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Agriculture and Climate Change

An Agenda for Negotiation in Copenhagen

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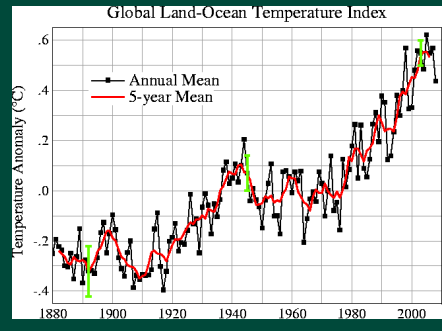
Presentation Overview

- Climate change will affect agriculture
  - Higher global temperatures, more precipitation, more variability and extreme events
  - Likely negative effects: Where and how much?
- Adaptation/resilience: Agriculture will need
  - New varieties, more infrastructure, changes in management practices and policies
  - International institutions that support resilience globally
- Mitigation: Agriculture can
  - Reduce emissions of greenhouse gasses
  - Act as a sink for other sectors

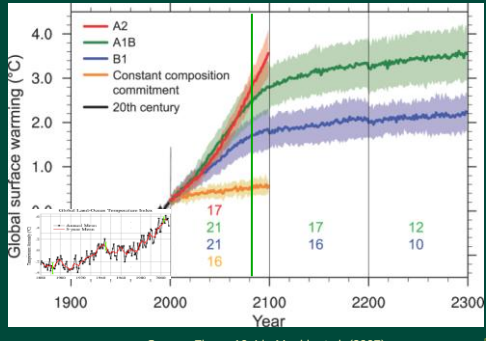
IMPACTS OF CLIMATE CHANGE ON AGRICULTURE

Rising average temperatures



Source: http://data.giss.nasa.gov/gistemp/graphs/

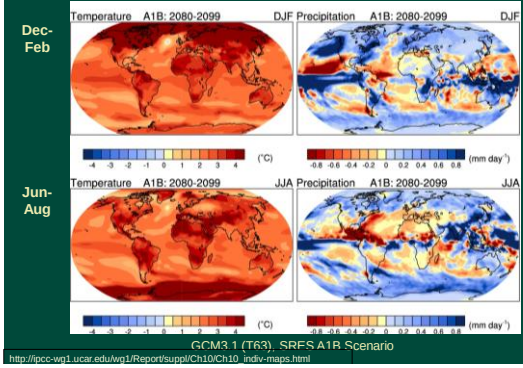
… could increase much more



Source: Figure 10.4 in Meehl, et al. (2007)

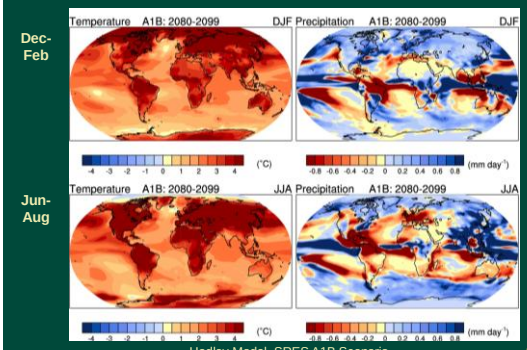
Consequences:

Higher temperatures and more but shifting precipitation…



GCM3.1 (T63), SRES A1B Scenario
http://ipcc-wg1.ucar.edu/wg1/Report/suppl/Ch10/Ch10_indiv-maps.html

… but uncertainty about where and how much



Hadley Model. SRES A1B Scenario

http://ipcc-wg1.ucar.edu/wg1/Report/suppl/Ch10/Ch10_indiv-maps.html

Climate Change Effects on Agriculture

What did we think in the *mid-1990s*?

- **No problems**
  - Agricultural effects of climate change would be manageable
  - Negative yield effects in temperate regions buffered by trade
  - CO_2 fertilization important
  - Increased trade flows needed

Climate Change Effects on Agriculture

What did we think in the *early 2000s*?

- **Potential problems but manageable**
  - Production in DCs benefit; declines in LDCs
  - Regional differences grow stronger over time
  - Substantial increases in risk of hunger in poorer nations
  - CO_2 fertilization important
  - Increased trade flows needed

Climate Change Effects on Agriculture

What did we think in the *mid-2000s*?

- **Potential for problems is larger**
  - Yields would likely increase somewhat in all regions
  - Smaller gains in the temperate regions than previous models
  - Small yield gains in the tropics
  - CO_2 fertilization important
  - Increased trade flows needed

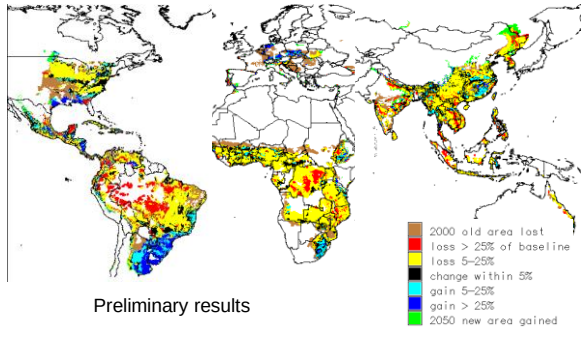
What about the CO_2 fertilization effect?

- **Needed in all models to offset some of productivity losses from climate change, but…**
- **Recent reports on field experiments on CO_2 fertilization are negative**
  - Higher levels of atmospheric CO_2 increase susceptibility
    - Soybeans to the Japanese beetle
    - Maize to the western corn rootworm

Climate Change Effects on Agriculture

What do we think in 2009?

Rainfed maize yields decline 17% by 2050

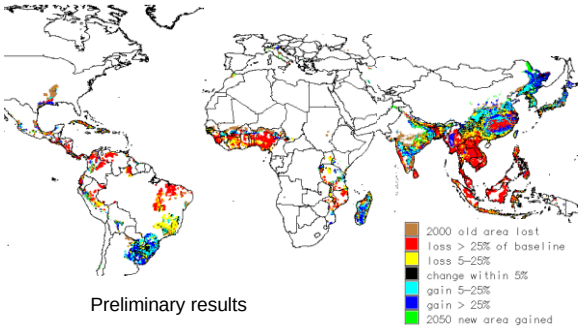


Preliminary results

Climate Change Effects on Agriculture

What do we think in 2009?

Irrigated rice yields decline 20%



Preliminary results

Suggested Negotiating Outcome for Agriculture

- Make funds available for research to improve our understanding of the interactions between climate change and agriculture
  - Higher spatial resolution and
    - more relevant outputs from climate models
    - better integration of agriculture into integrated assessment models
  - Better biophysical and socioeconomic modeling of climate change-agriculture interactions

AGRICULTURE AND CLIMATE CHANGE ADAPTATION

Adaptation in agriculture is essential

- **Good development policy** is important first step
  - Higher incomes from productive agricultural resources, used sustainably, provide resilience in the face of climate change
- **Location, location, location**
  - Climate change effects vary across the landscape
  - What's needed?
    - Location-specific analysis
    - Location-specific programs and policy measures
- **International institutions that support resilience globally are critical**

Adaptation needs

- Increased expenditures in agricultural science and technology
- Increased investments in water storage and management
- More development of rural Infrastructure, physical and institutional
- Policy improvements to internalize externalities associated with environmental services

Agriculture adaption: Suggested negotiating outcomes

- Include funding modalities for agriculture
  - Recognize the connection between pro-poor development policies for sustainable growth and climate-change adaption
  - Recognize and support synergies between adaptation and mitigation
- Provide funds for
  - Technology, infrastructure and institutional innovations
  - Global data collection
    - improves understanding of the spatial context of agriculture
- Support international institutions that foster resilience

AGRICULTURE AND CLIMATE CHANGE MITIGATION

Agriculture's GHG emissions are large, but shares differ by region

Region	Total GHG emissions (Mt CO_2e)	Share from agriculture	Share from land-use change and forestry
Europe	7,600	9.1	0.4
North America	7,208	7.1	-4.7
South America	3,979	23.6	51.6
Sub-Saharan Africa	543	12.7	60.4
Asia	14,754	14.4	26.8
Developing countries*	22,186	**15.7**	**35.6**
World	40,809	**14**	**18.7**

Source: WRI CAIT, 2009
* - Non Annex 1 countries

Agricultural mitigation: Cost-effective options

- Change crop mixes
  - plants that are perennial and/or with deep root systems
- Use cultivation systems that leave residues
  - reduce tillage, especially deep tillage
- Shift land use from annual crops to
  - Perennial crops
  - Pasture
  - Agroforestry
- KEY Issue – MRV - Measurable, Reportable, and Verifiable

Agricultural mitigation: Suggested negotiating outcomes

- Establish a chapter for agriculture-related mitigation (and adaptation) investments as part of any global mitigation funding mechanism
- Include agriculture and land-use change from the outset of any Post-Kyoto agreement but allow for long-term means-tested adjustment opportunities
- Fund development and implementation of low-cost monitoring systems
- Allow innovative payment mechanisms and support for novel institutions for agricultural mitigation

Concluding remarks

- Our children will pay the price of climate change
- We must start adaptation now if we are to feed the world sustainably and reduce poverty
- Agriculture can play an important role in mitigating GHG emissions
- Including agriculture in a Copenhagen agreement is essential