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CLIMATE CHANGE IMPACT AND LAND DEGRADATION MITIGATION STRATEGIES IN SOUTHERN AFRICA

A Methodological Framework Using Remote Sensing Based Models

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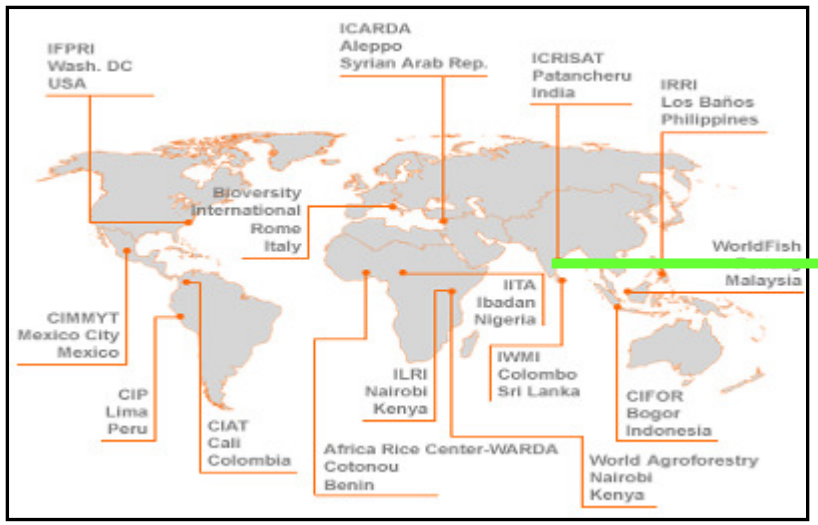
About ICRISAT



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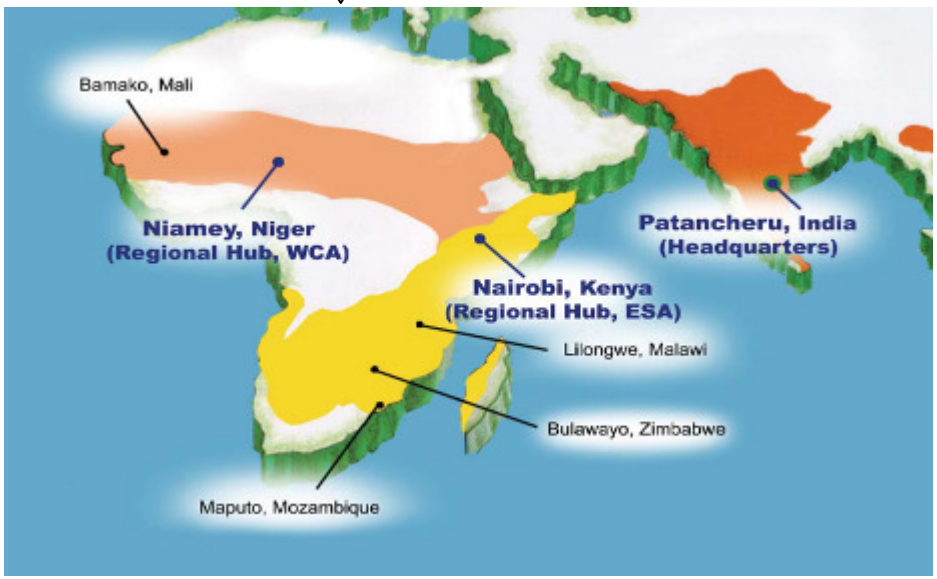

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Research Themes:

1. **Agro-Ecosystems:** to improve rural livelihoods, increase food security and sustainable natural resource management in SAT.

2. **Bio-technology:** to reduce poverty, hunger, malnutrition and environmental degradation in the SAT ---genetic engineering, wide-hybridization, diagnostic and bio-informatics tools.

3. **Crop- Improvements:** to improve food security and livelihoods by enhancing crop production and environmental protection eco-friendly and cost-effective pest and disease management practices, efficient seed systems.

4. **Institutions, Market Policy & Impact:** to deliver vital information and analytical tools that provide a rational foundation for decisions that affect the welfare of farmers and consumers in the semi-arid tropics

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Mission: To help the poor of the semi-arid tropics through science with a human face and partnership-based research for development to increase agricultural productivity and food security, reduce poverty, and protect the environment in semi-arid production system.

Vision: The vision of the organization is to improve the well-being of the poor in the semi-arid tropics through agricultural research for impact.

Objective: 1). Enhance productivity, quality and use of SAT crops

2). Reduce poverty, hunger and malnutrition in the SAT regions.

3). Effectively manage a fragile and risk prone environment.

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ICRISAT's MANDATE CROP

1. CHICKPEA
2. PIGEON PEA
3. SORGHUM
4. PEARL MILLET
5. GROUNDNUT

Climate Change

ICRISAT's Operational Research Strategy 2008-2015

- Helping farmers and stakeholders to cope better with current rainfall variability as a prerequisite to adapting to future climate change

- Adapting our mandate crops to grow in a warmer world

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CLIMATE CHANGE IMPACTS…

- The poor communities of the drylands of Africa and Asia
- Smallholder farmers
- Rain-fed farming systems of SATs

ICRISAT's Strategy

Resilience of livelihoods of rural communities and the resource base upon which they depend through a better understanding of current and future Climate Variability

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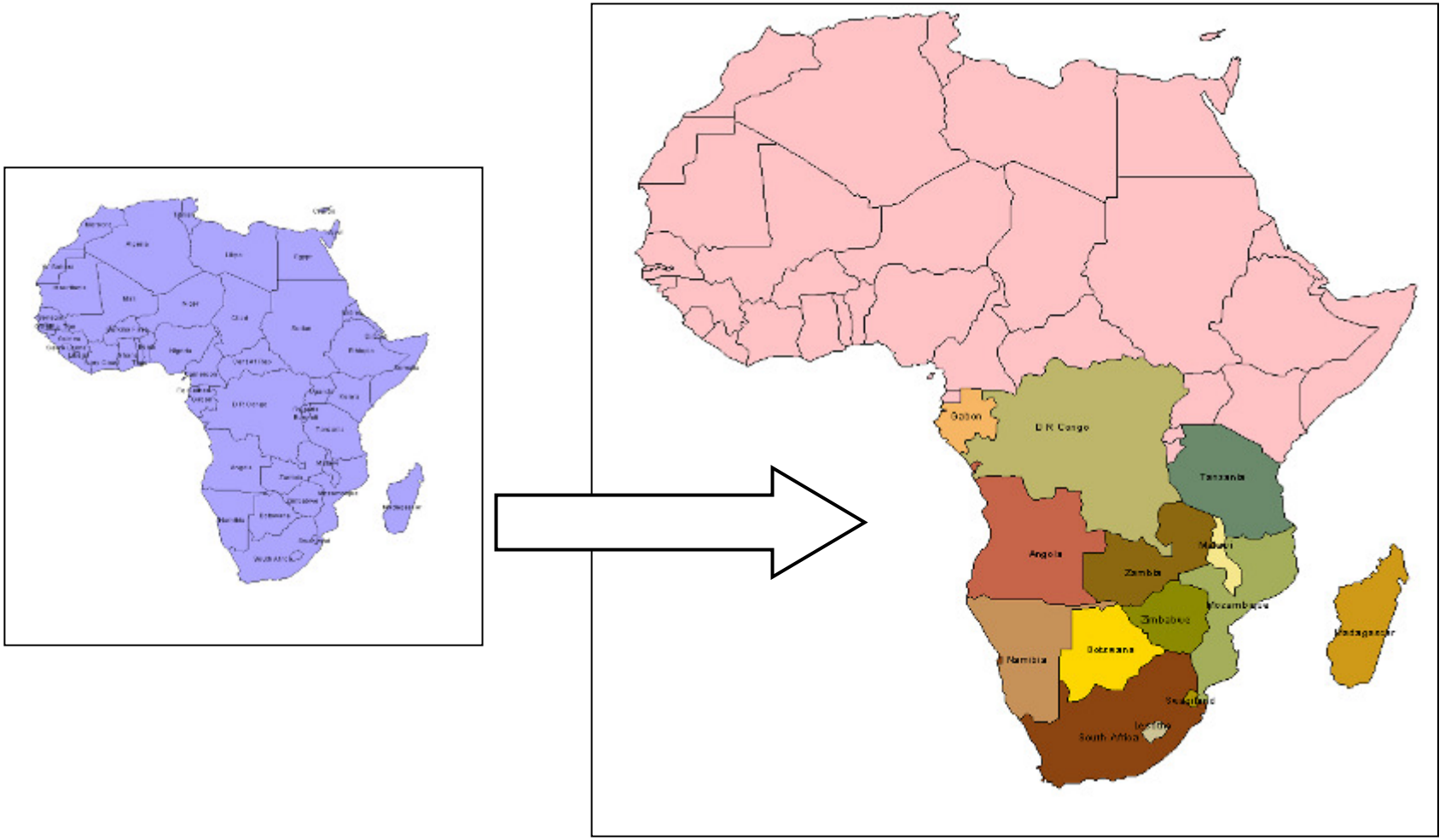
Southern African Countries



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CLIMATE CHANGE IMPACTS IN SOUTHERN AFRICAN REGION

- Land Degradation
- Severe threats to food production
- Changes in LGP
- Already undernourished population dependent on rain-fed agriculture
- Declining bio mass production

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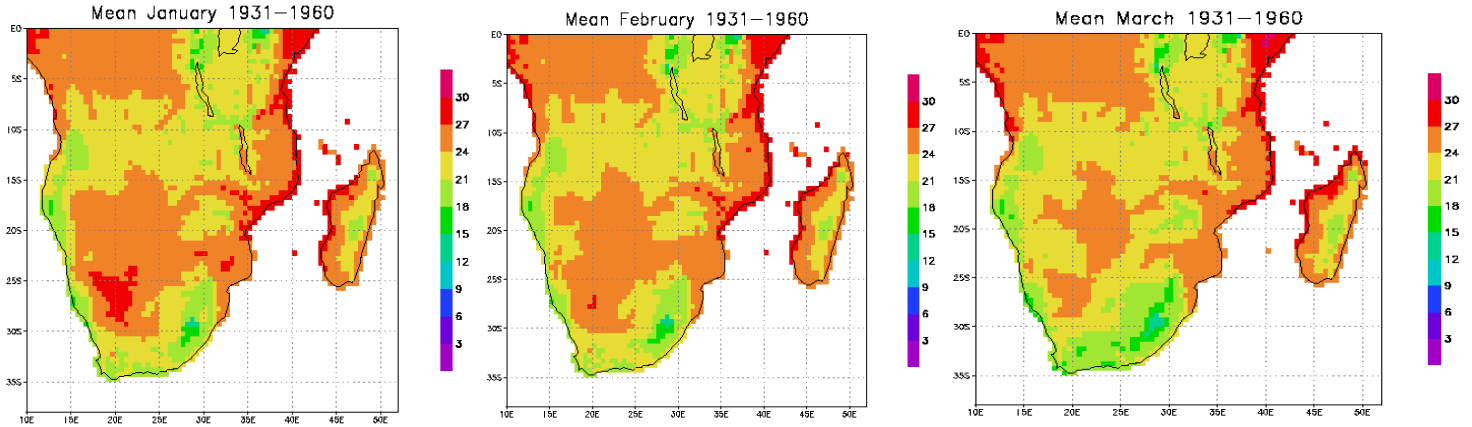
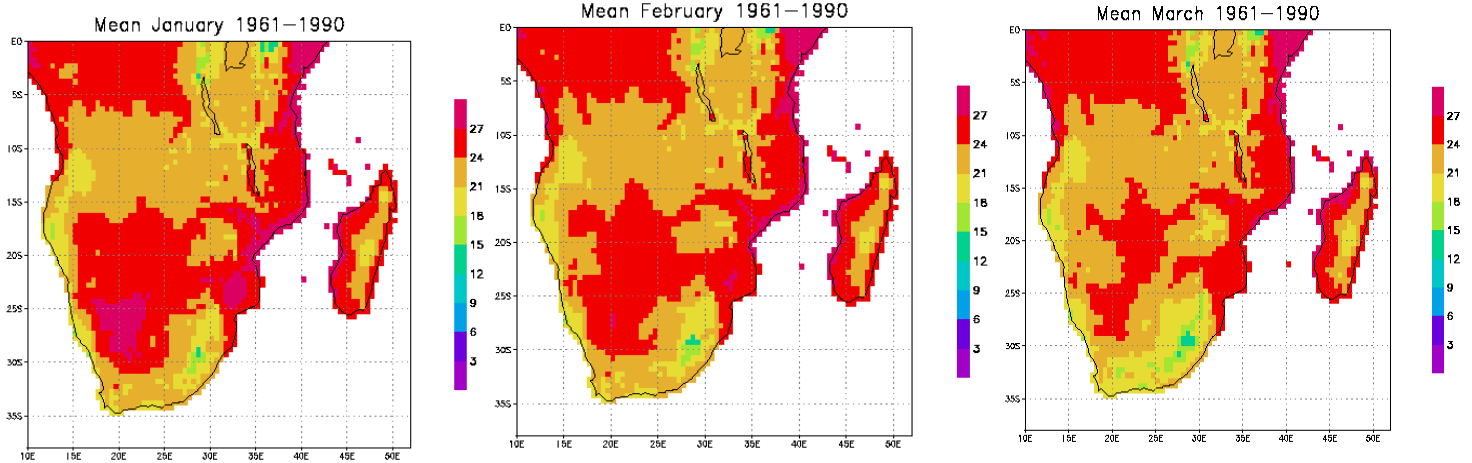
JAN-MAR

COMPARATIVE 30 YEAR MEAN MONTHLY TEMPERATURE

1931-1960



1961-1990



Source: ***http://www.geog.ox.ac.uk/~clivar/ClimateAtlas/ClimatologyIndex.html***

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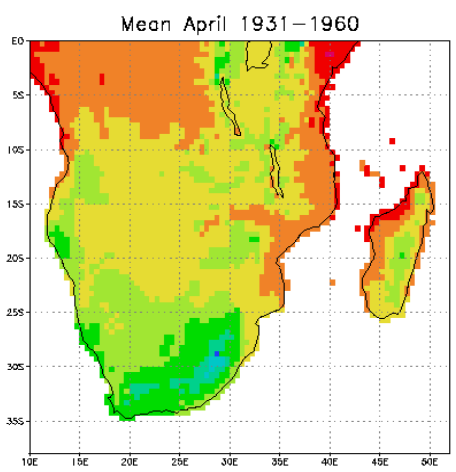
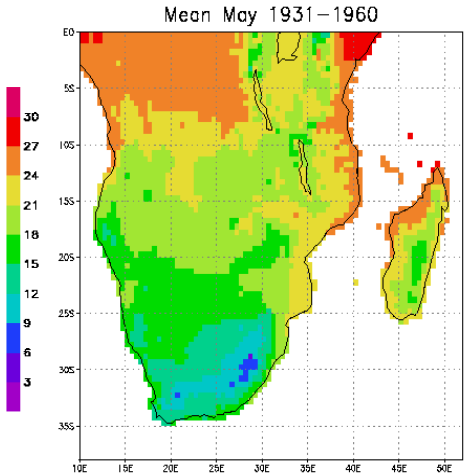
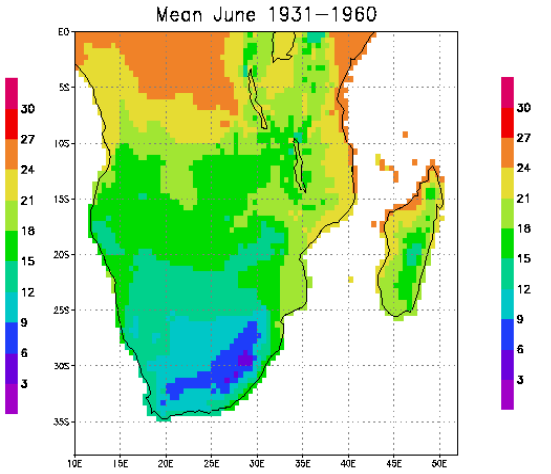
APR-JUN

1931-1960







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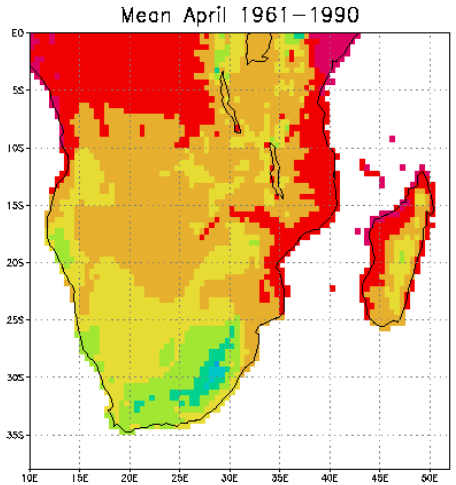

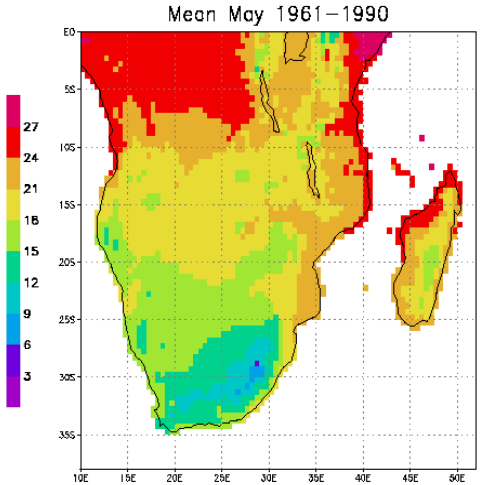

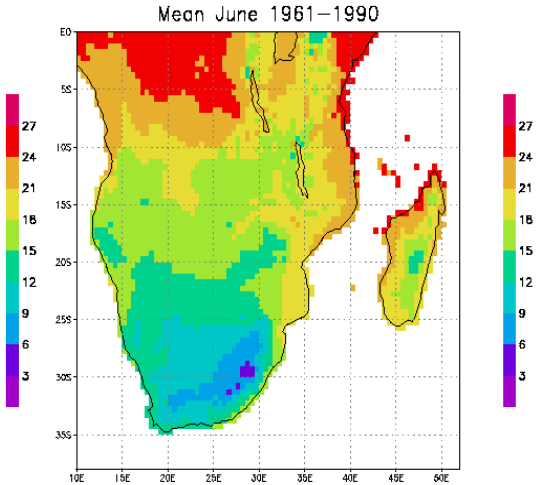

Source: ***http://www.geog.ox.ac.uk/~clivar/ClimateAtlas/ClimatologyIndex.html***

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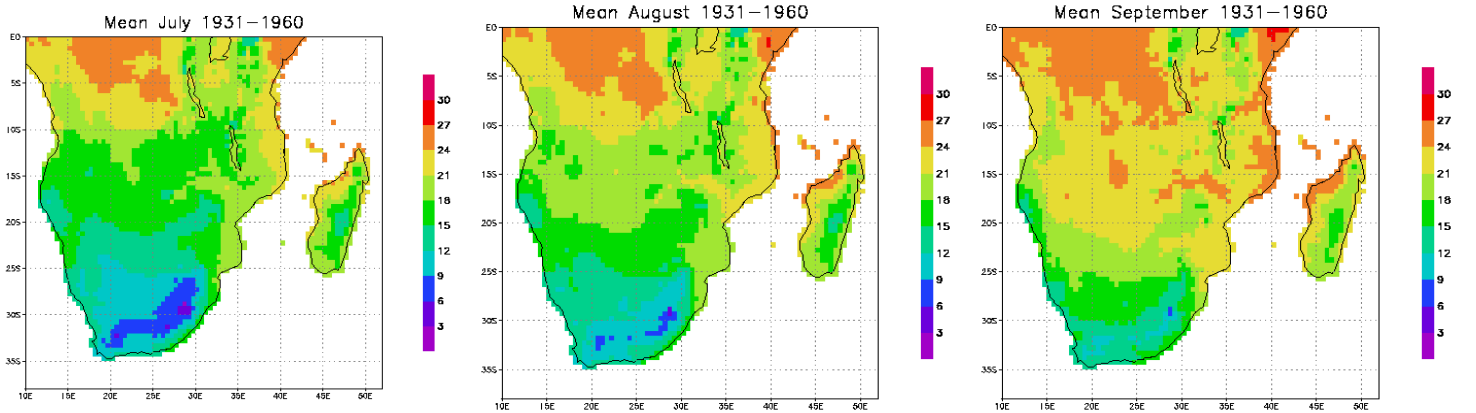
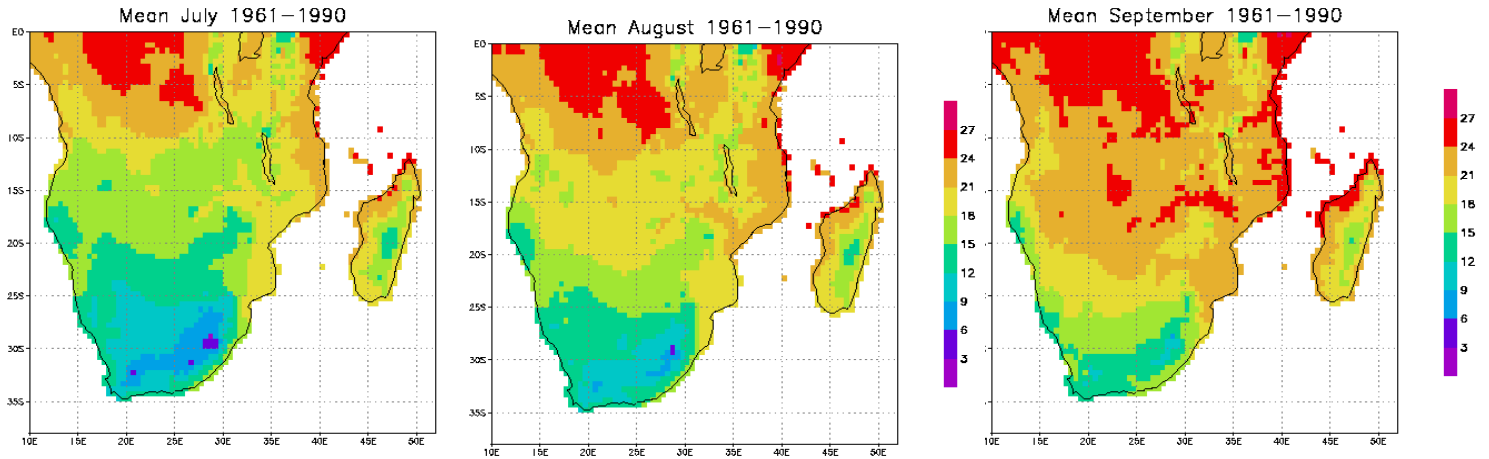
JUL-SEP

1931-1960



1961-1990



Source: ***http://www.geog.ox.ac.uk/~clivar/ClimateAtlas/ClimatologyIndex.html***

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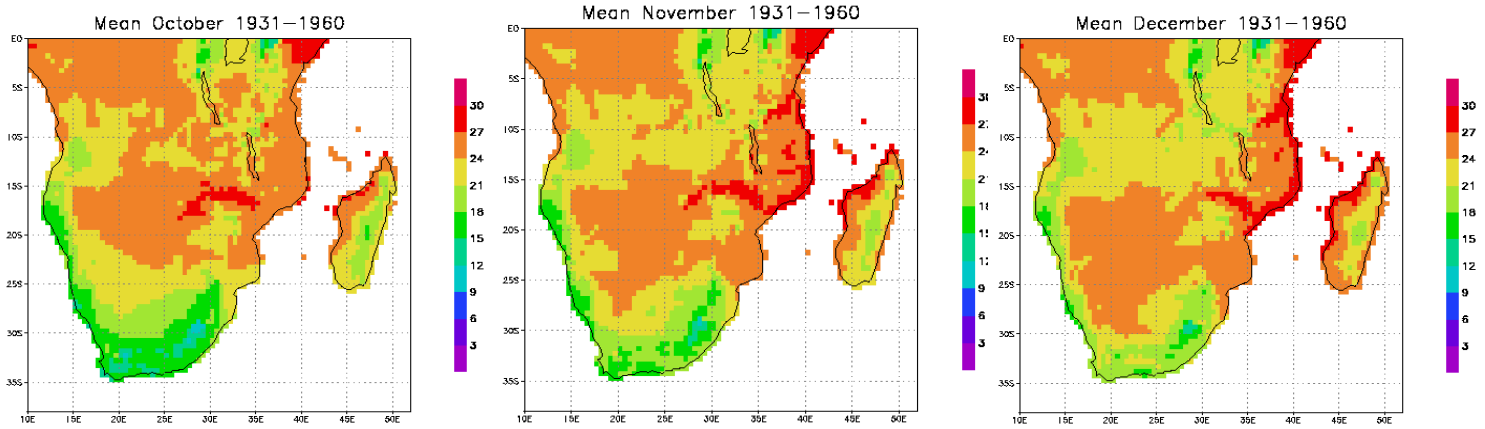
OCT-DEC

1931-1960



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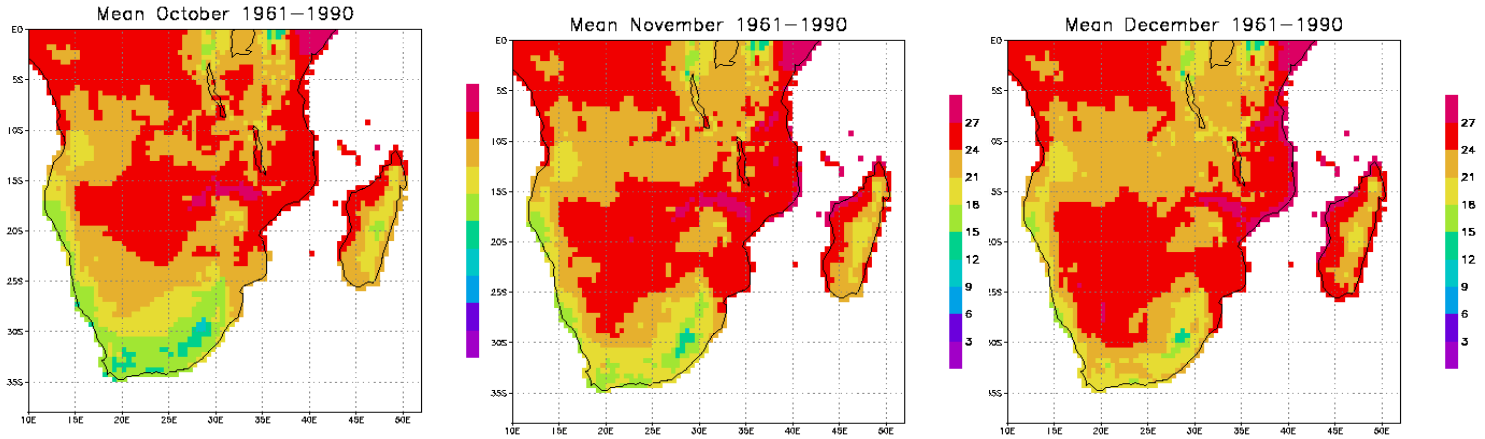

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LAND DEGRADATION IN SOUTHERN AFRICA

Characterised by

- Severe loss of productivity
- Severe loss of biodiversity

Due to

- inappropriate management of landuse
- overexploitation of local species
- overgrazing and poor rangeland management
- poor management of surface and groundwater resources

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Assessing land degradation and climate change impacts

THE ROLE OF REMOTE SENSING

- Landuse/Landcover change studies
- Natural Resource Inventory
- Time Series NDVI profile
- Remote sensing models (NDVI, NDWI, NDMI, NPP)

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REMOTE SENSING PRODUCTS USED

- SPOT VGT S10 Product for NDVI
- MOD17 MODIS Product for NPP
- SPOT VGT & Mean Annual Rainfall for RUE
- GLC2000 for Landuse/Landcover

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METHODOLOGICAL APPROACH

REMOTE SENSING MODELS

NORMALISED DIFFERENTIAL VEGETATION INDEX (NDVI)

NIR-R channel/ NIR+R channel

NET PRIMARY PRODUCTIVITY (NPP)

*derived from **MOD17** Product (MODIS)*

*P=LUE * fAPAR*PAR*

RAIN USE EFFICIENCY (RUE)

RUE= ANDVI/ Rainfall (mm.)

NDVI

Near Infra Red - Red/ Near Infra Red +Red

.

NDVI helps assess

Spatial distribution linkages of

1. Climatic parameters
2. Vegetative phenological cycles
3. Rainfed landuse

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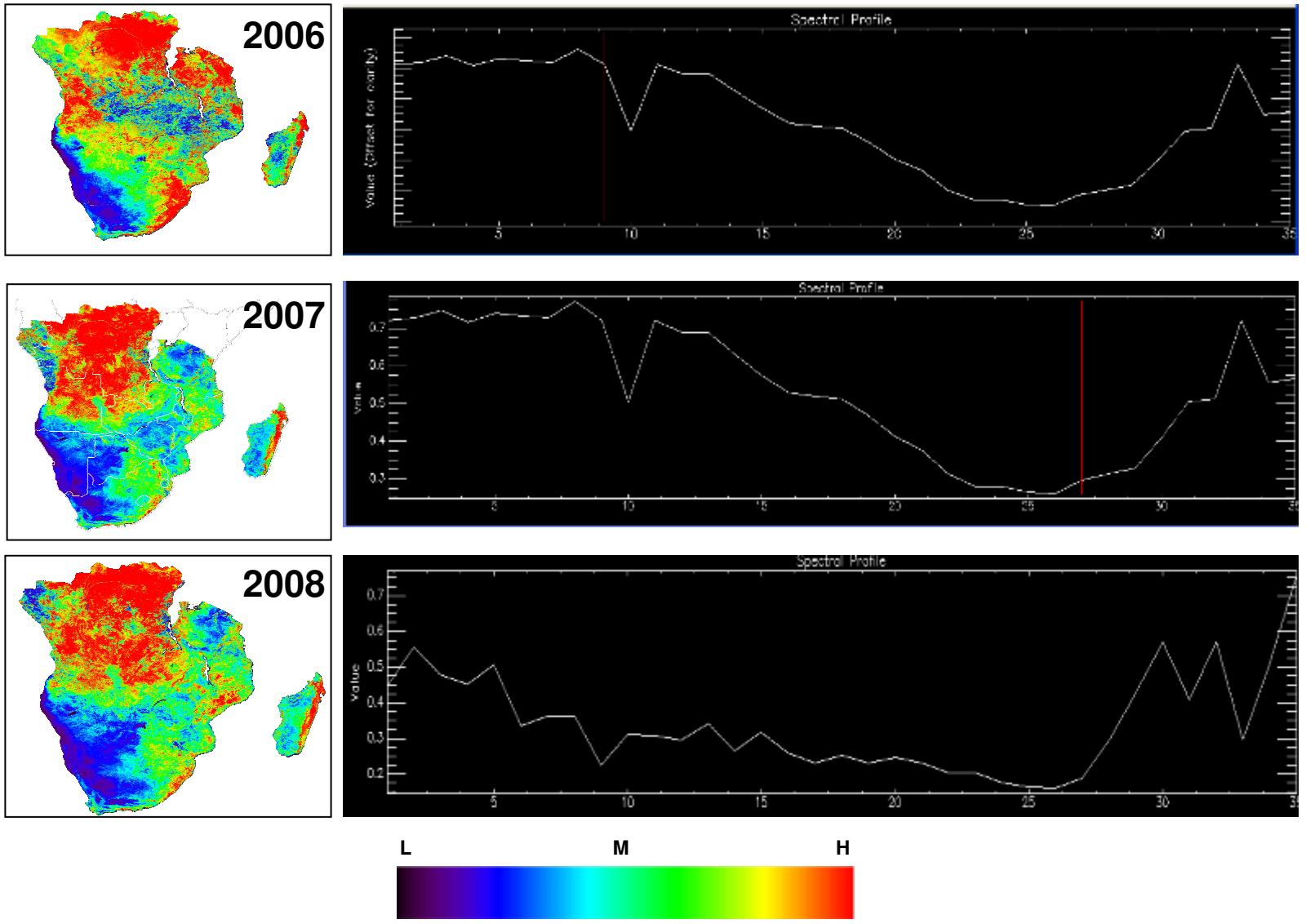
TIME SERIES NDVI PROFILE CALCULATED FROM SPOT-VGT S10--- 1Km



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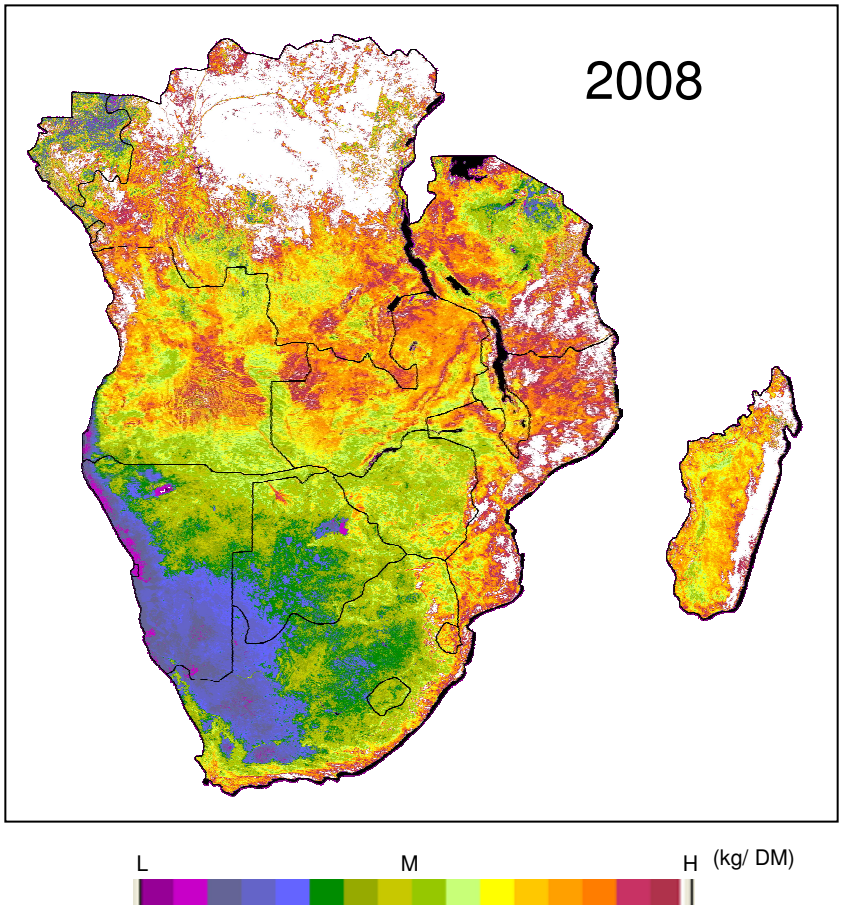
ANNUAL NET PRIMARY PRODUCTIVITY

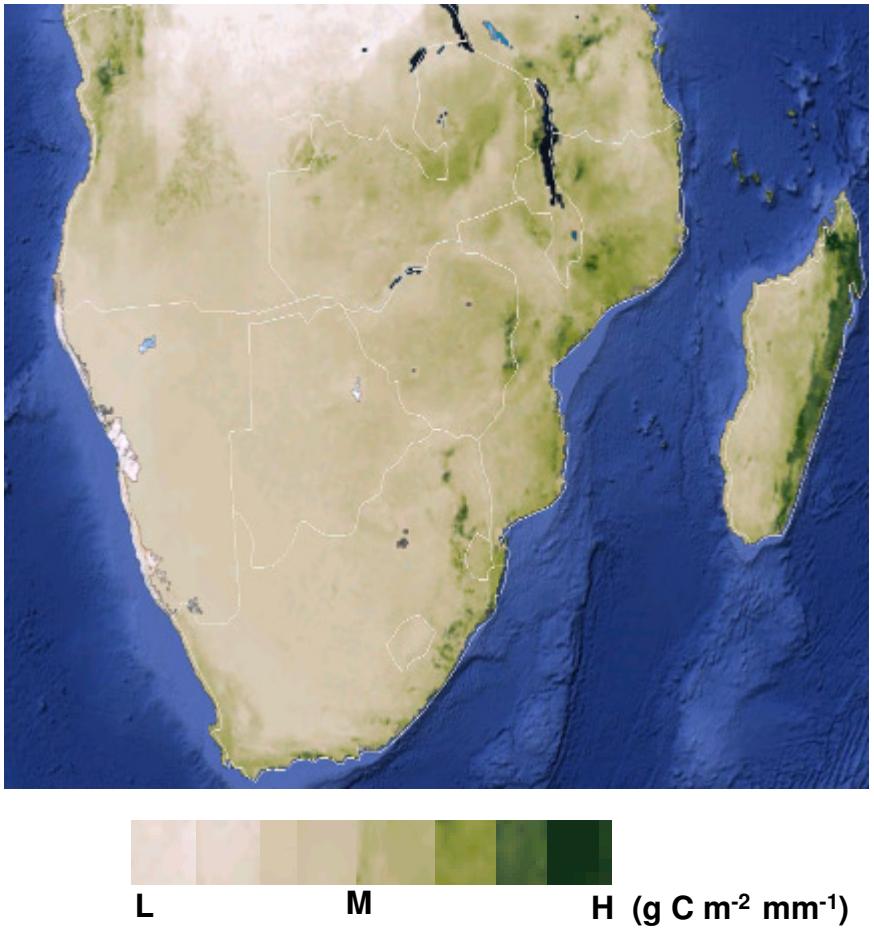


NPP FROM MODIS (1 KM)

- NPP is the rate of CO_2 fixation from atmosphere by vegetation
- It also indicates the ecosystem process of removing CO_2 from atmosphere and converting it to biomass.

RAIN USE EFFICIENCY

2008



- Rain Use Efficiency (RUE) is the ratio of Average NDVI over Rainfall
- It is a potential measure of rangeland condition
- It indicates spatial and temporal differences in land productivity

RUE ON GOOGLE EARTH IN KML FORMAT

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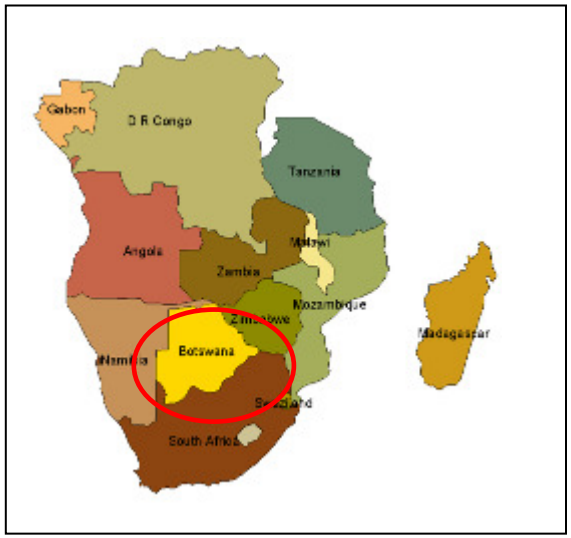
Climate Change Impacts and Land Degradation HOTSPOTS

1. Southern part of Zimbabwe
2. Northwestern part of Mozambique
3. Botswana
4. Western part of South Africa
5. Southern part of Namibia



Adaptation & Mitigation Strategies

- **Identifying hotspot areas**
- **Integrated land, water and rangeland management**
- **Improving livestock water productivity**
- **Identification of technology targeting areas to promote conservation farming such as mulching, basin crop residue and bed planting**
- **Promoting ICRISAT mandate crops for semi arid regions (Resilient varieties for warmer climates developed at ICRISAT HQ)**

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Thank You