Climate change impacts on agriculture and enhancing capacity to adapt in Tanzania

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1.0 AGRICULTURE……..

Contributes 21% on average (10-70% of GDP)

28% of the popn (200 milion people) are chronically hungry (Tabo et al., 2007)

Cultivate small area of land

Lack of technology and power to bargain on land

Water stressed to support irrigation

Degradation of soil fertility..

Met.records shows that unpredicability of rains is a common feature

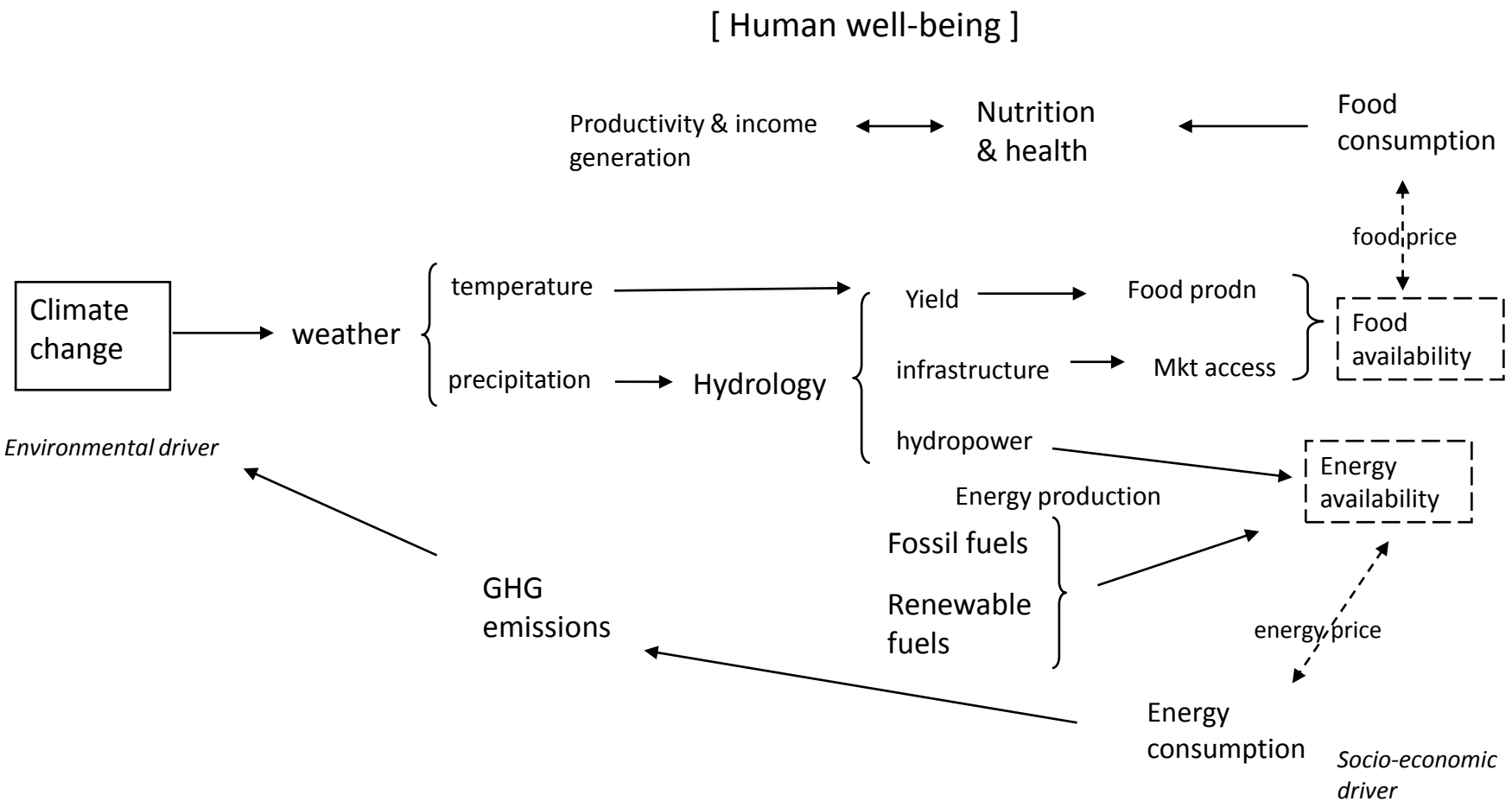
Agriculture in the region.....

- In many sub-Saharan African countries, poverty and food insecurity are linked to low agricultural productivity
- Affected by trends and shocks
  - Drought/floods-EL Nino
  - Removal of subsidies on input
  - Changes on policies and strategies
- Accelerating climate change and variability threatens to worsen this situation
- Diverse farming environments and complexities associated with peoples' livelihoods varying over time and space

Continue…….

- Smallholder agriculture underpins most rural livelihoods and national economy in Tanzania
- Agricultural production is frustrated by several factors
  - Policies changes and strategies
  - Biophysical factors
  - Climate change and variability impacts (CC&VI)
- The rural livelihoods context, including climate-related trends and shocks, together with people's capital asset base varies over time and space resulting in a wide range of coping and adapting strategies.
- There is a need to identify successful adaptation across countries and zones and upscale using innovation approach
- A number of

Linkages b/w climate change and food & energy availability



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- The paper builds on Tanzania's National Adaptation Programmes of Action
- It also builds on a number of case studies conducted by IRA over the last 4 years
- The NAPAs are linked to external funds, and prioritize agriculture in Tanzania being one of the most vulnerable sector
  - including incremental changes in cropping systems
  - Coping/livelihood strategies in relation to CC and V.

Continue……..

- **KEY CHALLENGE**: Understand the context and strategies of farmers and other stakeholders in agriculture for coping and adapting to changing/variable climatic conditions, in order to engender innovation.
- Lack of clear policy on climate change issues and also lack of integration among different policies/sectors
- Lack of proper ways or mechanism of sharing information on climate issues in the sector

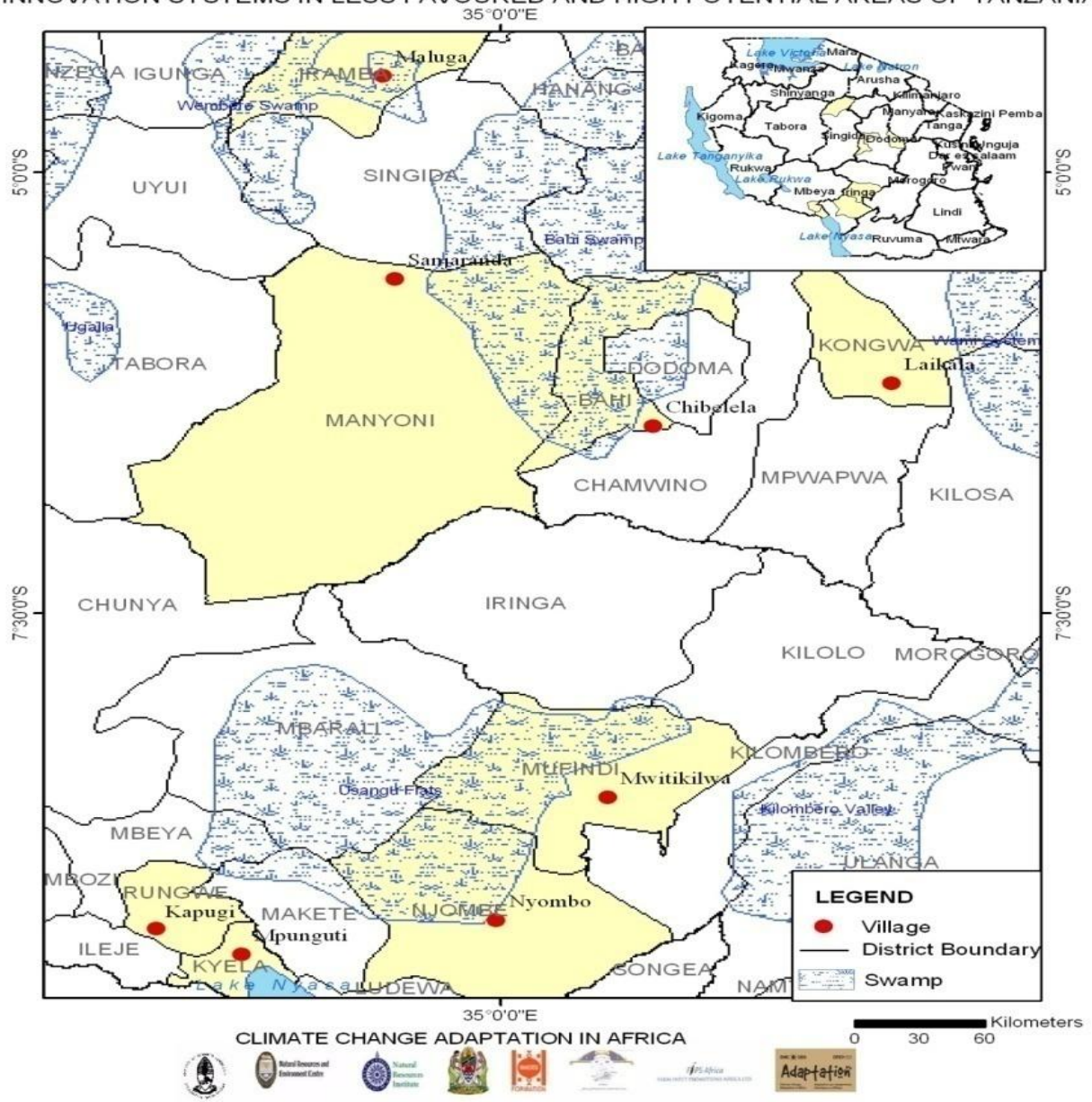
2 OVERALL OBJECTIVE

- Perceptions on climate issues based on local and scientific evidence
- Cantered on **strengthening** the capacity of **individuals, organizations and systems** within the agricultural innovation systems in less favoured areas and more favoured areas of Tanzania to adapt to the challenges and opportunities arising from CC & V.

Specific objectives….

- To examine perceptions on climate in terms of understanding, impacts, vulnerability and adaptations
- To examine how the capacity of private and public sector stakeholders to make agricultural innovation systems work more efficiently, equitably and responsively to climate change and climate variability
- To learn and share lessons for scaling up successful strategies for capacity strengthening (individuals, organizations and systems) within agricultural innovations systems to adapt to climate change and climate variability

PROJECT SITES FOR THE PROGRAM ON STRENGTHERNING LOCAL AGRICULTURAL INNOVATION SYSTEMS IN LESS FAVOURED AND HIGH POTENTIAL AREAS OF TANZANIA



CLIMATE CHANGE ADAPTATION IN AFRICA

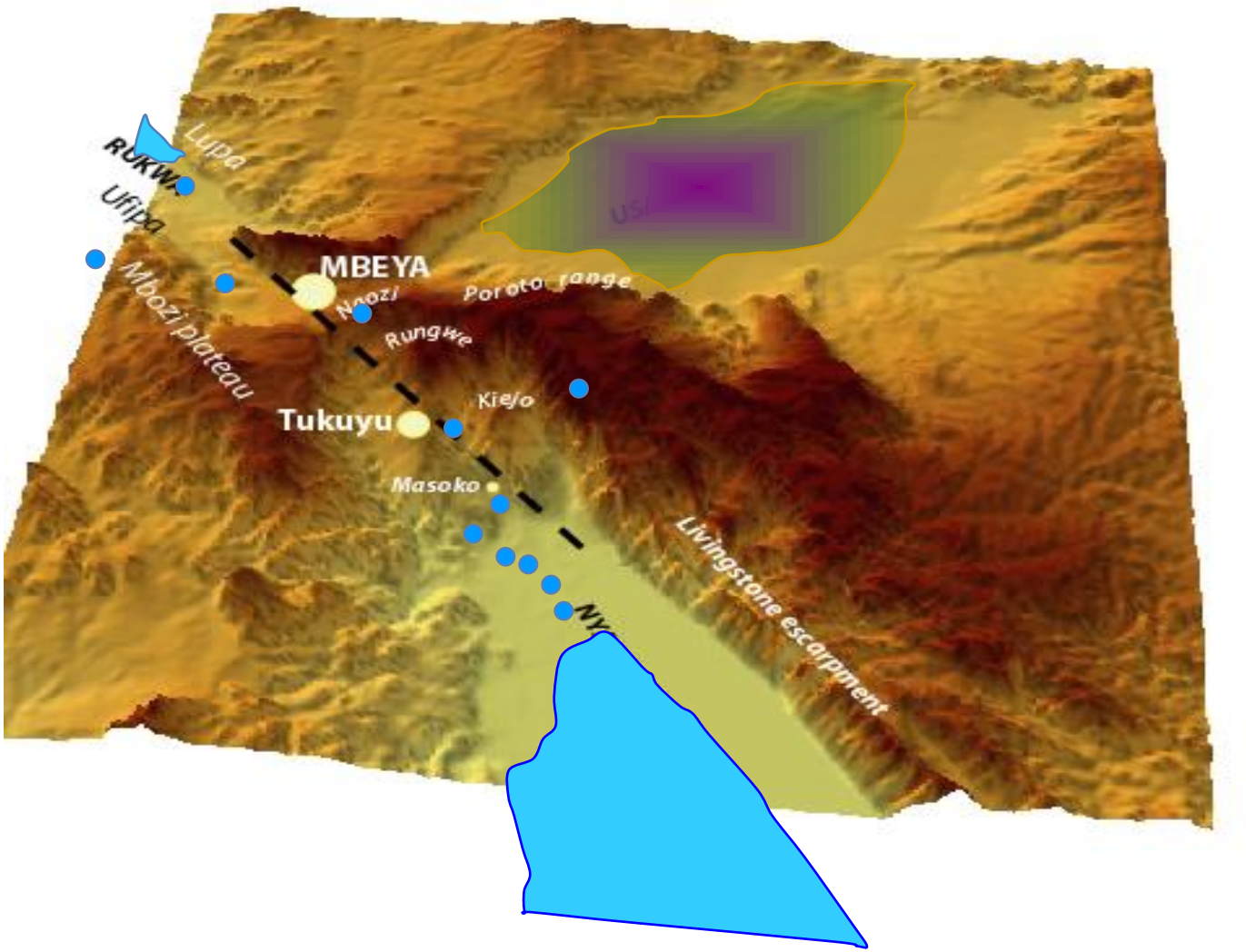
3.0 Approach-Review of climate change research

- IDRC/CCAA funded projects
- UDSM/NORWAY research projects
- CLEHA/RESON long term climate research
- Dissertations of Master students
- Stakeholders workshops and seminars etc
- Consultations with various stakeholders

4. MAJOR FINDINGS-Selected

- Climate change perceptions
  - Understanding of change and indicators
  - Impacts on crops and livestock
  - Vulnerabilities and factors
  - Copping and adaptation & future strategies
- Response from action research
- Changes observed from a PAR project

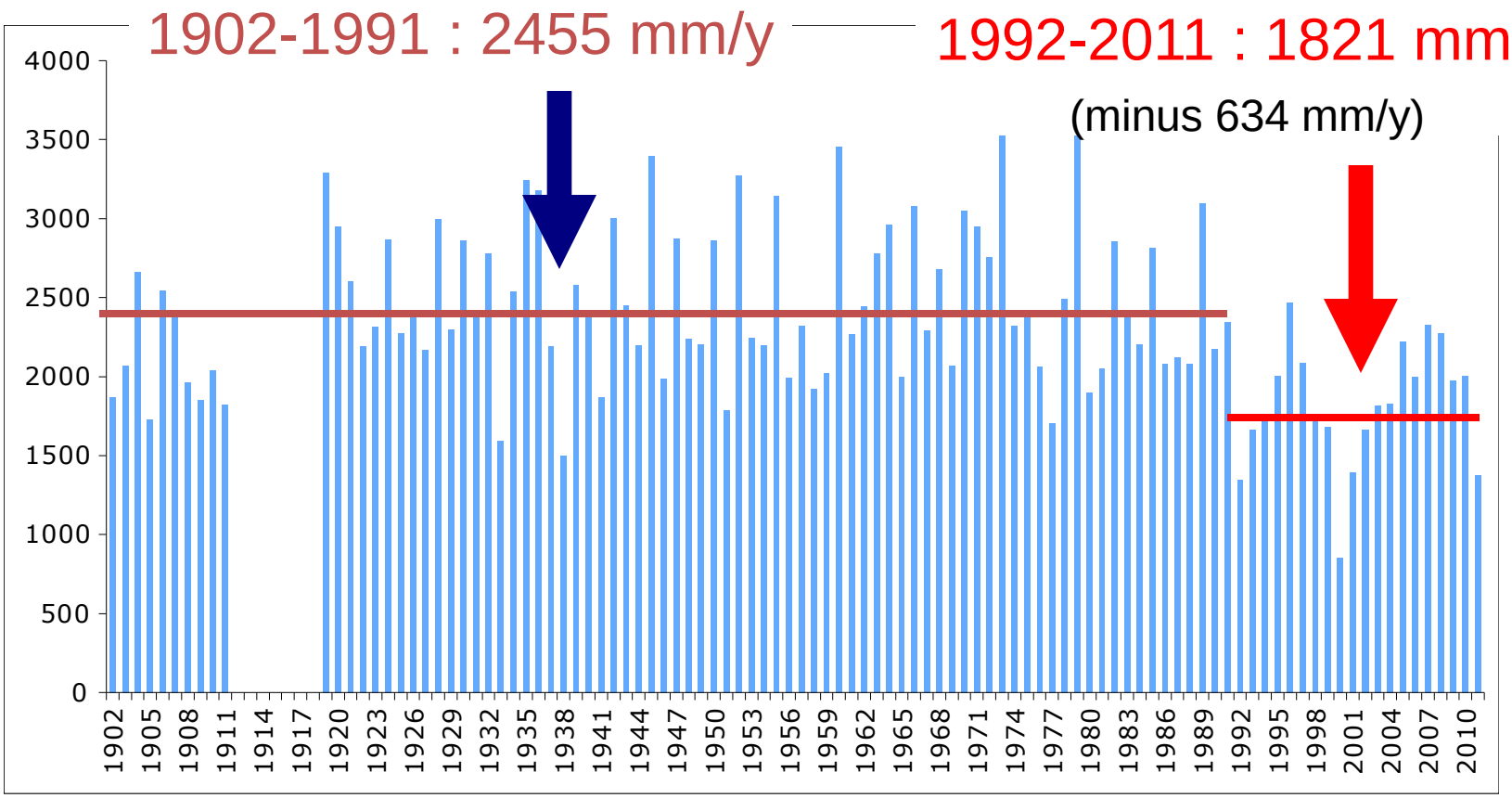
Location of Climate change monitoring station at Masoko in Tukuyu, Rungwe Mbeya



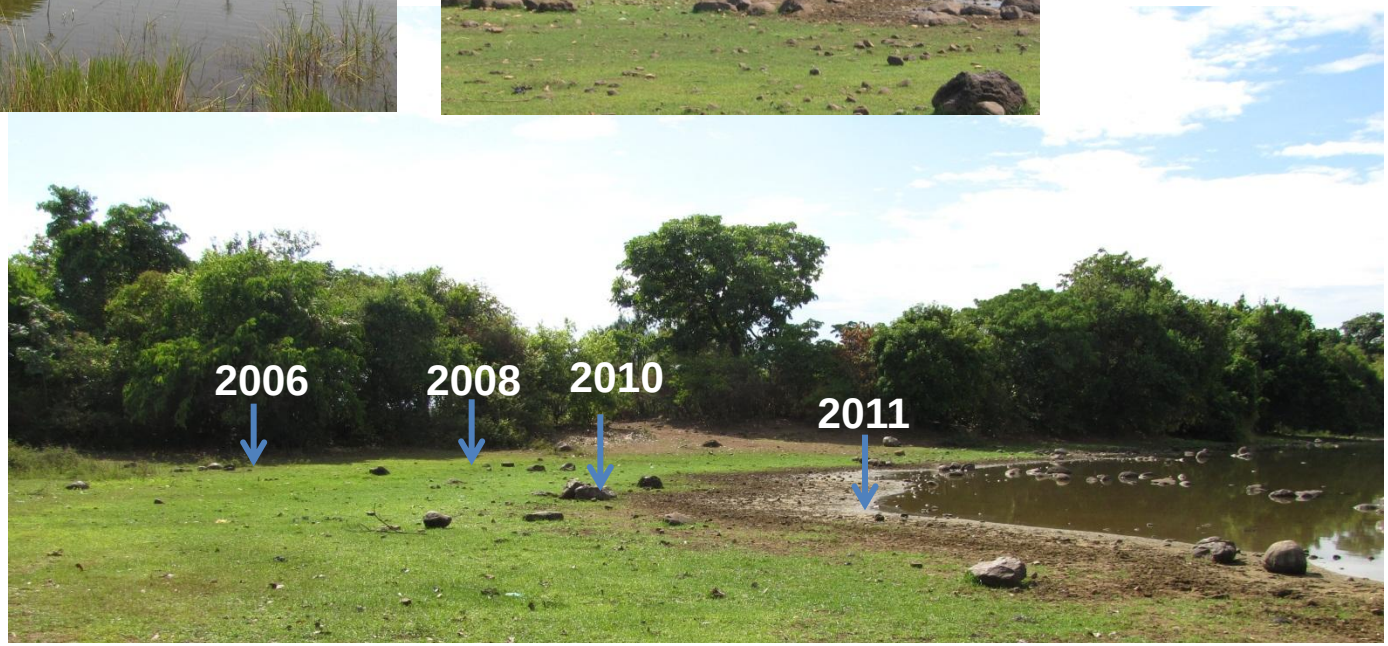
Rainfall

Record

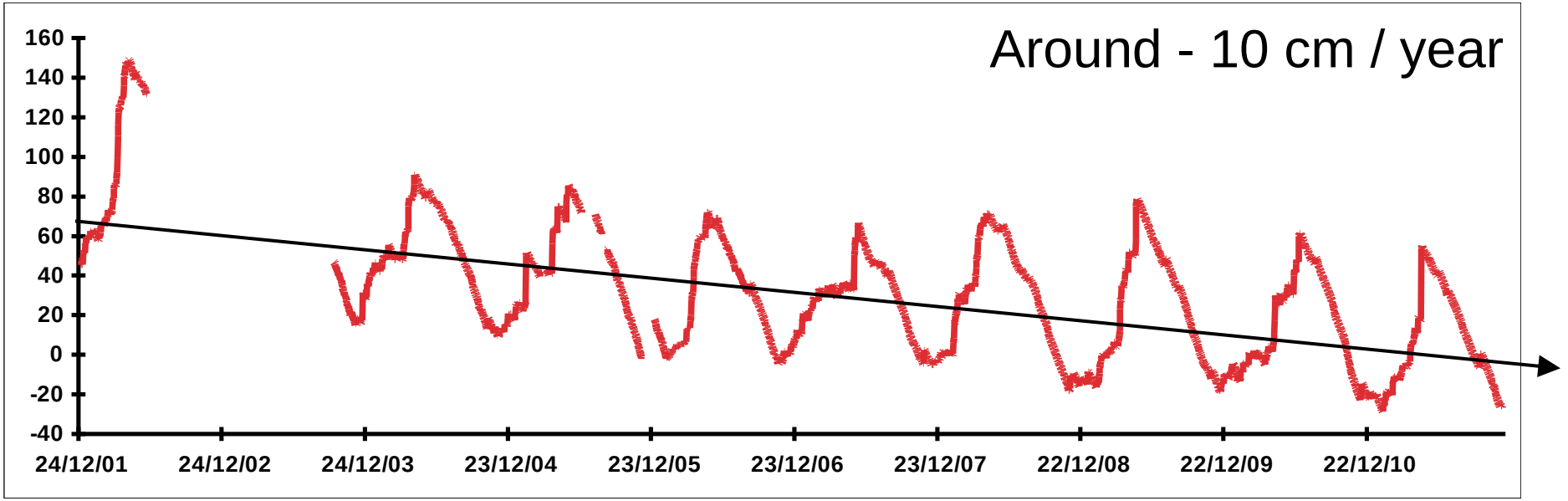
Annual rainfall in mm/year at Tukuyu (from 1902 to 2011)



Kingiri Lake in November

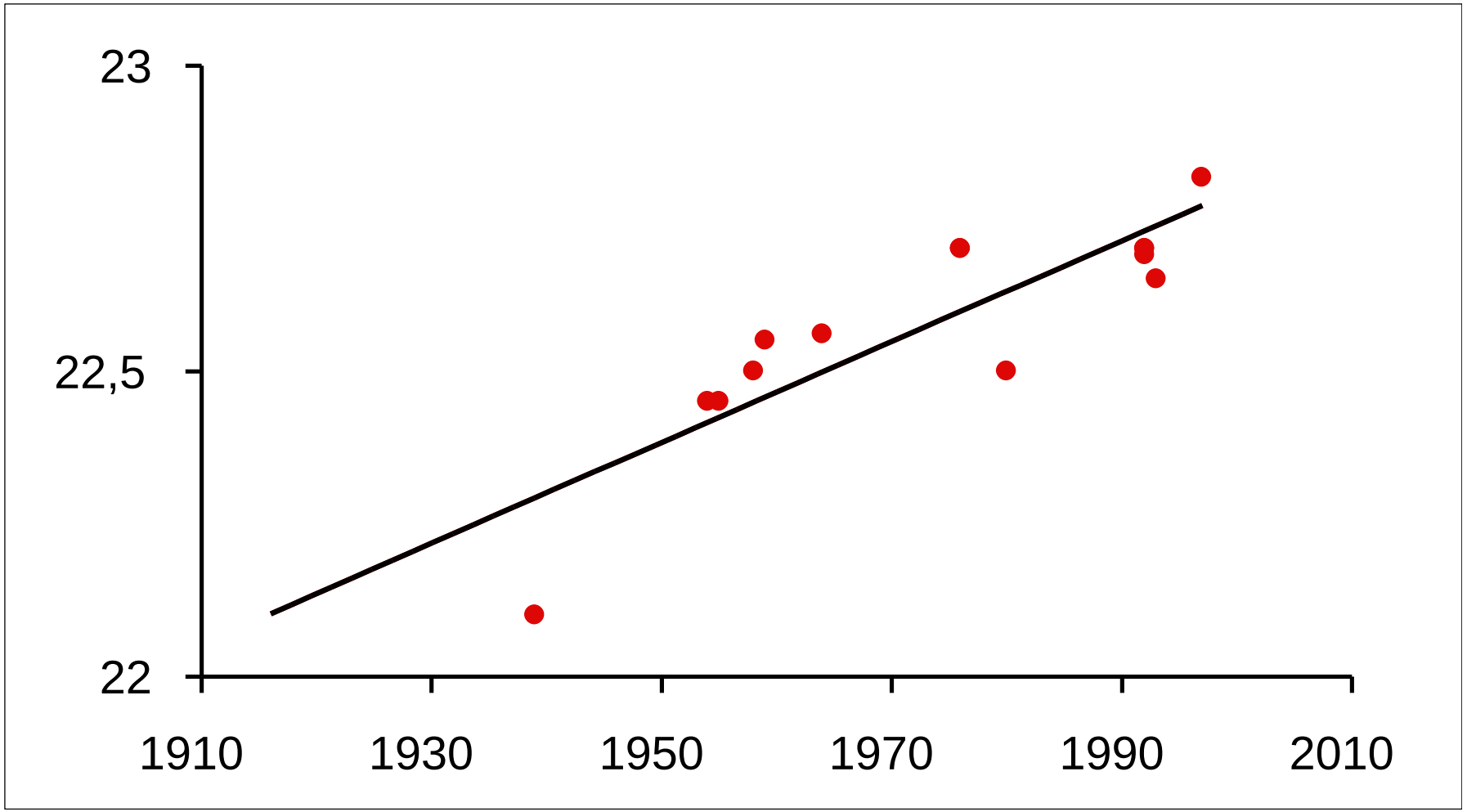


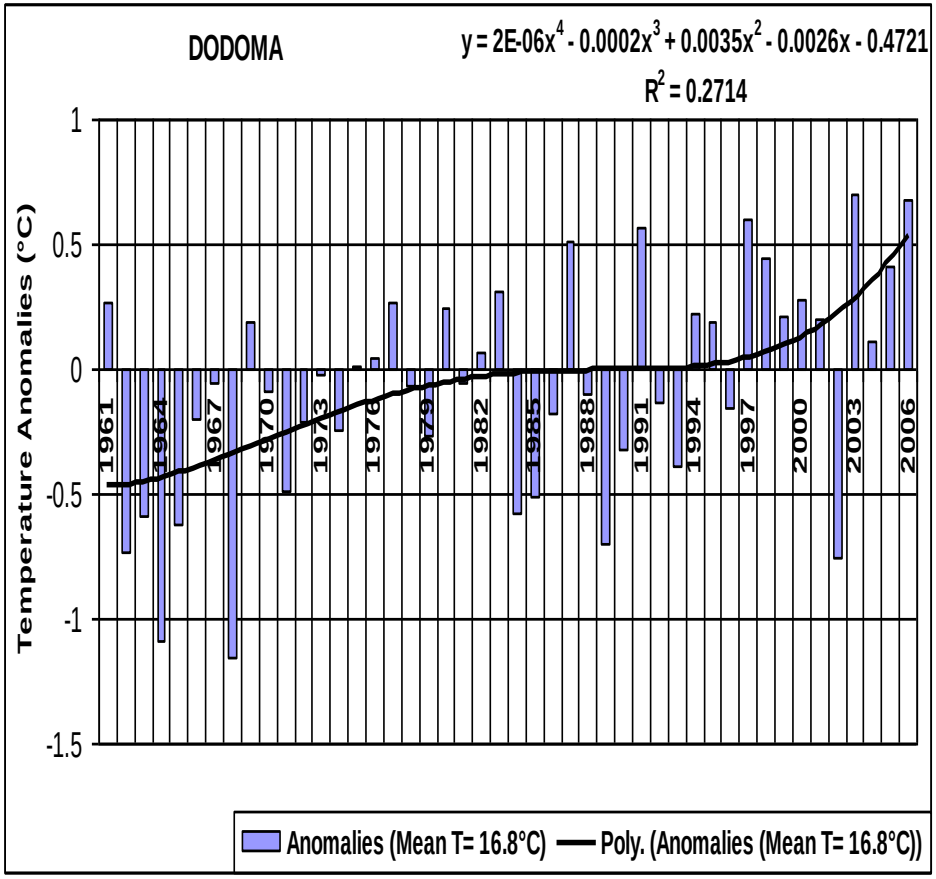
Masoko-Kisiba lake-level in cm (from december 2001 to december 2011)

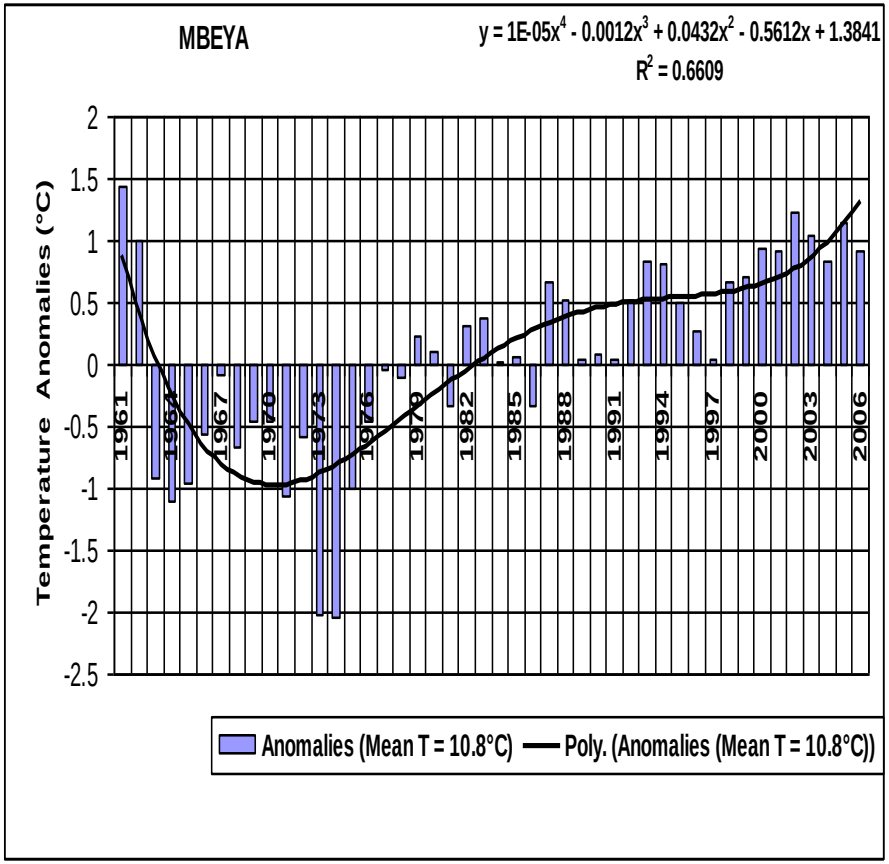


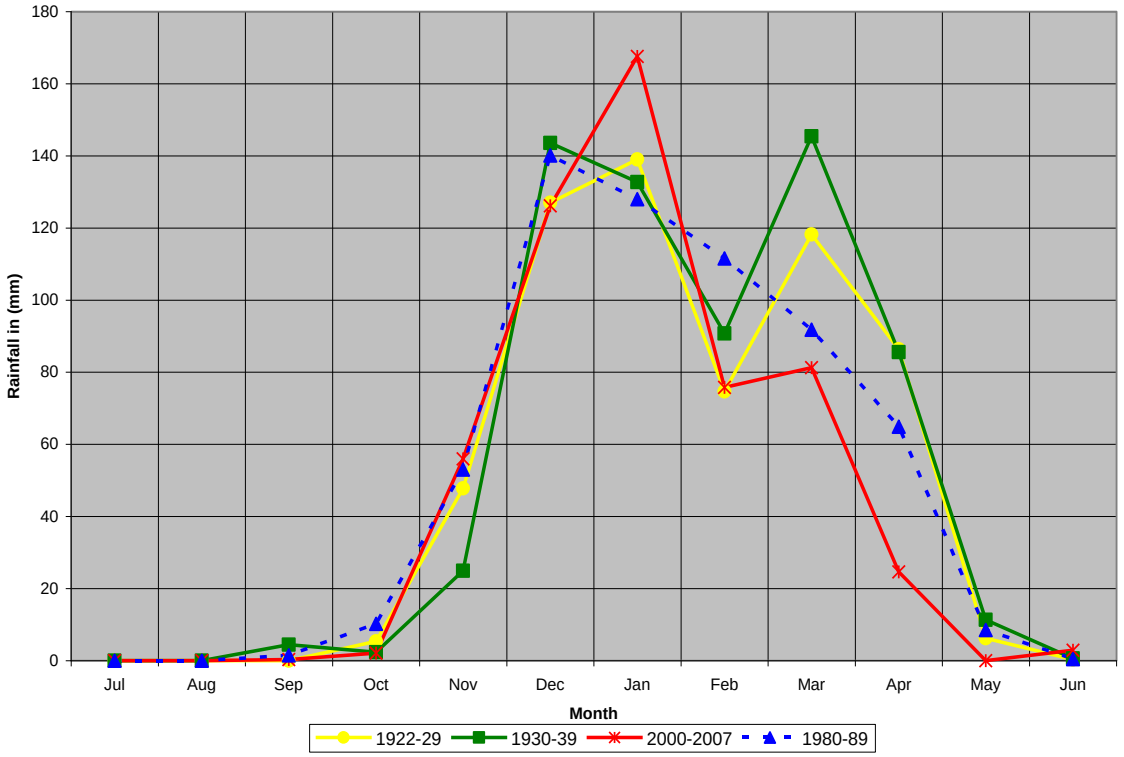
TEMPERATURE CHANGES

Lake Nyasa deep water temperature (below 300 m)




DODOMA
y = 2E-06x^4 - 0.0002x^3 + 0.0035x^2 - 0.0026x - 0.4721
R^2 = 0.2714
Temperature Anomalies (°C)
1
0.5
0
-0.5
-1
-1.5
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
Anomalies (Mean T= 16.8°C)
Poly. (Anomalies (Mean T= 16.8°C))


MBEYA
y = 1E-05x^4 - 0.0012x^3 + 0.0432x^2 - 0.5612x + 1.3841
R^2 = 0.6609
Temperature Anomalies (°C)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006
Anomalies (Mean T = 10.8°C)
Poly. (Anomalies (Mean T = 10.8°C))



Challenges: **Temperature** increased dry spell, early onset of summer while increased **Rainfall** variability and patterns.

Evidence are supported by **local communities** observations

Lema and Majule (2009).

- Reflect shift in on set of rains and shrinking of rain season
- Shrinking or disappearing of one rainfall peak
- Excessive rains for a shorter period
- Implications on cropping patterns

	Tanzania	
Perceptions and changes	**Low potential area**	**High potential area**
	-Climate (temperature, rainfall, wind, whirl wind) -Temperature increasing -Rainfall decreasing more unpredictable -Rainfall coming late and ends soon	-Climate (temperature, rainfall, dew, wind, lightning) -High temperature starts early, cool period increased -Rainfall came late and unpredictable -Dew decreasing
Impacts	-Declining crop yield -Traditional crops abandoned -Poor livestock production -Increasing livestock diseases such (ECF)	-Decline soil fertility -Stuntent crop growth -Destruction of mature crops in the field and stored ones due to shift of rainfall
Vulnerability	-The poor in the community -Women, children, and elders are the most vulnerable -People with less education -Disabled and sick people -Crop growers and livestock keepers	-The poor are most vulnerable -Women, children, elders are the most vulnerable
Adaptations	-Use drought resistant crops (eg sunflower) -Small scale irrigation of crops -Increasing non farm income generating activities -Uuse of appropriate crop varieties (early maturing) -Introduction of new crops	-Increasing wetland farming -Improved social networks -Use of improved seed varieties -Use of artificial fertilizers -Networking

Changes in GDP across regions of TZ

	Initial GDP share	deviation in avg annual real GDP from baseline 2046-50 (%)			
	(%)	HOT	COOL	WET	DRY
Northern zone	21.85	-9.76	-1.89	+8.51	-15.51
Southern highlands	15.72	-2.14	-1.88	-0.84	-6.33
Northern coast	13.48	-3.59	-1.32	+5.66	-9.23
Southern coast	3.95	-1.88	+0.65	+0.1	-6.49
L. Victoria	30.21	-6.24	-0.12	-3.53	-13.61
Western Zone	6.96	-0.57	-4.04	-5.32	-9.47
Central Zone	7.83	-5.39	-0.11	+0.05	-10.19
National	100	-5.42	-1.19	+1.10	-11.51

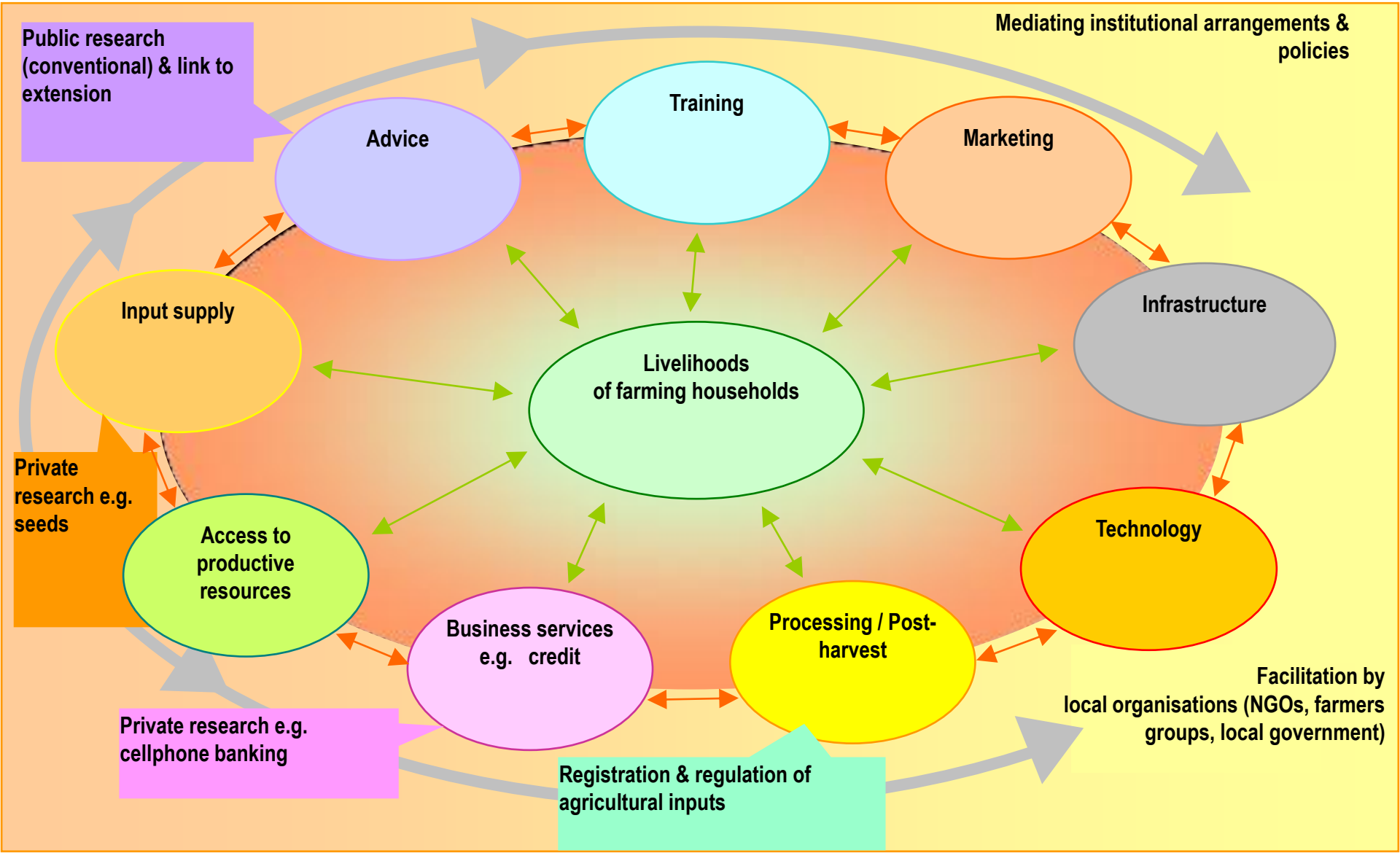
Arndt *et al.* (2011)

Table 1: Extent to which crop yields (kg/acre) has been affected by pests due to increase in temperature
Source: Field data (2011).

Upungu village					**Mbogwe village**			
Type of crop	*Average yield before pests*	*Average yield with pests*	*Loss incurred*	*% Loss*	*Average yield before pests*	*Average yield with pests*	*Loss incurred*	*% Loss*
Maize	1131	435	696	62	809	436	373	46
Rice	2033	683	1350	66	2336	647	1689	72
Cassava	1525	725	800	52	480	155	325	68
Cotton	n/a	n/a	n/a	n/a	479	97	382	80
Groundnuts	1356	488	869	64	763	313	450	59
Sweet potato	1325	500	825	62	675	258	418	62

An Innovation System (IS) is a 'network of organizations, enterprises and individuals focused on bringing new products, new processes and new forms of organization into economic use, together with the institutions and policies that affect their behavior and performance'

Agricultural innovation system from farmer's perspective



Implement appropriate agronomic practices at community level

3.2 Crop performance base on tillage and fertilizer management

Tillage methods	Farmyard (Tons/ha)			MPR	Mean
	0	2.5	5		
Slash and burn (Traditional tillage)	1000	1000	1650	1660	**1328**
Ripping (Magoye ripper)	2085	3750	4580	2500	**3229**
Deep ploughing (Spring hoe-jembe)	1660	2080	3750	3750	**2810**
Shallow plough (Ox-plough)	1250	833	1500	1000	**1146**
Tie Ridging (Ox- ridger)	2080	2917	2080	2000	**2269**
Mean	**1615**	**2116**	**2712**	**2182**	

Improve the flow and use of weather information

- Train farmers to keep and monitor information on rain and temperature and also how to use it



- Share information on weather through local radio programs, TV, mobile phones and down scale weather predictions

Farmers: Outcome challenges: *an example*

The key outcome challenge for farmers is that "the project intends to see farmers are diversifying crops to increase yields and income, using appropriate soil and water conservation techniques. They are accessing and experiment appropriate innovations such as small pack of improved seeds and appropriate fertilizers. Farmers are accessing, sharing and using meteorological, adaptation and marketing information.

Project Boundary Partners	Tanzania
Farming communities	-Increased knowledge on climate -Planting well adaptable crops (sunflower, sorghum, banana, wheat and beans) -Planting new tree crops eg avocardo -Using deep tillage equipments -Establishing more adaptation groups -Capacitated to produce quality declared seeds -Using irrigation pumps to grow vegetables
Extension staff	-Transferring knowledge to other villages -Documenting and disseminating successfully strategies using flip cameras -Increased their responsibility to work with farmers

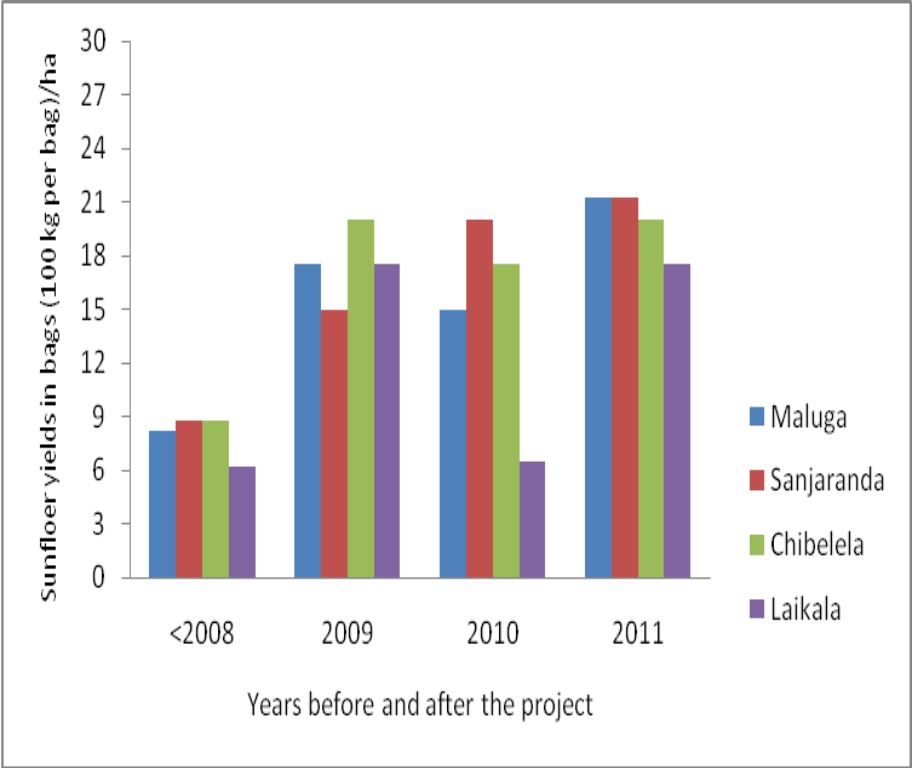
NGO's	-Packing seeds and fertilizers according to farmers demand -Supplying inputs and tools suitable to farmers -Training farmers on agronomic practices
Political domain *NCG-National Consultation Groups (Tanzania and Malawi)*	-Increased knowledge on CC -Supporting farmer groups in terms of tillage tools such as power tillers -Mainstreaming climate change issues in planning process (DADPs) -Support tree planting initiatives by groups
Media group	-Publishing climate change adaptation news -Broadcasting climate change news -visiting project sites and associated activities

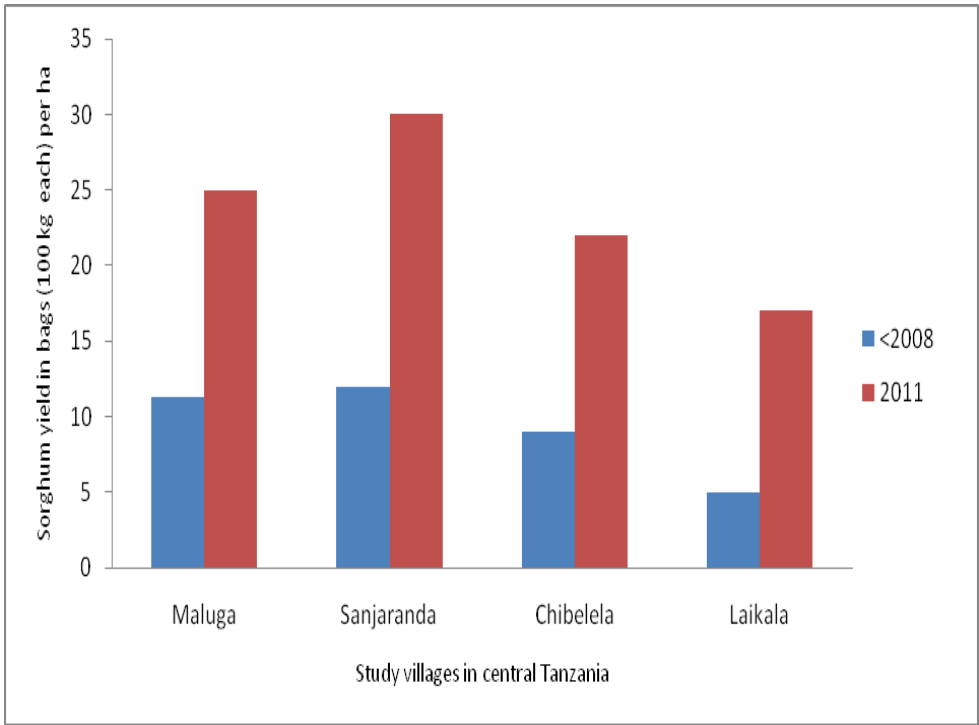
What to be done?

- Strengthen farmers' capacity to access and use quality information, training and products in order to adapt to climate change and climate variability

- Strengthen the capacity of private and public sector stakeholders to make agricultural innovation systems work more efficiently, equitably and responsively to climate change and climate variability

- Share lessons for scaling up successful strategies for capacity strengthening (individuals, organizations and systems) within agricultural innovations systems to adapt to climate change and climate variability


Sunfloer yields in bags (100 kg per bag)/ha
30
27
24
21
18
15
12
9
6
3
0
<2008
2009
2010
2011
Years before and after the project
Maluga
Sanjaranda
Chibelela
Laikala


Sorghum yield in bags (100 kg each) per ha
35
30
25
20
15
10
5
0
Maluga
Sanjaranda
Chibelela
Laikala
Study villages in central Tanzania
<2008
2011

5. CONCLUSIONS

- Climate change is a reality; communities have wide knowledge on changes and associated impacts
- Impacts, vulnerability and adaptation strategies varies according to both biophysical and social factors
- There is strong evidence that behavior of farmers, institutions and organizations can be changed if PAR process is well implemented
- Involvement of policy makers at various level is crucial in adaptation research

6.POLICY RECOMMENDATIONS

- Mainstream climate change issues into research and development agenda in agricultural sector
- Strengthen AIS by maximizing interactions among institutions involved
- Integration of different knowledge, agricultural development programs/projects at community level is crucial: This will avoid confusions to the farming communities
- Needs for strengthening environmental unit

Investments required

- Expand access to rural finance and cost-sharing programs
- Strengthen research and outreach services
- Support for local institutions
  - farmer organizations
- Land tenure and resource ownership policies

THANK YOU 4 YOUR ATTENTION

AHSANTE SANA