Plenary 3. Sectoral Adaptation in Agriculture – part 1

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A philosophical analysis

General remarks 1

Adaptation to climate change has been a somewhat neglected subject… much has been said about it **but not so much has been done yet.**

The problem is that adaptation is a very broad subject and a very costly one **requiring a lot of funding**. As most of this funding should be a responsibility of developed (**Annex 1**) countries, it's natural that **these aspects have been the subject of many diplomatic and political debates.**

General remarks 2

Instead of **focusing on adaptation** to climate change **most part of international efforts** have been centred on the **mitigation of climate change**… that is, reducing the emissions of GG in order to **decrease the magnitude of climate change** and/or **retarding the future dates** at which **a given rise in temperature will be reached.**

General remarks 3

Adaptation of actual production systems to new expected climate conditions is not an easy subject, and it surely will be a costly one.

A real effort in adaptation strategies **should be preceded by a complete assessment of expected climate change impact on the sector at hand**. An adaptation process to ill known climate change impacts **could easily lead to a waste of resources and efforts**. And even to **maladaptation to climate change**.

General remarks 4

Adaptation to climate change can be seen and obtained **at many different levels**, let's say:

- **Individual**
- **Community**
- **Sector**
- **Country**
- **Region**
- **Global**

Since 1998 in an IPCC meeting I have been thinking that **adaptation will eventually achieve the global level.**
It seems to me that adaptation strategies at lower levels could even be contradictory. As in Jericho serial!

General remarks 5

Adaptation policies and strategies can be applied (**some time imposed**) from the **highest** authorities **level**, some kind of **top-down approach** to adaptation. But they can also be applied from the **community level** to higher ones in some kind of bottom-up approach.

A **suitable combination of both approaches** would be **most successful**… knowing that adaptation to climate change must first go **through the conscience of people…!**

General remarks 6

We may also conclude that **there is not such a thing** as an **ultimate adaptation to climate change.**

As climate **changes continuously with tim**e – maybe until the 23rd century or something – **adaptation to climate change will be a continuous process lasting a very long time.**

If we adapted **tomorrow** to the expected climate of 2100 **we won't be adapted to actual climate for a very long time…!**

Introduction… 0

We better **not assume that** our agricultural systems, or any other sector activities, **are already adapted to our stable previous/actual climate conditions.**

That is not necessarily the case.

The actual drought episode affecting maize and soya production in the United States cast doubt about that agricultural system being really adapted to actual climate conditions. **And what about the "impact compensation theory"?**

Introduction… 1

Agricultural production systems are many times adapted to a wider set of external factors such as market or historical trade agreements with third parties. **This kind of ties deprive countries** of the so-called **national food security** and **make them dependent of the vagaries of global market.**

One should also realize that adaptation options and strategies or policies could be different between **“cash crops” for exportation and “staple crops” for internal consumption.**

Introduction… 2

In most cases agricultural impact assessments are based or rely heavily in the study of biophysical impacts on growth and development of crops in production fields. **This we saw in discussing impact modeling.**

But we must be aware that **climate change may impact any other link of the** agricultural production **chain** (land preparation, germination, harvest conditions, storage and transport of final products). **Including aspects for which we have no available models.**

Introduction… 3

Adaptation measures and strategies could be classified in two different types according to their actual relationship with expected climate change impacts.

If an adaptation option provides positive results **even in the absence of climate change**, that option is usually named as a **“no-regret” or “win-win” option**.

These kinds of options are **encouraged** as **they have no direct dependence** with the accuracy of the **previous impact assessment and climate change scenarios**.

A whole set of adaptations options don’t fulfill this condition because **they are heavily dependent of the nature of the impacts previously assessed**. **There is some degree of risk** in the case of these adaptation options. **Risks are a consequence of uncertainties…!**

Introduction… 4

The most obvious example with **adaptations options of this last kind**, is related to **uncertainties in the future behavior of precipitation**. A **projected decrease** in precipitation could be achieved **in many different ways**, such as:

First. Number of rainy days remains constant or even increase, but with less rain per day.

Second. Number of rainy days decrease even if precipitation intensity remains practically unchanged.

Third. Any other possible combination of changes in number of rainy days and rainy event intensity.

IMPACTS WILL NOT BE THE SAME…

… ADAPTATION OPTIONS COULD BE DIFFERENT ALSO.

Introduction… 5

Surprisingly enough the spectra of adaptations options that can be sketched **depends of the broadness and depth of the previously done impact assessment**. Following our usual approach derived from the Wageningen School of Modeling, we usually estimate **crops yields of various kinds:**

We saw something about this in my previous presentation about impact models…

Introduction… 6

First. Potential yields depending only on **genetic**, **temperature** and **global solar radiation**

Second. Water limited yields depending **also on precipitation**, **potential evapotranspiration** and **soil hydrophysical properties**

Third. Nutrient limited yields depending also on **nutrient availability** (N, P, K) **in the soil**

Fourth. More complex types of yields depending of many factors (**including management**) and trying to simulate actual field conditions

Examples of Options

If your previously done impact assessment consisted only in determining **impacts on potential yields of crops**, the set of **available adaptations options will be rather small**. Let's say,

One. To introduce **new crops** or new crops **varieties** with **higher potential yield in the new expected climates**

Two. Application of **management strategies** including artificial control of temperature and global solar radiation on crops.

Introduction… 7

Additionally, **you should not think that there will always be an available adaptation option for every identified impact of climate change** or **believe that all possible adaptations options will be found inside the agricultural sector alone.**

In **many instances** adaptation options will be related **with cross-sectoral impacts and will involve more than one sector**.

This fact lead us to the subject of **integrated assessments and adaptation strategies**.

Introduction… 8

Loosely speaking, integrated assessment could refer to different things, such as:

One. A broad impact assessment over a sector, region or other administrative division **that relies heavily on economical and market considerations**. Monetary losses and profits are used as a standard (integrated) measure of impact and adaptation options. Cost/benefits analysis, offer and demand, changes in Gross Domestic Product (GDP) and similar tools are common to these assessments.

This kind of integrated assessment is not my field of expertise…!

Introduction… 9

Two. An (internally or externally) **compendium of sectoral impact assessments and adaptation options provided by multiple different sectors** but **related to some specific geographical, natural or administrative unit**. They may content some **integrating transversal element** such as water availability and quality or other useful one of interest.

An **internally integrated** assessment of this kind **is planned** and done **from its very beginning** but **an externally integrated assessment is always done at the end** when all sectors **have already done their individual assessments.**

RESULTS AND SCOPE WILL BE DIFFERENT

Introduction… 10

Three. A **cross-sectoral study using coupled models belonging to different sectors**. These coupled models **may use some integration parameter** that is not necessarily estimated in strictly sectoral studies.

A common case refers to **agricultural production and water resources availability**. This is possible because **climate change will simultaneously affect potential or water-limited yields as well as hydrological potential for a given region**. This circumstance leads to **combined impacts on production** and conditions **the number and quality of available adaptations options.**

An example of this… 1

A crop model will tell you than an irrigated crop is going to decrease its yield but simultaneously increase crop evapotranspiration and water irrigation needs. An independent water resources model then tells you that hydrological potential (and then water availability) is going to decrease also.

A cross-sectoral model will then tell you that the total crop area that you'll be able to plant in the future with irrigation will also decrease in time.

An example of this… 2

As the crop area that you will be able to plant in future climates will decrease and simultaneously irrigated yields will also decrease… you have then an explosive situation with total crop production, estimated as:

Total Production = Planted Area * Crop Yield

Per capita = PA*CY / Total population

If your total population is also increasing you'll be **in real trouble… !**

The MIIA model…

The cross-sectoral integrated model MIIA **combines parameters estimated using crop models** with **parameters derived from the hydrological water balance of a given area**. Methods used differ radically and may be changed without altering the spirit of the integrated model. **The model is able to assess irrigated and rainfed agriculture at the same time and include scenarios for population increase and technological development.**

Theoretical Approaches 1

Adaptation to climate change is not a bare concept. In fact **there are many proposed approaches to adaptation** recommended by leading authors, international agencies and NGO's.

Now we'll list some of these approaches **without trying to be complete or very accurate in its description.**

Theoretical Approaches 2

One. Individual adaptation (going elsewhere)

Two. Spontaneous adaptation (the law of the jungle)

Two. Neogreen revolution methods (contamination)

Three. Ecosystem based adaptation (not an administrative unit)

Fourth. Community based adaptation (administrative unit)

Fifth. Adaptation by increasing agricultural biodiversity (FAO) and producing food near the place where it will be consumed.

Sixth. Response farming

And many others

Debating the spontaneous adaptation option…..

Some no-regret adaptation options 1

First. Increasing the role of climate sciences in agricultural regionalization and planning

Second. Increasing the role of operational agrometeorology during all the growth and development cycle of the field crops

Third. Developing surveillance and early warning systems for extreme agrometeorological events (fire, floods, droughts), plagues and diseases.

Some no-regret adaptation options 2

Fourth. Developing and introducing new crop varieties better adapted to higher temperatures, low levels of soil water content and flooding.

Fifth. Developing and introducing irrigation systems with higher efficiency in the use of water, once understood that huge amounts of water coming from irrigation systems are actually directly evaporated to the atmosphere from the soil without participating in crops biophysical processes.

Questions and ideas?

Adaptation to climate change must go first through the conscience of people…

THANKS!