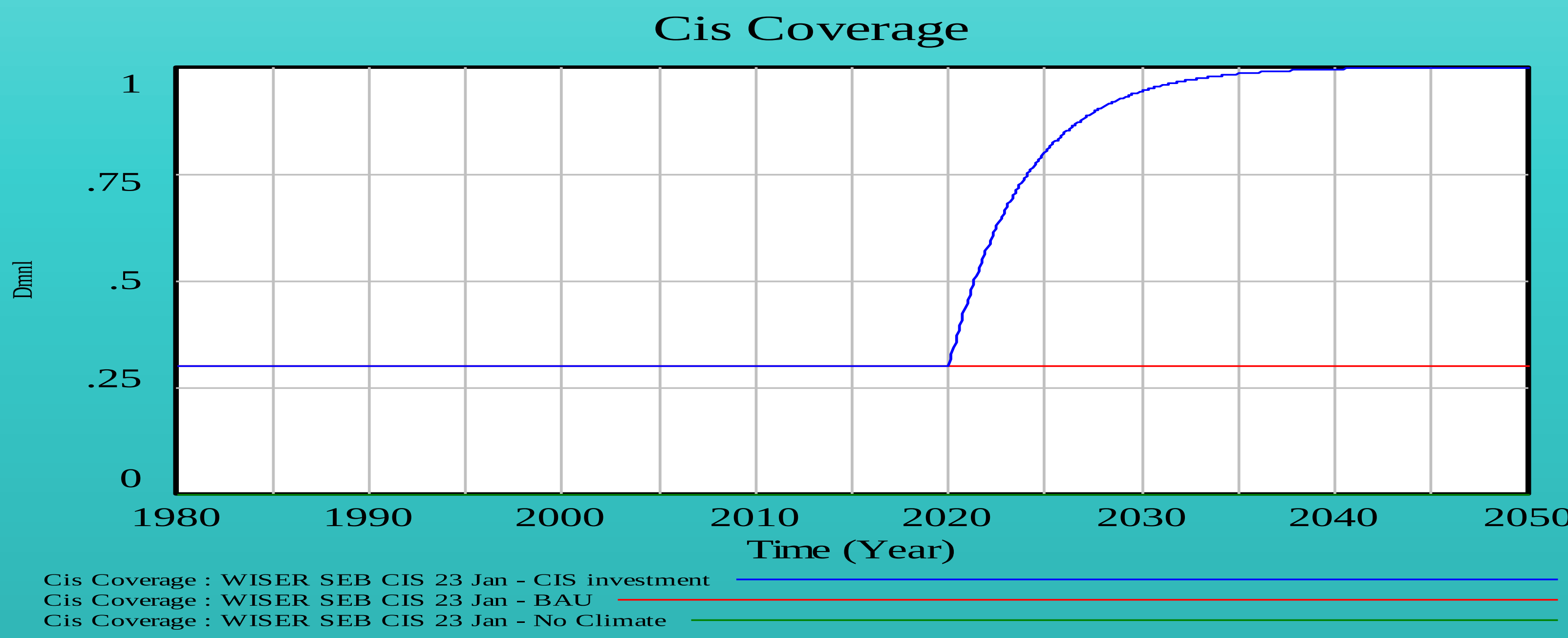


Figure: Cumulative value of climate impacts in the agriculture sector 2020 to 2050

CIS Coverage and DRR Intervention



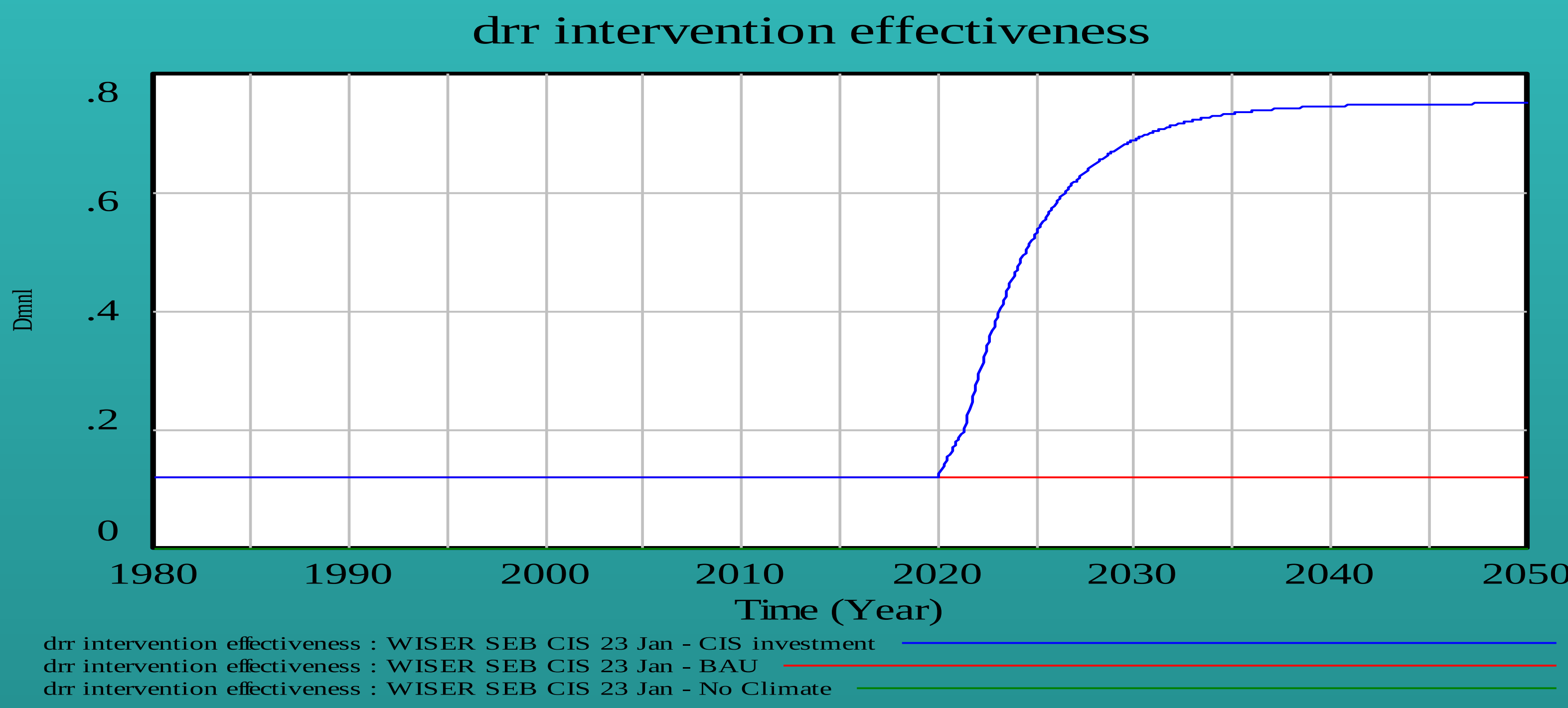


Figure: CIS coverage and DRR intervention effectiveness all scenarios

Cost of Hydrometeorological hazards

Sector	Costs of adverse weather by scenario and sector				
	Reference (million USD)	BAU (million USD)	% of Reference	CIS investment (million USD)	% of Reference
Roads	465.6	410.3	-11.88%	166.1	-64.33%
Health Care	94.8	83.4	-11.98%	31.7	-66.58%
Agriculture	54.8	49.8	-9.05%	22.3	-59.21%
Livestock	5.3	4.7	-11.45%	2.2	-58.91%
Crop production	49.5	45.2	-8.79%	20.2	-59.25%
Capital	8'545.3	7'615.8	-10.88%	2'807.1	-67.15%
Total	9'160.5	8'159.3	-10.93%	3'027.2	-66.95%

Added Benefits By Scenario And Sector

Sector	BAU to Reference	Added benefits CIS investment	Total SEBs	Total investment (in BAU)
	(million USD)	(million USD)	(million USD)	(million USD)
Roads	55.3	244.2	299.5	211.3
Health Care	11.4	51.8	63.1	
Agriculture	5.0	27.5	32.4	
Livestock	0.6	2.5	3.1	
Crop production	4.4	25.0	29.3	
Capital	929.6	4'808.7	5'738.3	
Total	1'001.2	5'132.1	6'133.4	211.3

Some values of SEBs on CIS

Scenario	Total impacts (million USD)	Total SEBs (million USD)	Total investment (million USD)	Cost to benefit ratio
Reference (0% CIS coverage)				
Full climate impacts	9'160.55	-	-	-
BAU (30% CIS coverage)				
Impacts climate	8'159.32	1'001.23	208.31	4.81
CIS investment (100% coverage by 2035)				
CIS investment	3'027.19	6'133.36	845.14	7.26

Summary

1	HYDROMETEOROLOGICAL DISASTERS COSTS ARE 10-14 OF GDP
2	INVESTMENTS IN CIS ARE LOW, < 0.1% OF GDP; CURRENTLY CIS IS BETWEEN 30 TO 60% OF IDEAL
3	SEBS ON CIS FOR DRR HAVE BEEN SUCCESSFULLY DEMONSTRATED THROUGH SYSTEM DYNAMICS MODELLING
4	INVESTMENT IN AND APPLYING CIS WILL GREATLY REDUCE DISASTER IMPACTS ON COMMUNITIES AND INCREASE GDP GROWTH
5	BENEIFTS COST RATIOS OF MUCH GREATER THAN 7-11 TIMES THE INVESTMENTS

Way Forward

1	APPROPRIATE INVESTMENTS IN CIS TO MAKE IT MORE EFFECTIVE AND MORE EFFICIENT TO BENEFIT COMMUNITIES BETTER
2	PILOT PROJECTS IN PARTNERSHIPS WITH RESEARCH INSTITUTIONS/UNIVERSITIES AND RCC IN ORDER TO REFINE THE SEB ON CIS MODELS
3	RISK MAPPING NEED TO BE CARRIED OUT AT SUBREGIONAL AND NATIONAL LEVELS ACROSS SSA.
4	COMPREHENSIVE OUTREACH PROGRAMMES TO IMPROVE UTILIZATION OF CIS; AND ADVOCACY FOR INVESTMENTS IN CIS
5	OUTREACH TO BE ORGANIZED FOR THE SPECIFIC SECTOR PROFESSIONALS AT SUBREGIONAL AND NATIONAL LEVEL HENSIVE TRAINING

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Thank You For Your Attention

T: +263 242 793691-4
M: +263 772 220330 (WhatsApp)
M: +263 784 996 727 (WhatsApp)

E: bjgaranganga@digitron.co.zw
bjgaranganga@gmail.com
E: trymoren@digitron.co.zw