The Adaptation Dynamics of Agriculture to Climate Change

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The impact of climate change will fall disproportionately on the world's poorest countries, many of them here in Africa.

Poor people already live on the front lines of pollution, disaster, and the degradation of resources and land.

For them, adaptation is a matter of sheer survival.

Past UN Secretary General, Kofi Annan, COP 12

Adaptation

Adjustment in response to actual or expected climatic stimuli or their effects, which can help to **moderate the harmful** effects and/or **exploit beneficial** opportunities.

Types of adaptation :

- **Anticipatory (proactive) adaptation:** Adaptation that takes place before impacts of *climate change* are observed.
- **Autonomous (spontaneous) adaptation:** Adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or *welfare* changes in *human systems*.
- **Planned adaptation:** Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.

Sectors that are already **tightly managed by humans** – food systems, forestry, and water systems - can most readily be adapted to the impacts of climate change, e.g. shift to alternative crops/tree species that require less or tolerate more water, or that remain productive under higher temperatures.

(However, there are limits to such adaptations if the climate changes too much or too fast).

On the other hand, it is more difficult to develop adaptation strategies for **natural systems**, which provide the indirect ecosystem services that ultimately underpin human well-being.

Here, the need is for a **holistic approach** to nature conservation – namely improving health and enhancing the resilience of well functioning ecosystems.

Appropriate adaptation strategies include :

- expansion and connection of PANs,
- control of alien species,
- use of active adaptive management
- *ex situ* conservation.

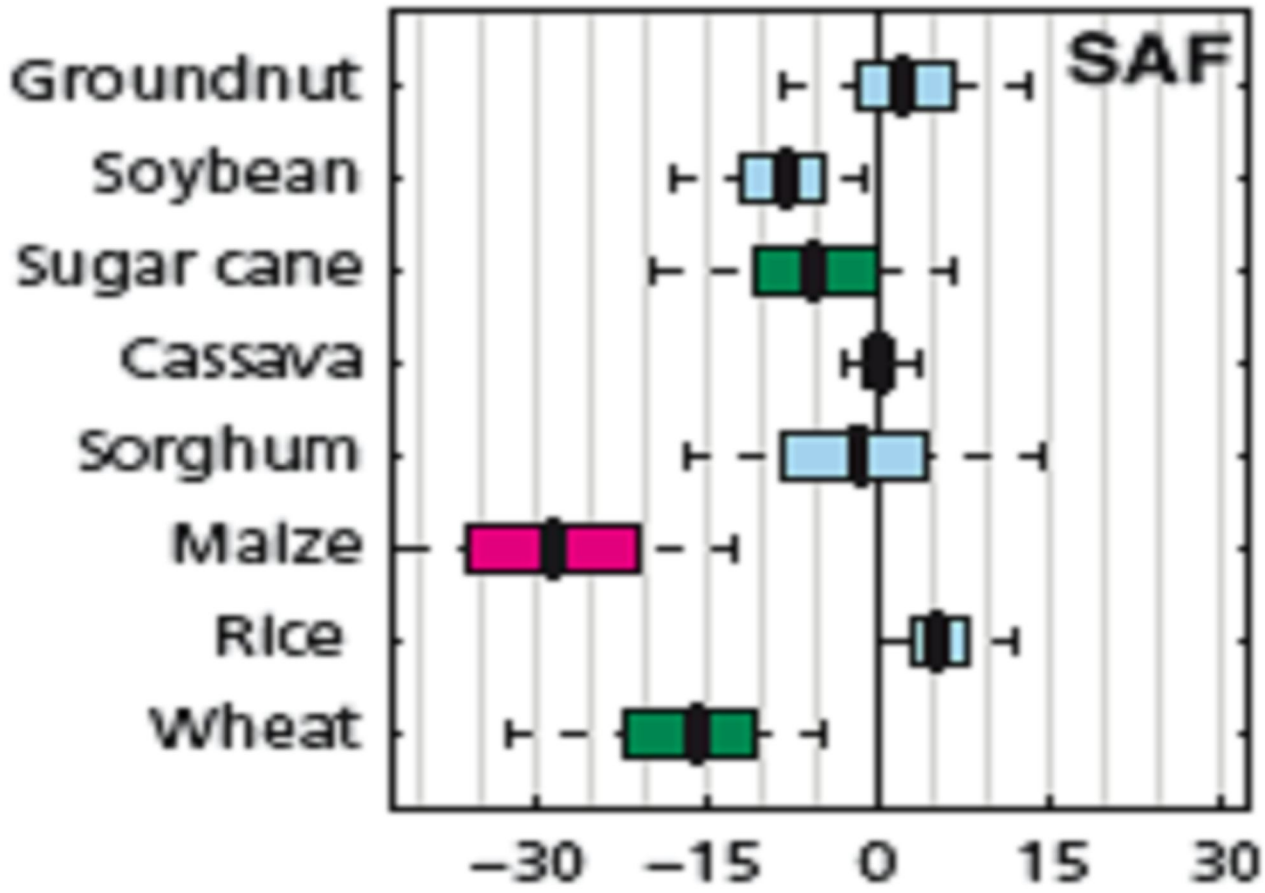
(Nonetheless, large numbers of species will not survive with unabated climate change)

Temperature Change Projections

(IPCC, 2007)

	Temperature Change (C at 2090-2099 relative to 1980-1999)	
Scenario	Best Estimate	Likely Range
B1	1.8	1.1 - 2.9
A1T	2.4	1.4 - 3.8
B2	2.4	1.4 - 3.8
A1B	2.8	1.7 - 4.4
A2	3.4	2.0 - 5.4
A1F1	4	2.4 - 6.4

Projected climate change impacts on agricultural production in Southern Africa in 2030, expressed as a % change relative to 1998-2002 averages



Synthesis Report, Copenhagen, 2009

Adaptation Planning

- Must recognize the levels of uncertainty in climate change scenarios.
- Plans themselves must be adaptable.
- Requires adoption of a system-of-systems principle.
- Requires adoption of long-term strategy solutions.

Adaptation is urgent, and requires substantial resources

- Financial and technical assistance will be required for the additional costs of designing and implementing interventions.
- Developing countries & LDCs do not have the financial resources and technical knowledge for anticipatory and planned intervention.

Annual investment expenditure needed to counteract the effects of climate change on nutrition (million US$)

(IFPRI, 2009)

Scenario	South Asia	East Asia and the Pacific	Europe and Central Asia	Latin America and the Caribbean	Middle East and North Africa	Sub-Saharan Africa	Developing countries
NCAR with developing-country investments							
Agricultural research	172	151	84	426	169	314	1,316
Irrigation expansion	344	15	6	31	–26	537	907
Irrigation efficiency	999	686	99	129	59	187	2,158
Rural roads (area expansion)	8	73	0	573	37	1,980	2,671
Rural roads (yield increase)	9	9	10	3	1	35	66
Total	1,531	934	198	1,162	241	3,053	7,118
CSIRO with developing-country investments							
Agricultural research	185	172	110	392	190	326	1,373
Irrigation expansion	344	1	1	30	–22	529	882
Irrigation efficiency	1,006	648	101	128	58	186	2,128
Rural Roads (area expansion)	16	147	0	763	44	1,911	2,881
Rural Roads (yield increase)	13	9	11	3	1	36	74
Total	1,565	977	222	1,315	271	2,987	7,338

Adaptation must be part of national development strategies

- Adaptation to climate change cannot be successfully implemented if treated as an “add on” and implemented separately from other initiatives aimed at fostering economic and social development and increasing the resilience of societies.

Climate change is local and site-specific

Adaptation planning requires detailed analysis of local impacts and also site-specific effects of the proposed adaptations, but

The adaptation interventions should also be incorporated into larger scale coherent adaptation programmes.

Adaptation must be evolutive

- Climate change impacts will change over time, and individual elements of adaptation must change with them.
- Adaptation requires a variety of technical measures that can be applied at different speeds at different times.
- Required inputs should be programmed and sustained for the whole of the adaptation period.

Climate risk management

CRM is an approach to climate-sensitive decision making for adapting to climate variability and change.

Helps reduce the vulnerability associated with climate risk.

Involves proactive ‘no regrets’ strategies aimed at maximizing positive and minimizing negative outcomes for communities and societies in climate-sensitive areas such as agriculture, food security, water resources, and health.

The ‘no regrets’ aspect of CRM means taking climate-related decisions or action that make sense in development terms anyway, whether or not a specific climate threat actually materializes in the future.

Adaptation & Disaster Preparedness

- Climate is almost near the upper range of projections, and societies require adaptation policies, practices and infrastructure that can cope with extreme events at the severe end of the probability distribution.
- Thus, adaptation strategies should include a strong component of disaster preparedness, placing even more emphasis on emergency management services.

Adaptation and Mitigation

- Adaptation and Mitigation are closely related as response strategies, and need to go hand in hand.
- Even a massive mitigation effort initiated today would be unable to eliminate the impacts of the climate change that are already occurring
- At the other extreme, if no mitigation is initiated, the risk of the cc-induced catastrophes is large.
- Even the wealthiest of societies, with the best and most well-resourced adaptation activities, would not be able to completely adapt to such drastic events related to climate change.

Adaptation and Mitigation

- The integration of adaptation and mitigation activities in a systems framework is paramount in order to capture synergies that enhance each other, and to prevent antagonistic interactions. Examples of synergies :
  - Sustainable forest management;
  - Natural regeneration of local biodiversity;
  - Community-based natural resource management.

Some Adaptation Strategies required for coping with climate change, particularly among poor resource farmers in Africa.

- Recognize that enhanced food security and climate-change adaptation go hand in hand.
- Support community-based adaptation strategies.
- Increase funding for adaptation programs.
- Better access to education and to markets, more efficient agricultural extension, and easier credit services, technology and farm assets (such as labour, land and capital).

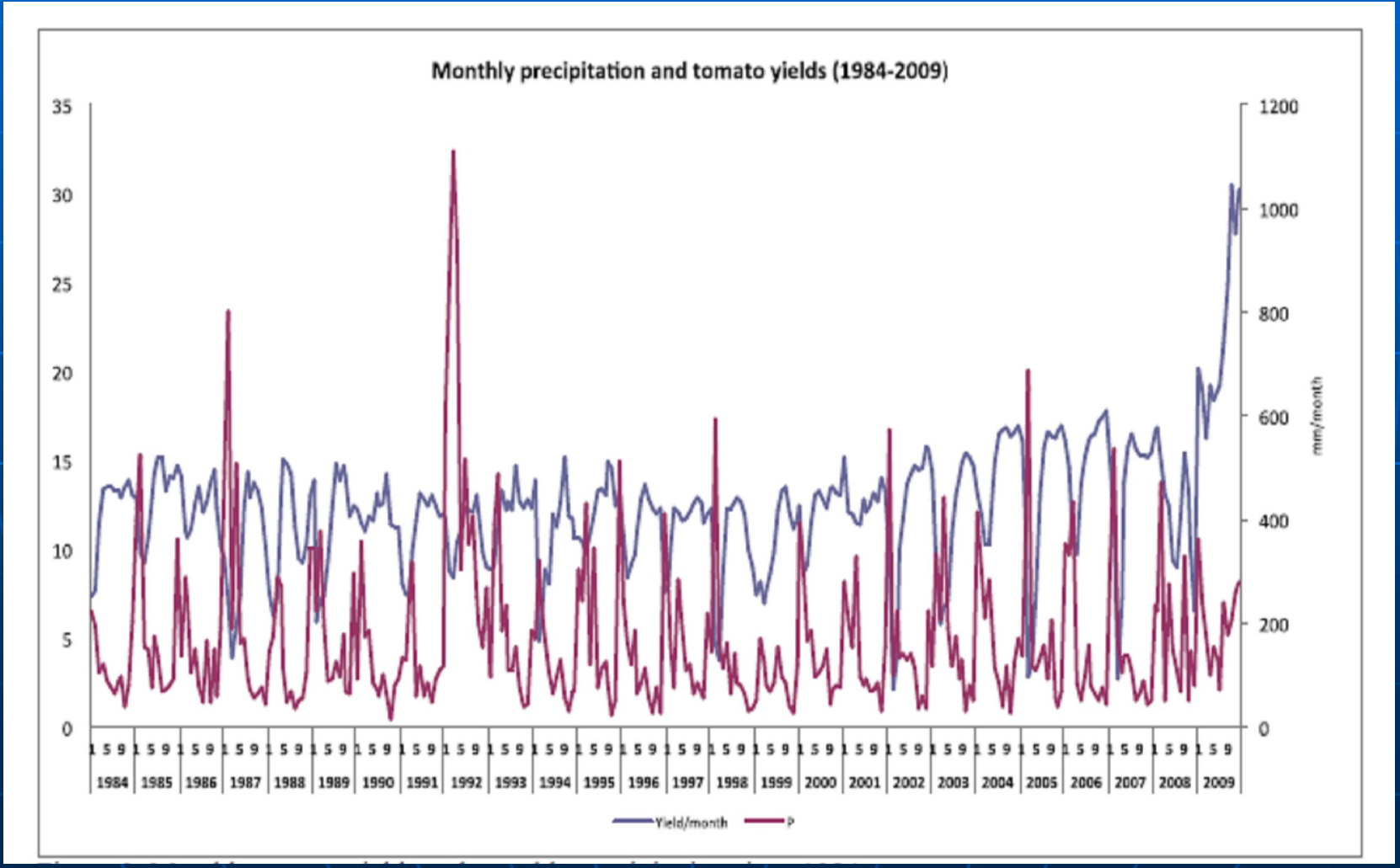
Some Adaptation Strategies required for coping with climate change, particularly among poor resource farmers in Africa.

- Design and implement good overall development policies and programs.
- Increase investments in agricultural productivity
- Reinvigorate national research and extension
- programs.
- Improve global data collection, dissemination, and analysis.
- Make agricultural adaptation a key agenda point within the international climate negotiation process.

Climate Change & Food Security in Mauritius

- Mauritius, being a net food importing country, climate change impacts will be felt not only directly on food production in the country, but also indirectly through the impacts on agricultural production in importing countries (e.g. increased droughts in Australia).
- The latter will affect Mauritius through the impacts on food prices and even availability of food products.

Madeleine Jönsson (2011, Uppsala) carried out a socio-econometric study on the impact of cc on tomato production in Mauritius.



Impacts of climate change on monthly yield variation/ha in tomato yields in Mauritius (Jönsson, 2011)

	Climate change scenairos		*Impacts on monthly yield*
Time period	*ΔT*	*ΔRain*	*Whole Island*
Short-run	*+0.5°C*	-	-2%
	+1°C	-	-4%
	+2°C	-	-8%
	+3°C	-	-12%
	-	*-5%*	0.1%
	-	*-10%*	0.2%
	-	*-20%*	0.4%
	+0.5°C	*-5%*	-1.9%
	+0.5°C	*-10%*	-1.8%
	+0.5°C	*-20%*	-1.6%
	+1°C	*-5%*	-3.9%
	+1°C	*-10%*	-3.8%
	+1°C	*-20%*	-3.6%
	+2°C	*-5%*	-7.9%
	+2°C	*-10%*	-7.8%
	+2°C	*-20%*	-7.6%
Long-run	*+0.5°C*	-	-4%
	+1°C	-	-8%
	+2°C	-	-16%
	-	*-5%*	0.4%
	-	*-10%*	0.7%
	-	*-20%*	1.4%
	+0.5°C	*-5%*	-3.7%
	+0.5°C	*-10%*	-3.3%
	+0.5°C	*-20%*	-2.6%
	+1°C	*-5%*	-7.7%
	+1°C	*-10%*	-7.3%
	+1°C	*-20%*	-6.6%
	+2°C	*-5%*	-15.7%
	+2°C	*-10%*	-15.3%
	+2°C	*-20%*	-14.6%

Impacts of climate change on monthly yield variation/ha in tomato yields in different regions of Mauritius (Jönsson, 2011)

	Climate change scenairos		Impacts on monthly yield			
Time period	ΔT	ΔRain	North	East	West	South
Short-run	+0.5°C	-	-3%	-4%	-0.4%	-
	+1°C	-	-6%	-8%	-0.8%	-
	+2°C	-	-12%	-16%	-1.6%	-
	+3°C	-	-18%	-24%	-2.4%	-
	-	-5%	0.2%	-0.1%	-0.1%	-0.02%
	-	-10%	0.5%	-0.2%	-0.2%	-0.04%
	-	-20%	1%	-0.4%	-0.4%	-0.08%
	+0.5°C	-5%	-2.8%	-4.1%	-0.5%	-0.02%
	+0.5°C	-10%	-2.5%	-4.2%	-0.6%	-0.04%
	+0.5°C	-20%	-2%	-4.4%	-0.8%	-0.08%
	+1°C	-5%	-5.8%	-8.1%	-0.9%	-0.02%
	+1°C	-10%	-5.5%	-8.2%	-1%	-0.04%
	+1°C	-20%	-5%	-8.4%	-1.2%	-0.08%
	+2°C	-5%	-11.8%	-16.1%	-1.7%	-0.02%
	+2°C	-10%	-11.5%	-16.2%	-1.8%	-0.04%
	+2°C	-20%	-11%	-16.4%	-2%	-0.08%
Long-run	+0.5°C	-	-6.5%	-6.5%	0.5%	-
	+1°C	-	-13%	-13%	1%	-
	+2°C	-	-26%	-26%	2%	-
	-	-5%	0.05%	-0.1%	-0.2%	-0.05%
	-	-10%	0.1%	-0.3%	-0.4%	-0.10%
	-	-20%	0.2%	-0.6%	-0.8%	-0.20%
	+0.5°C	-5%	-6.5%	-6.6%	0.3%	-0.05%
	+0.5°C	-10%	-6.4%	-6.8%	0.1%	-0.10%
	+0.5°C	-20%	-6.3%	-7.1%	-0.3%	-0.20%
	+1°C	-5%	-13%	-13.2%	0.8%	-0.05%
	+1°C	-10%	-12.9%	-13.3%	0.6%	-0.10%
	+1°C	-20%	-12.8%	-13.6%	0.2%	-0.20%
	+2°C	-5%	-26%	-26.2%	1.8%	-0.05%
	+2°C	-10%	-25.9%	-26.3%	1.6%	-0.10%
	+2°C	-20%	-25.8%	-26.6%	1.2%	-0.20%

Other climate change related works in Mauritius

- Farmer perception on climate change impacts and adaptation with respect to agricultural production.
- Study of climate change impacts on agricultural insect pests and their biocontrol agents.
- Study of climate change impacts on sugarcane production.
- Study of climate change impacts on non-sugarcane crops.

Thank you for your attention !