

Climate change adaptation and mitigation strategies in agriculture: threats and opportunities

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Introduction

- Already a lot of info / initiatives
- Intention with this presentation is not to repeat
- We will not debate the reasons for CC change



Positive proof of global warming.



**18th
Century**

1900

1950

1970

1980

1990

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Agriculture and climate change

- "Agriculture is inherently sensitive to climate... Without adaptation, climate change is generally problematic for agricultural production and for agricultural economies and communities; but with adaptation, vulnerability can be reduced..."
- "Global climatic changes will in all likelihood result in both positive and negative impacts on agriculture."
- "Climate change will impact agriculture by causing damage and gain at scales ranging from individual plants or animals to global trade networks."
- "The agriculture sector historically has shown enormous capacity to adjust to social and environmental stimuli that are analogous to climate stimuli."



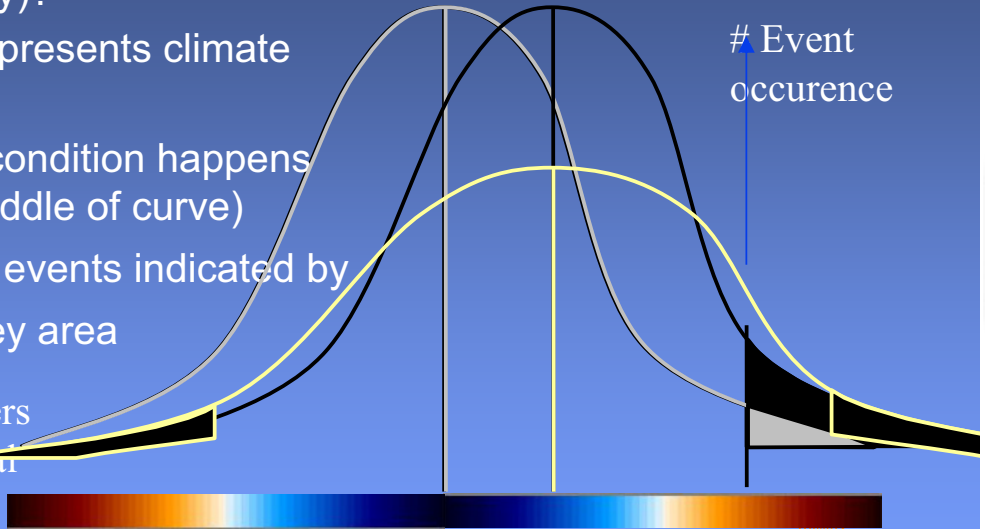
- "The ability of farmers to adapt... will depend on market and institutional signals, which may be partially influenced by climate change."

Climate variability

Why being concerned about shifting climate (variability)?

- Curve represents climate (events)
- Normal condition happens often (middle of curve)
- Extreme events indicated by black/grey area

Red: disasters
Blue: normal conditions



With a small change in the mean, frequencies can rise rapidly

General impact on livestock

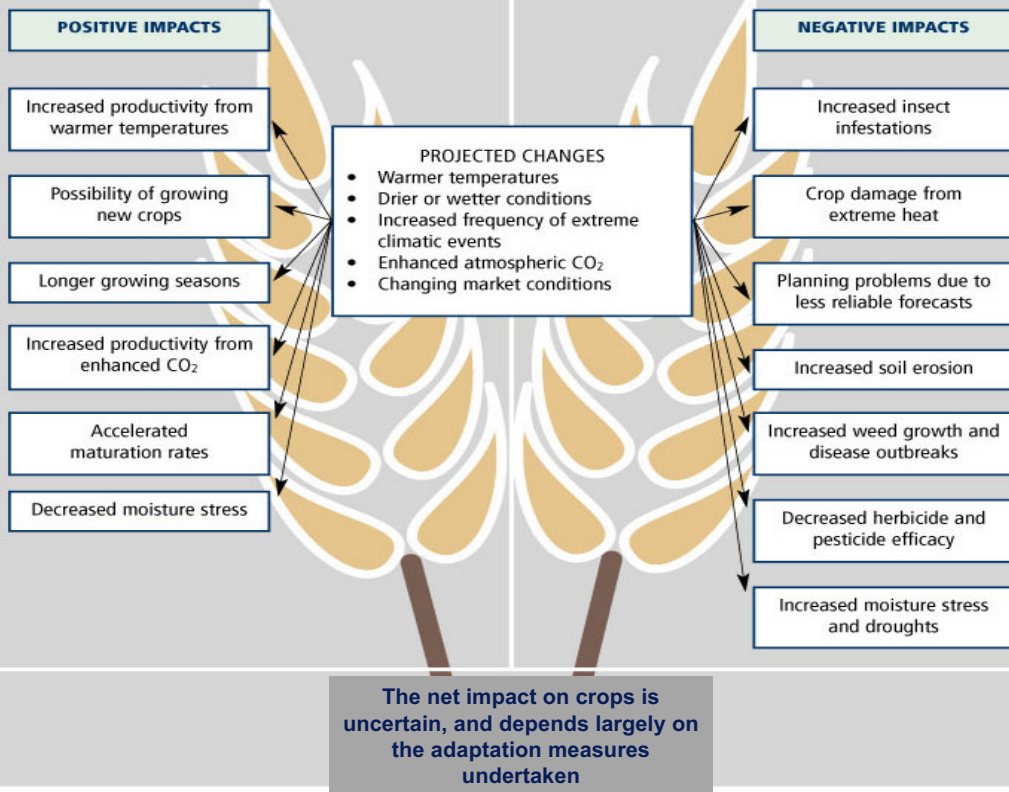
- Temperature is generally considered to be the most important bioclimatic factor for livestock.
- Warmer temperatures are expected to present both benefits and challenges to livestock operations.
- Benefits would be particularly evident during winter, when warmer weather lowers feed requirements, increases survival of the young, and reduces energy costs.
- Challenges would increase during the summer, however, when heat waves can kill animals.

- Large numbers of chicken deaths are commonly reported during heat waves.
- Heat stress also adversely affects milk production, meat quality and dairy cow reproduction.
- In addition, warmer summer temperatures have been shown to suppress appetites in livestock and hence reduce weight gain.
- For example, a study conducted in Canada found that a 5 deg C increase in mean summer temperature caused a 10% decrease in cow/calf and dairy operations.
- Provided there is adequate moisture, warmer temperatures and elevated CO₂ concentrations are generally expected to increase growth rates in grasslands and pastures – major variation between regions

- Future climate changes, particularly extreme events, may promote the invasion of alien species into grasslands, which could reduce the nutritional quality of the grass
- An increase in severe moisture deficits due to drought may require producers to reduce their stock of grazing cattle to preserve their land – need for even larger farms and/or structural changes
- In addition to the direct effects on animals, storms may result in power outages that can devastate farms that are heavily dependent upon electricity for daily operations

- Animal products have hit the headlines recently because of their contribution to greenhouse gas emissions, perception of using less animal product meat is better for the planet.
- On climate change and human health grounds we need to eat less meat, but the focus for reduction must be on intensively produced white meat (chicken and pork), and grain fed beef, while we eat proportionately **more grass-reared beef, lamb and mutton**. Soil Association research challenges the current orthodoxy by insisting that cows and sheep will play a central role in the carbon-friendly farming systems of the 21st Century, by making it possible to **return atmospheric carbon to the soil while at the same time converting grass into food**.

Figure 1: Potential impacts of climate change on agricultural crops in Canada



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5 projected changes in agricultural productivity from climate change without carbon fertilisation at 2050

relative to the reference case

	%
Australia	-17
China	-4
Japan	-4
New Zealand	+1
ASEAN	-12
India	-25
Canada	-1
United States	-4
Rest of Europe	-4
Argentina	-7
Brazil	-10
Least developed countries	-18
European Union	-4
Rest of the world	-13

Source: Based on Cline (2007).

7 climate change impact on world agricultural production

comparative static

	world production	
	without carbon fertilisation %	with carbon fertilisation %
rice	-4.69	-0.35
wheat	-4.37	-0.54
other grains	-3.03	1.85
other crops	-2.02	-0.33
livestock	-2.31	0.07
processed agriculture	-3.33	-0.15

Source: Schimmelpfennig et al. [1996].

Doomsday ????

- A key factor in determining the magnitude of climate change impacts on agriculture is adaptation.
- Appropriate adaptations would allow agriculture to minimize losses by reducing negative impacts, and maximize profits through capitalizing on the benefits.
- There are many different adaptation options available to the agricultural sector, which vary greatly in their application and approach.

- **Selecting and implementing adaptation strategies will require consideration of the physical, socio-economic and political influences on agriculture, as well as the contributing roles of producers, industry and government.**
- **It is also necessary to recognize that climate change is just one of many challenges facing the agricultural sector, and that it may not be considered a short-term priority in decision making.**

Adaptation options: Six questions to be asked?

- To what climate variables is agriculture most sensitive?
- Who needs to adapt (e.g., producers, consumers, industry)?
- Which adaptation options are worth promoting or undertaking?
- What is the likelihood that the adaptation would be implemented?
- Who will bear the financial costs?
- How will the adaptation affect culture and livelihoods?

- It is also important to understand how adaptation to climate change fits within larger decision-making processes.
- Climate change itself is unlikely to be a major control on adaptation; instead, decision making by producers will continue to be driven jointly by changes in market conditions and policies.

Adaptation options: four categories

- technological developments (e.g., new crop varieties, water management innovations);
- government programs and insurance (e.g., agricultural subsidies, private insurance);
- farm production practices (e.g., crop diversification, irrigation); and
- farm financial management (e.g., crop shares, income stabilization programs).

- These adaptations could be implemented by a number of different groups, including individual producers, government organizations, and the agri-food industry.
- These groups have differing interests and priorities, which may at times conflict. Therefore, before determining which adaptation options should be promoted or implemented, they should be carefully and thoroughly assessed

- The applicability and success of different adaptation options will vary greatly between regions and farm types.
- To determine whether an adaptation option is appropriate for a given situation, its effectiveness, economic feasibility, flexibility, and institutional compatibility should be assessed.
- In addition, the characteristics of the producer and the farm operation should be considered, as should the nature of the climate change stimuli. Possible economic and political constraints are also important considerations.

- Most importantly, however, the adaptation option should be assessed in the context of a broader decision-making process.
- Researchers agree that agriculture will adapt to climate change through ongoing management decisions, and that the interactions between climatic and non-climatic drivers, rather than climate change alone, will direct adaptation.

Producers attitudes

- Agricultural producers have demonstrated their ability to adapt to changes in climate and other factors in the past, and they will continue to adapt in the future.
- However, the key question for agriculture is whether adaptation will be predominantly planned or reactive. The answer appears to depend largely on the background, attitudes and actions of individual producers
- Producer interviews and focus groups reveal that, to date, there is generally moderate concern in the South African agricultural community regarding climate change
- These attitudes have been attributed to the confidence of producers in their ability to adapt to changing climatic conditions, and their tendency to be more concerned with political and economic factors

- Indeed, numerous studies have demonstrated that financial and economic concerns are the primary influence on producer decision making.
- This does not mean that adaptation to climate change will not occur, but rather suggests that climate change adaptations will be incidental to other adaptations, and should be viewed as one element of an overall risk management strategy.

- It is also possible that events such as droughts and floods are changing producers' attitudes toward climate change, particularly when viewed as an analogue of what might be expected in the future.
- Multiyear droughts and floods seriously challenge the adaptive capacity of agriculture.

Socio-economic Consequences of Adaptation

- As other countries take action to adapt to climate change, South Africa will need to keep pace or risk being placed at a competitive disadvantage.
- In fact, successful anticipatory adaptation in the agri-food industry could provide South African producers with a competitive advantage.
- Before promoting adaptation options, however, it is necessary to consider the full range of socio-economic impacts.
- For example, although switching production to a new crop may increase overall agricultural production, it may not be economically viable due to marketing issues and higher capital and operating costs

- The effect that adaptation options to climate change will have on culture and livelihood must also be considered.
- Another important focus for agricultural research is the identification of thresholds.
- The agriculture sector has proven itself to be highly adaptive, but this adaptation takes place within a certain range of climate conditions.
- New adaptive measures may serve to expand this range somewhat, but there exist climatic thresholds beyond which activities are not economically viable and substantive changes in practices would be required.
- An improved understanding of where these critical thresholds lie will contribute to the development of appropriate adaptation strategies.

Mitigation opportunities

- Preserve current crops – carbon credits
- New crops – carbon credits
- Use of clean energy – sun, wind and other alternatives
- OR – Combination

Carbon sequestration potential

- Bamboo– 50 to 70 ton per ha – is the highest – depends on planting density and commercial harvesting
- Spekboom – only 3 to 4 ton per ha. Very little other commercial value
- Commercial forestry – only 3-5 tons

Potential example

- One ha of Bamboo can produce approximately 40 tons of bamboo briquettes which can replace coal without any conversion on the boilers. Therefore, a 1000 ha of Bamboo on marginal soils and with little or no irrigation (needs 700mm per annum) can potentially replace 40 000 tons of coal and simultaneously capture 70 000 tons of carbon emissions.

Bamboo roof sheeting

Comparison of Bamboo Mat Corrugated Sheets with standard building material

Materials	Energy for production MJ/Kg	Weight per volume Kg/m ³	Energy for production MJ/m ³
Concrete	0.8	2400	1920
Steel	30	7800	234000
Wood	1	600	600
Bamboo	0.5	600	300

Source: Prof.J.A.Janssen, Eindhoven University, The Netherlands

Some Important Properties of BMCS

Size	1.05m X 1.8 m X 3.5 mm
Weight	6.5 – 7.90 kg/sheet (app. half that of A CCS)
Load Bearing Capacity	4.8 N/mm width
Deflection at Breaking Point	85 mm
Thermal Conductivity	0.1928 k cal/m °c (app. half that of Asbestos Cement CS)
Fire Resistance	Conforms to flammability test
Energy Requirement	Highly Energy Efficient

Terminology

Units which may be transferred under the scheme, each equal to one tonne of CO₂, may be in the form of:

- A removal unit (RMU) on the basis of land use, land-use change and forestry (LULUCF) activities such as reforestation
- An emission reduction unit (ERU) generated by a joint implementation project
- A certified emission reduction (CER) generated from a clean development mechanism project activity

Carbon trading concepts

- “Clean development mechanism (CDM)
- “Certified emission reduction credits” (CER)
- Byers buy the right to pollute by financing others to not pollute or to reduce pollution
- Projects under the CDM include projects such as new crop establishment, sun, wind and hydro energy
- CDM’s were started to encourage developed nations to invest in developing countries to reduce carbon emissions

- Current value of trading = R450 billion but Africa's share only 4%
- Africa's major shortcoming is funding to get projects started
- The WB plays an important brokers role – however many reports shows a lot of corruption in this field
- In 2008, Africa only had 25 projects compared to 581 in Asia

- Carbon trading in SA not very active since government was not serious – up to now. BUT
- It is widely accepted that SA can take advantage of huge opportunities out of CER and CDM projects at a cost being bared by the developing countries.

Conclusion

- Climate change – negative and positive impact
- CC – Threats and opportunities
- Adaptation - challenge to explore the opportunities, counter the threats and simultaneously contribute to mitigation
- Simplest form of adaptation = Good Agricultural Practices (Water management and cultivation practices) – not jet science

Get the facts, or the facts will get you. And when you get them, get them right, or they will get you wrong.

Dr. Thomas Fuller (1654 – 1734) British physician

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Let us take things as we find them: let us not attempt to distort them into what they are not. We cannot make facts. All our wishing cannot change them. We must use them.

John Henry Cardinal Newman English Catholic cardinal



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Thanx

COMING TOGETHER IS A BEGINNING .
KEEPING TOGETHER IS PROGRESS,
WORKING TOGETHER IS SUCCESS