Climate change impacts on global food security

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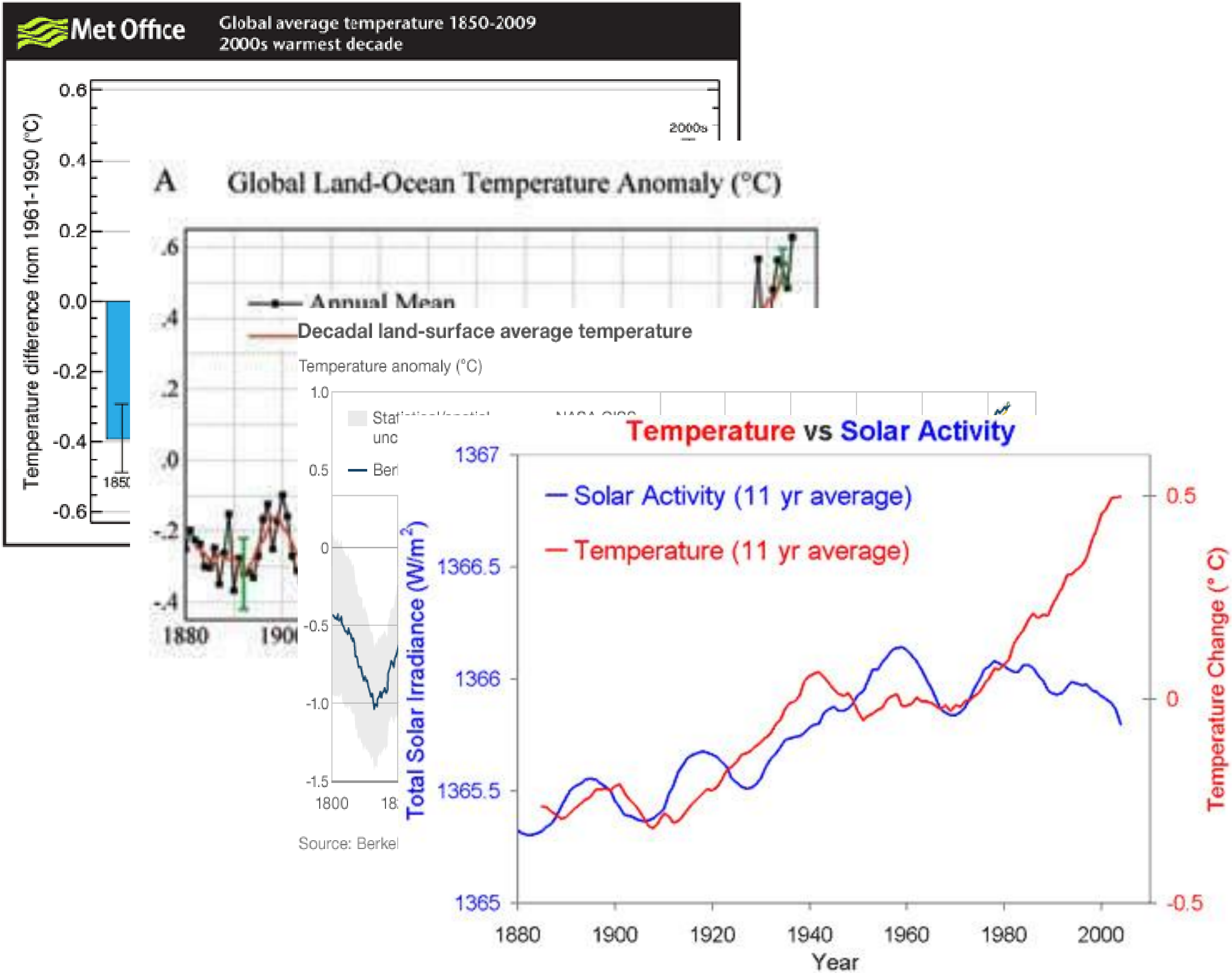
1. **The evidence base on climate change and food security is still very patchy, with a strong focus on production**

2. **Broad-scale impacts on production are well-understood, with many threats expected to developing country agriculture. Local, detailed impacts are still highly uncertain**

3. **A wide range of potential adaptation and resilience options exist and more are being developed. Effective knowledge-sharing of adaptation options is needed**

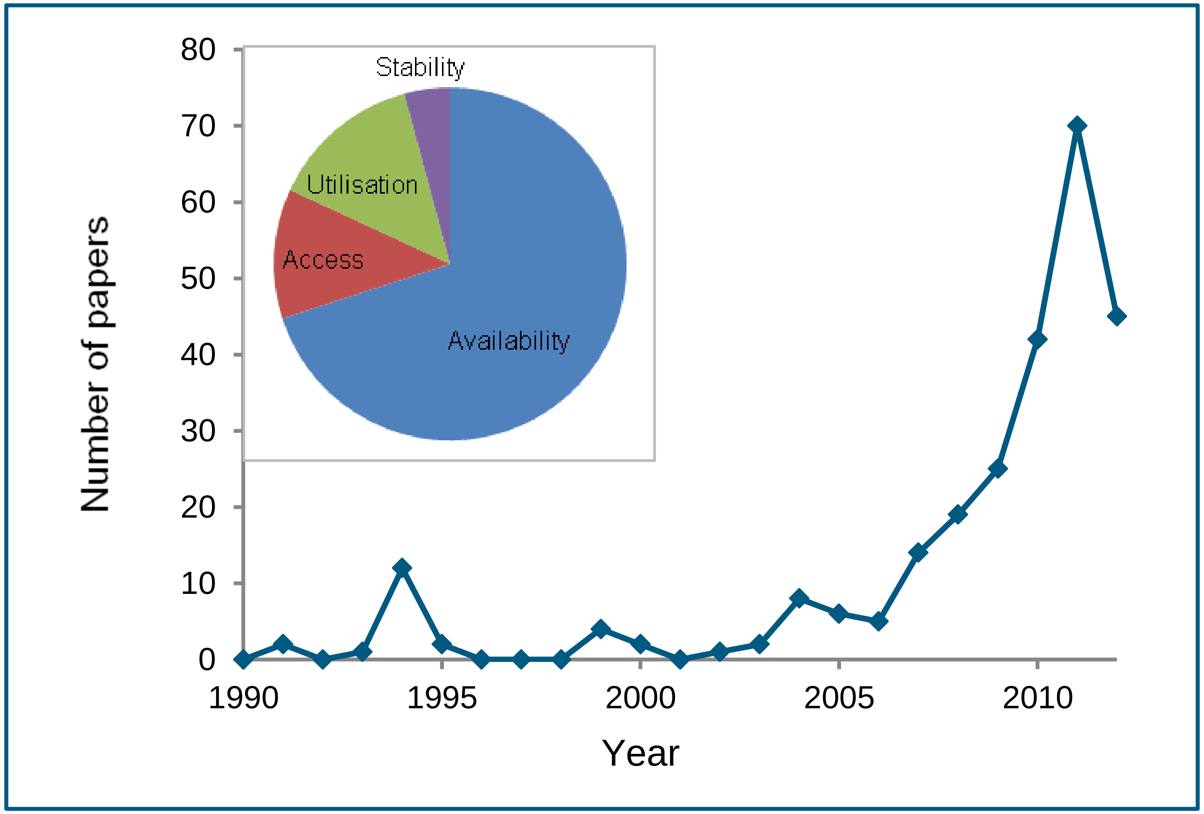

Met Office
Global average temperature 1850-2009
2000s warmest decade
Temperature difference from 1961-1990 (°C)
A Global Land-Ocean Temperature Anomaly (°C)
Annual Mean
Decadal land-surface average temperature
Temperature anomaly (°C)
Source: Berkel
Temperature vs Solar Activity
Solar Activity (11 yr average)
Temperature (11 yr average)
Total Solar Irradiance (W/m^2)
Temperature Change (° C)
Year

The four dimensions of food security:

1. **Food availability:** the availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports.
2. **Food access:** access by individuals to adequate resources (entitlements) for acquiring appropriate foods for a nutritious diet.
3. **Food utilization:** Utilization of food through adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met.
4. **Stability of the food system:** To be food secure, a population, household or individual must have access to adequate food at all times.

Tim Wheeler and Joachim von Braun *Climate change impacts on global food security*. Science 134, 508 (2013) doi 10.1126/science.1239402

The evidence base for climate change impacts on global food security is heavily skewed towards food availability, with serious gaps on the broader aspects of food security



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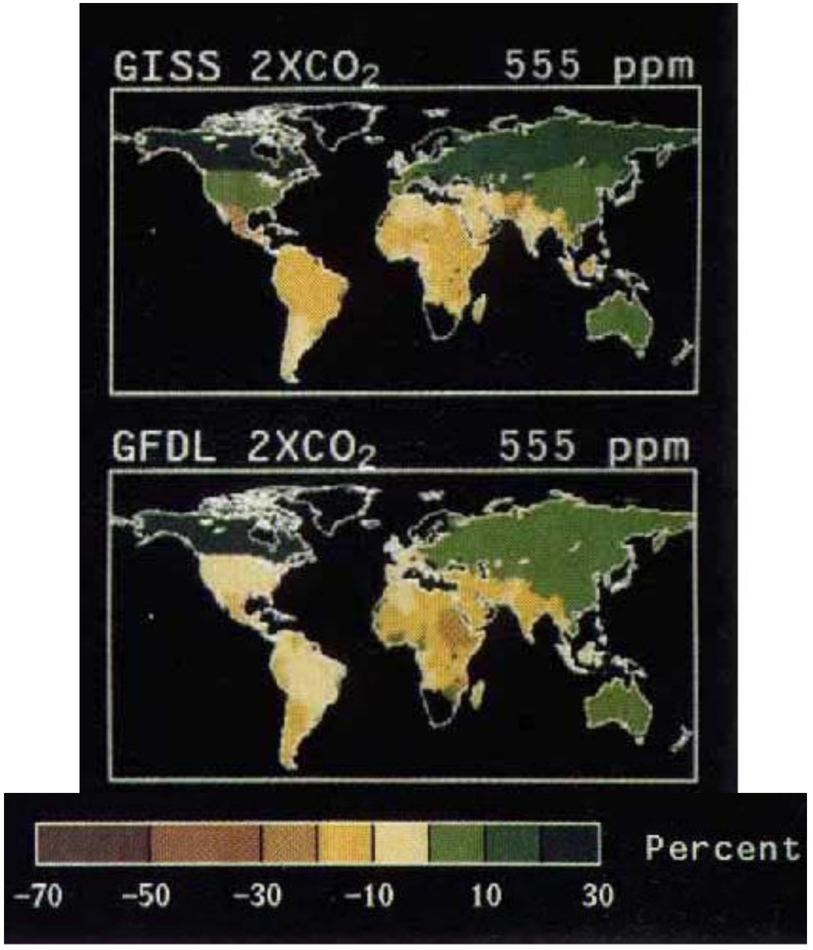
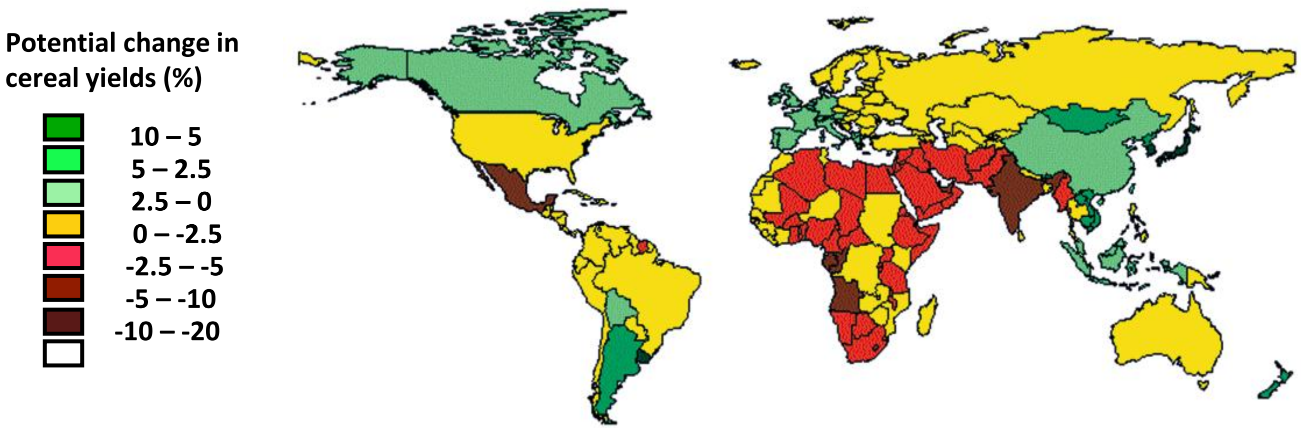
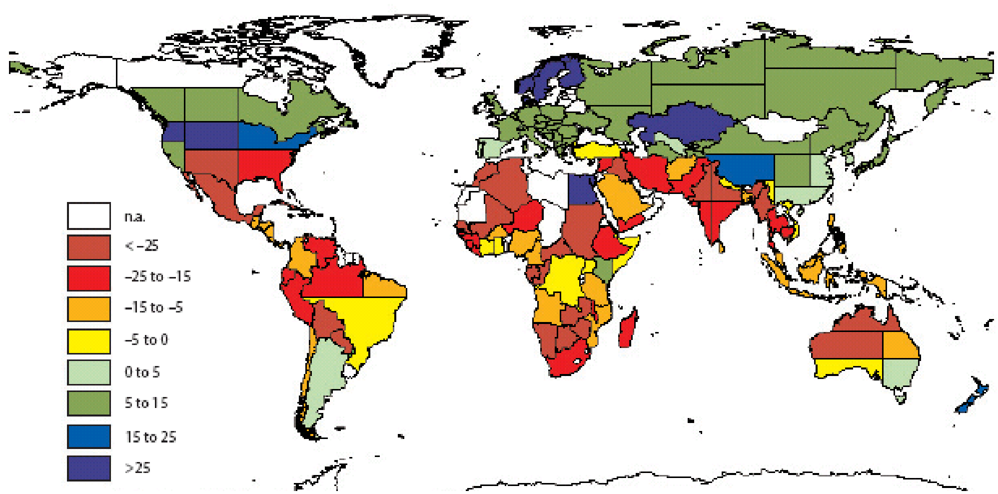


Broad-scale impacts on crop production

Potential change in grain yield Rosenzweig and Parry, *Nature, 1994, 367 133-138*



Parry ML et al *Global Env Change 2004, 14 53-67*

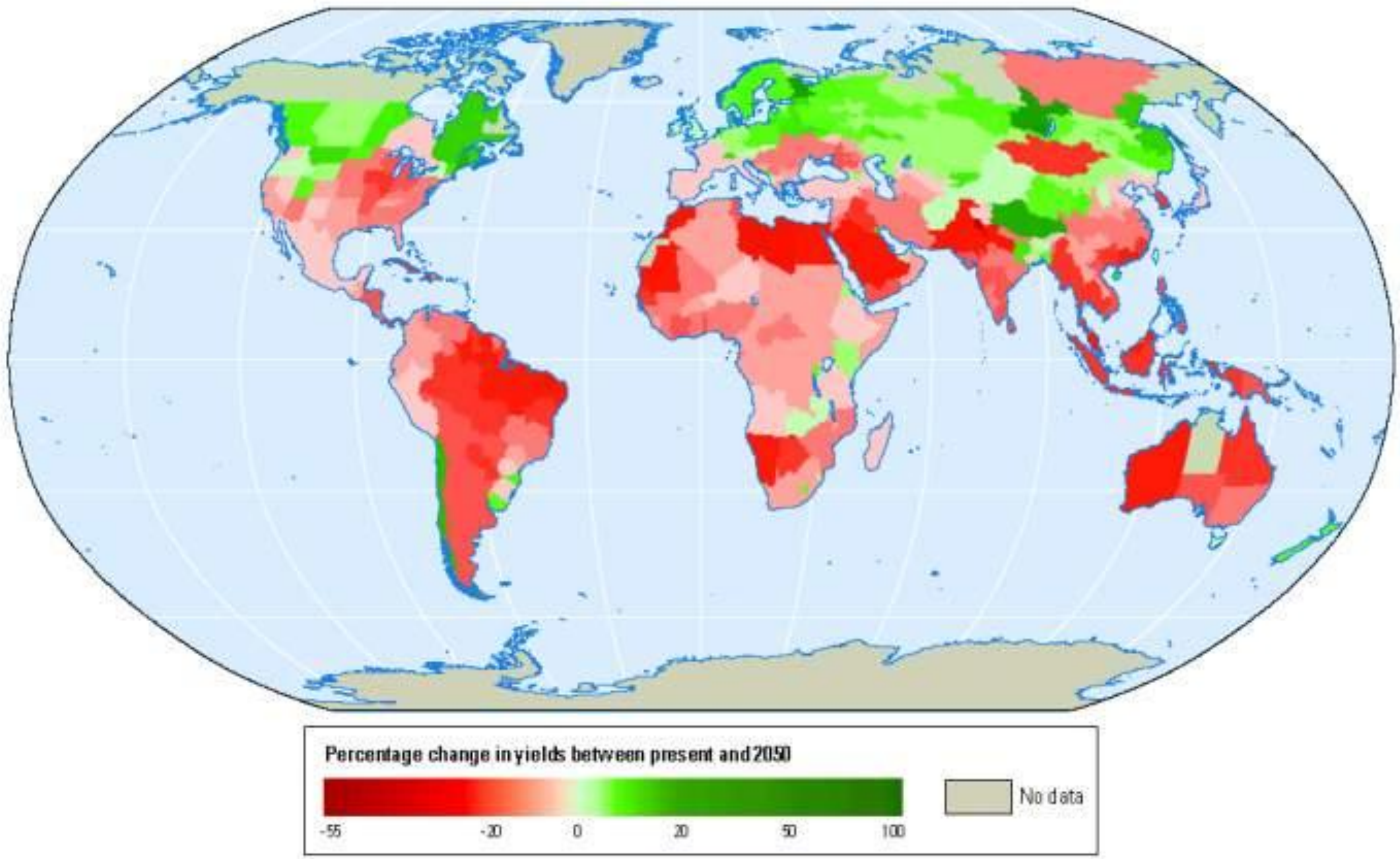


Cline WR 2007 *Global Warming and Agriculture*

Broad-scale impacts on crop production

Potential change in grain yield

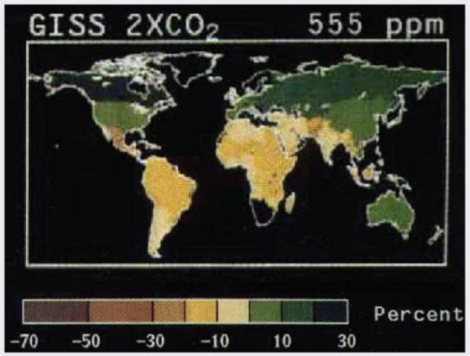
Map 1 Climate change will depress agricultural yields in most countries in 2050, given current agricultural practices and crop varieties



Broad-scale impacts on crop production

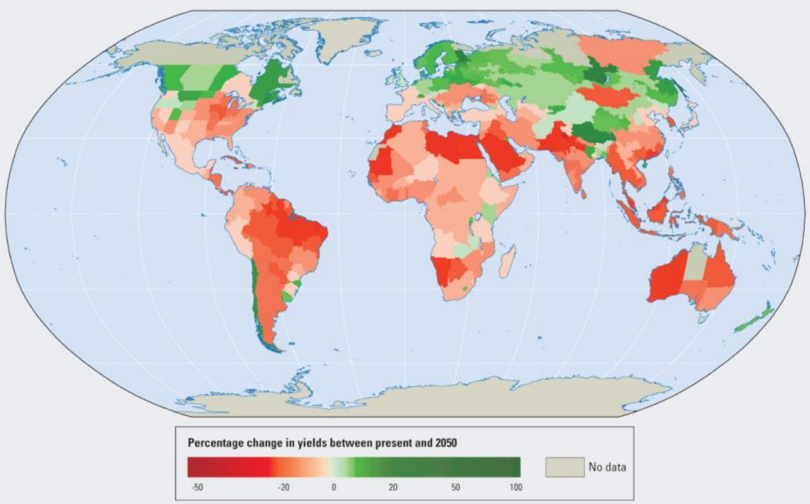
Potential change in crop yield World Bank Development Report 2010

A robust and coherent pattern of climate change impacts on crop productivity exists at the global scale



1994 assessment of the impacts of climate change on the productivity of 4 food crops

Macmillan Publishers Ltd
C Rosenzweig and M Parry
Nature 367, 133-138 1994



2010 assessment of the impacts of climate change on the productivity of 11 food crops

World Bank Publishers
World bank Development report 2010
http://wdronline.worldbank.org/

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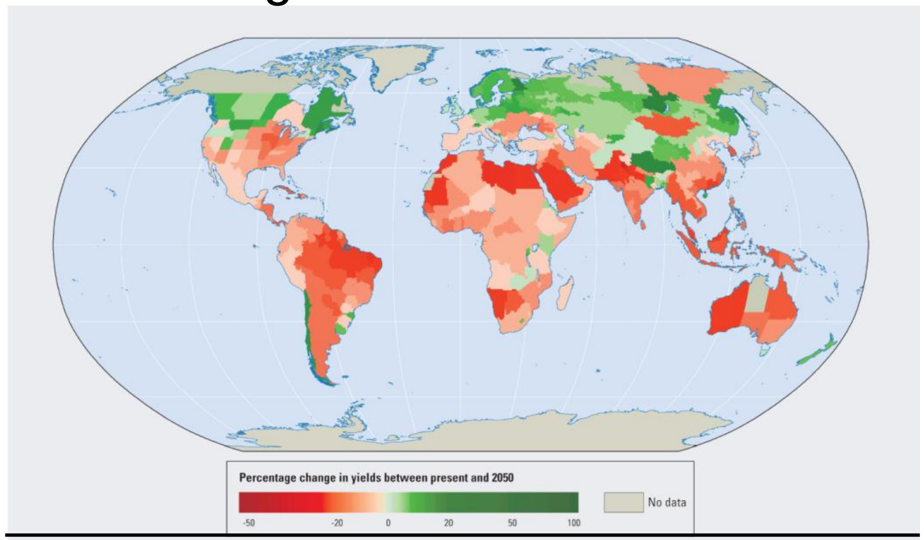
Climate variability and change will exacerbate food insecurity in areas currently vulnerable to hunger and under-nutrition

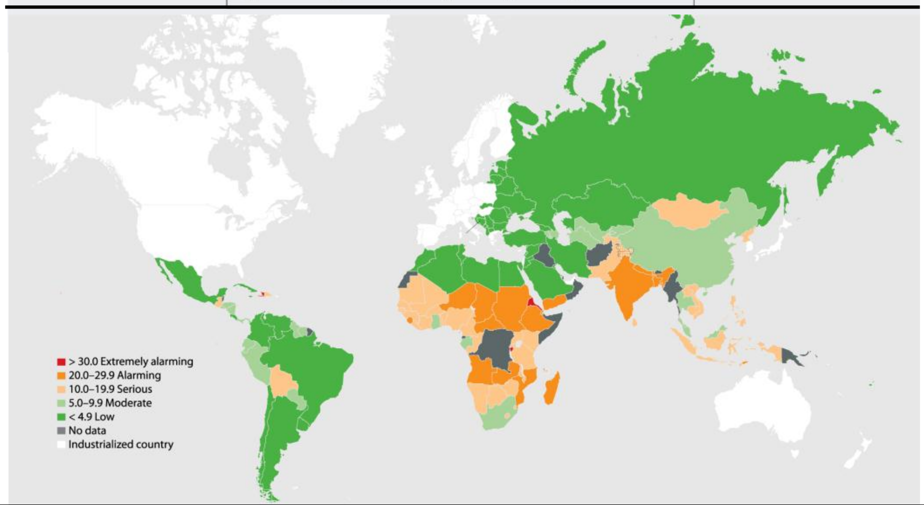
Impacts of climate change on the productivity of food crops in 2050

World Bank Publishers
World bank Development report 2010
http://wdronline.worldbank.org/



2012 Global Hunger Index

Welthungerhilfe, IFPRI and Concern Worldwide
K von Grebmer et al 2012
http://www.ifpri.org/ghi/2012



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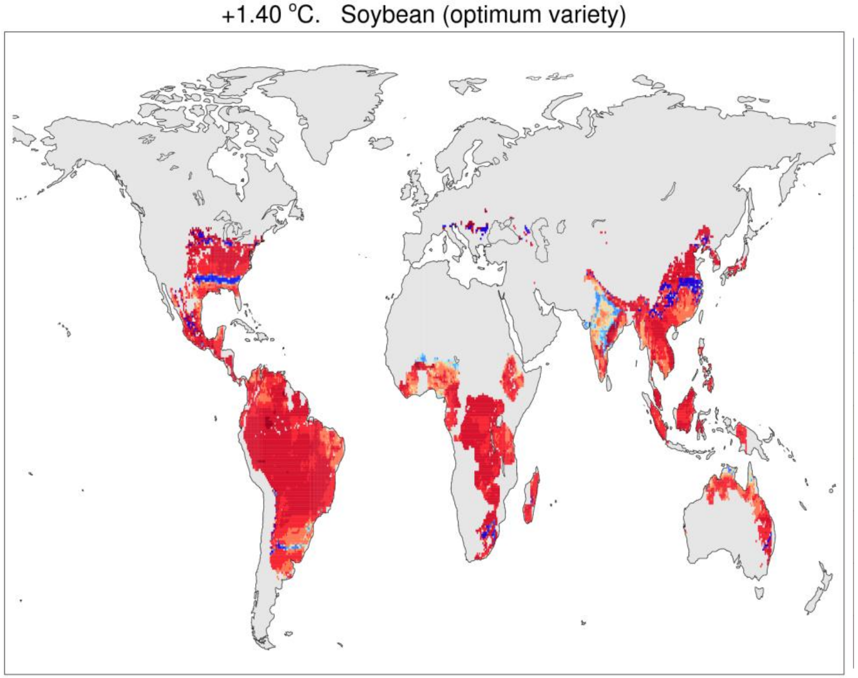
Impacts of climate change on soyabean yield Osborne et al. 2012 *Ag For Met*



57% of world's coarse grains were used for animal feed in 2011

> 66% of all plant protein meal consumed by livestock in 2011 was soyabean

Wheeler and Reynolds 2013 *Animal Frontiers*

Summary of % change in yield under climate change by crop

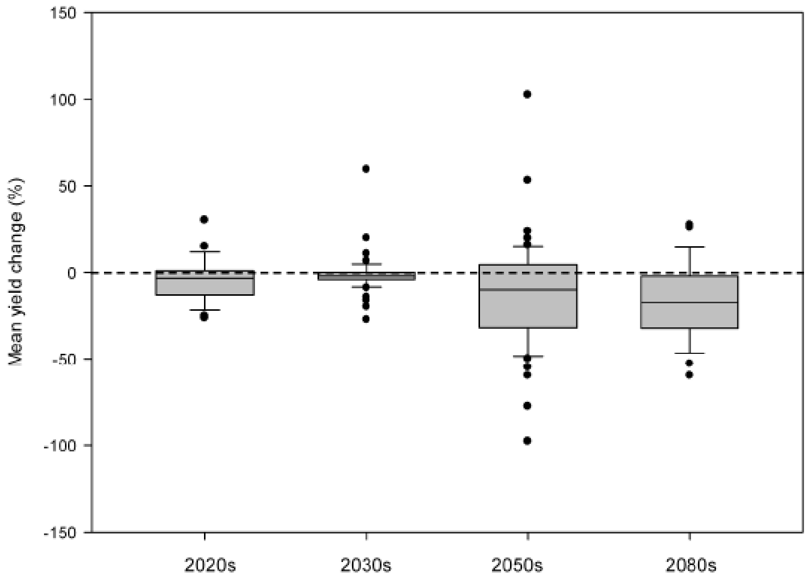
Across Africa	**-17% wheat**
	- 5% maize
	-15% sorghum
	-10% millet
Across South Asia	**-16% maize**
	-11% sorghum

No change in yield was detected for rice

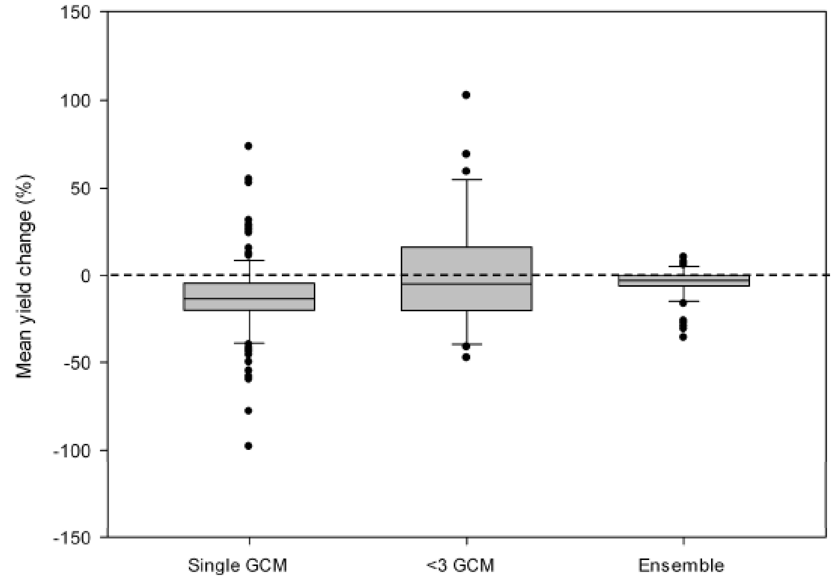
Systematic review of climate change impacts across Africa and Asia
Meta analysis of data in 52 publications from an initial screen of 1144 studies
Knox et al *Env Res Letters 2012 vol* 7

Cranfield UNIVERSITY

Projected yield changes (%) for all observations for all crops and all regions, by time slice.



Projected yield changes (%) for all observations for all crops and all regions, by climate model



Systematic review of climate change impacts across Africa and Asia
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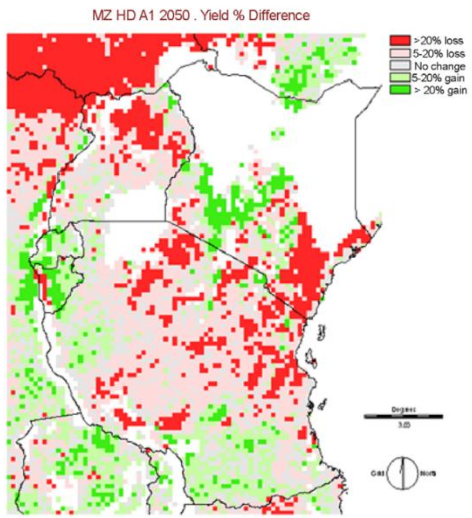
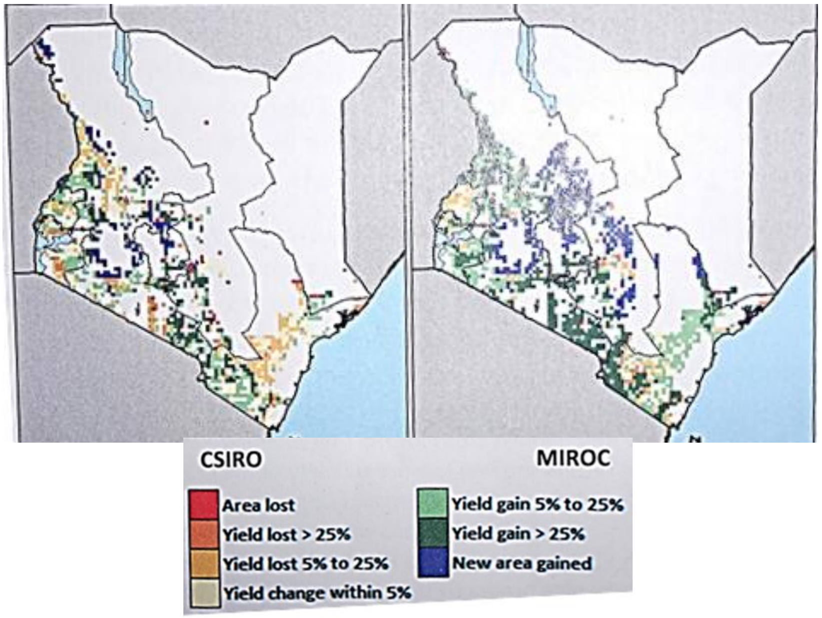
Regional studies of maize yields in East Africa

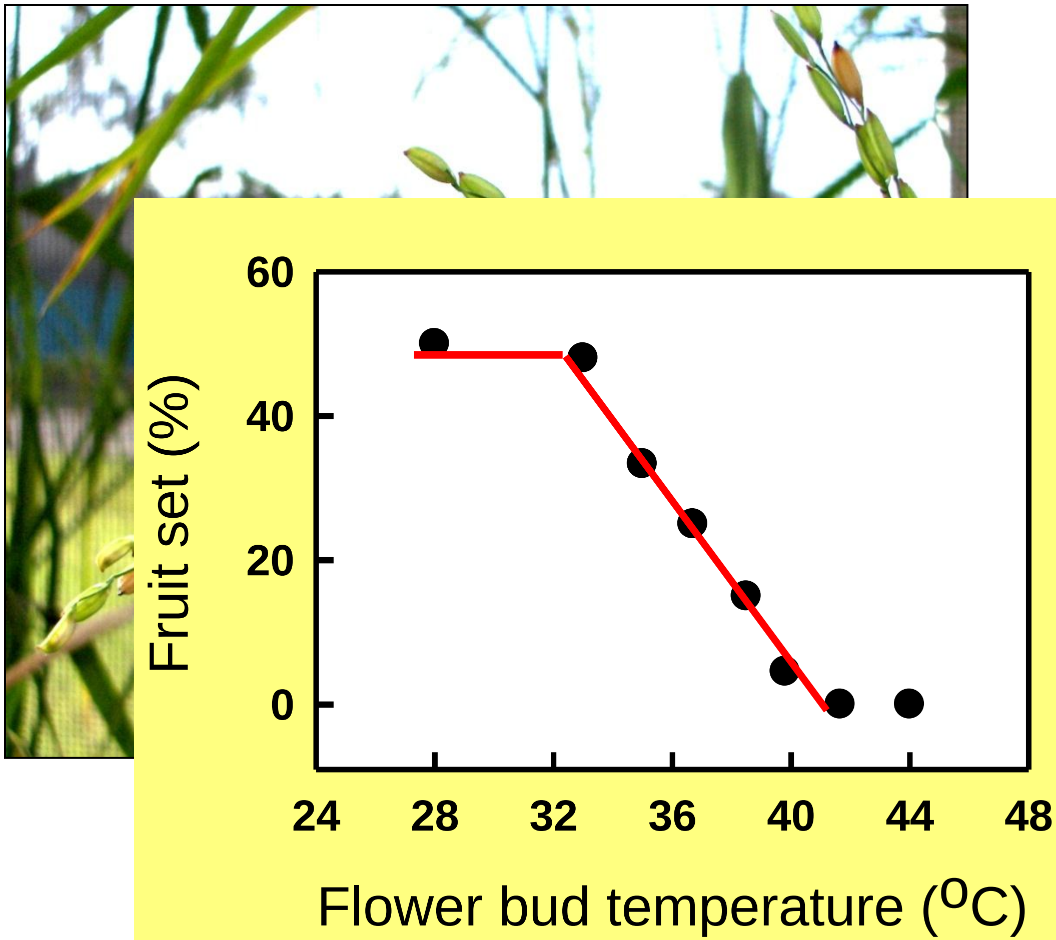




Left - Thornton PK et al *Global Env Change 2009, 19 54-65*

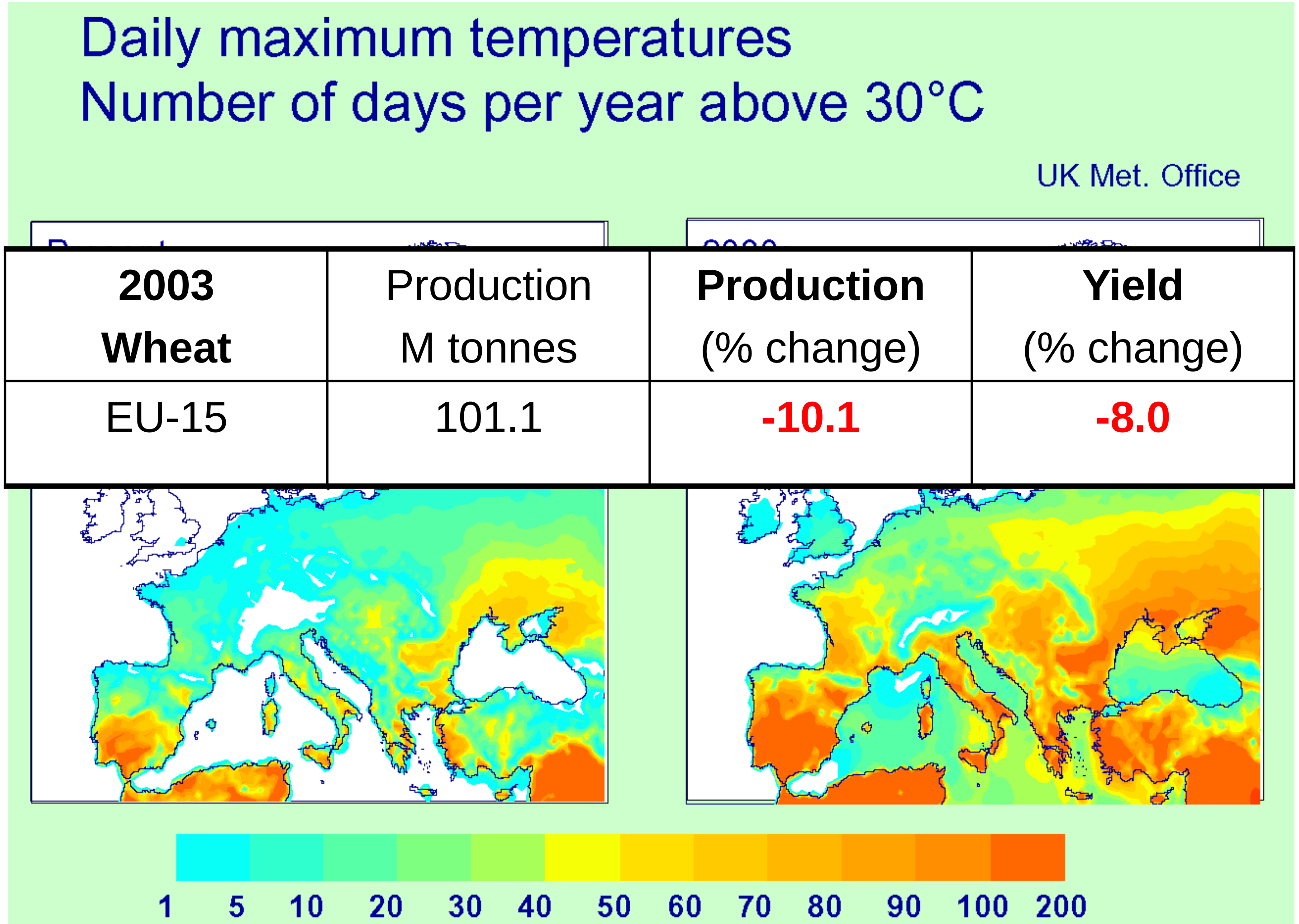
Right – Odera et al*, CCAFS 2012*

Crop productivity is highly vulnerable to variations in climate



Hot temperature

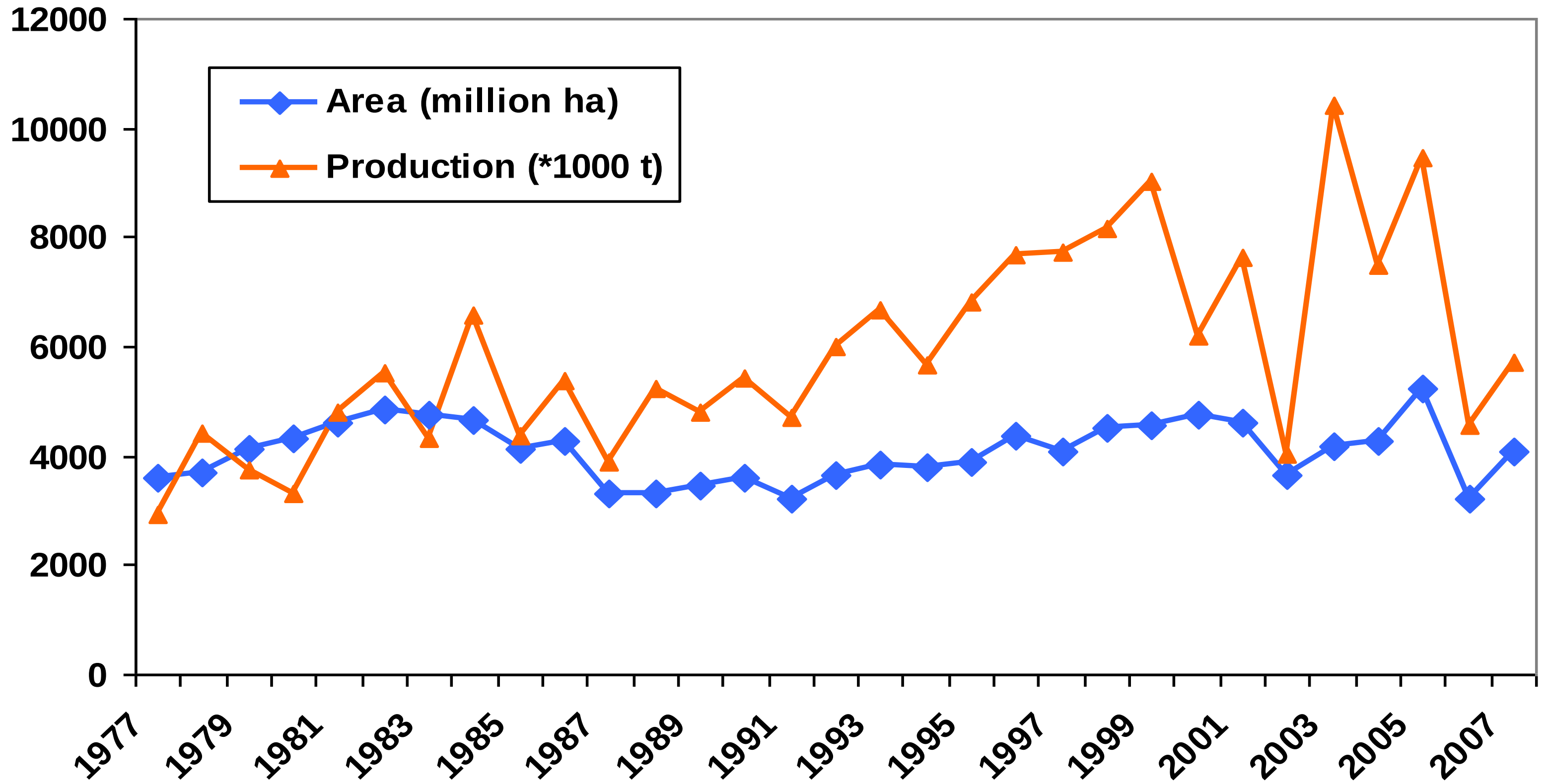
After a single hot day, only the brown grains contain rice seed that will be harvested



2003 Wheat	Production M tonnes	**Production** (% change)	**Yield** (% change)
EU-15	101.1	**-10.1**	**-8.0**

Under A2 scenario, from Parry et al. ACACIA project

W. Australia wheat production



Cost of adaptation?

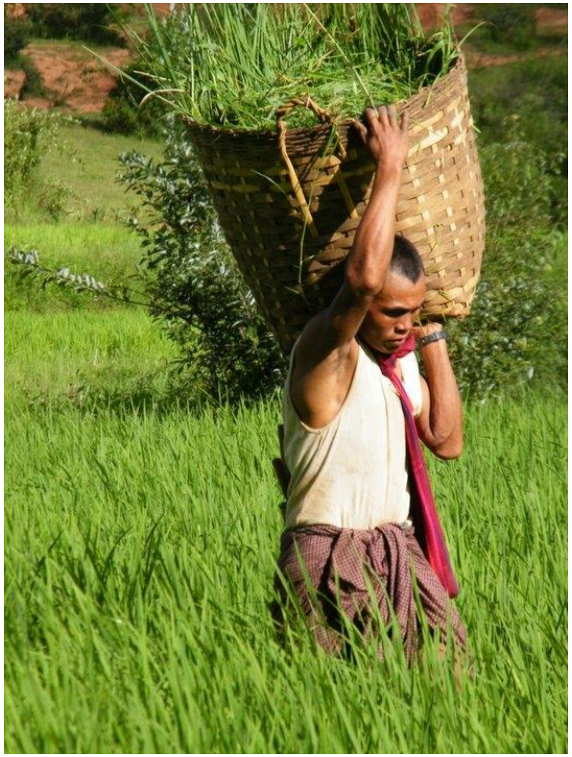
- US $12-14 billion in the year 2030 for research, extension and infrastructure for AFF. Equal split developed / developing countries (UNFCCC, 2007)
- Difficult to estimate but probably more (Parry et al 2009)
- US $ 7 billion per year for developing nations only. No FF (IFPRI ,2009)

Annual cost of ‘climate proofing’ MDGs in Africa in 2010-2020 for agricultural sector is US $1.6-2.7 billion per year above a US $ 8.0 billion per year baseline (Fankhauser & Schmidt-Traub, 2010)

Scuba rice

IRRI
INTERNATIONAL RICE RESEARCH INSTITUTE

- **Paddy loss due to flooding in Bangladesh and India amounts to an estimated 4m tons of rice p/year - enough to feed 30m people**
- **The flood tolerant “scuba” versions of rice varieties can withstand 17 days of complete water submergence**
- **Six Sub1 “mega varieties” of rice have been produced**
- **>200,000 farmers are now using scuba rice**



"I gave up hope of getting any yield from my land as paddy seedlings remained submerged for 17 days. But to my surprise the seedlings grew green again after the flood. Still I can't believe I have got 18 maunds (672 kg) of paddy from there.“**Biplob Sarker, farmer, Bangladesh**

Drought tolerant maize for Africa

- Developed by CIMMYT and IITA, with the support of the BMGF, DFID and a broad range of partners

- Goal is to help farmers in Sub-Saharan Africa living in drought-susceptible areas increase their maize productivity by more than 30 percent.

- >2 million smallholder farmers in Africa are already realizing the benefits of higher yields and incomes from these new maize varieties

Climate change, agriculture and food security program

1. Identify and develop **pro-poor adaptation and mitigation practices, technologies and policies** for agriculture and food systems**.**

2. Support the inclusion of agricultural issues in **climate change policies**, and of climate issues in **agricultural policies**, at all levels.

CLIMATE CHANGE AGRICULTURE AND FOOD SECURITY

Knowledge sharing for development

– CDKN's mission is to support decision-makers in designing and delivering 'climate compatible development (CCD)'

– After 2.5 years, there are > 120 projects in 48 countries

– Our public/private alliance consists of Southern and Northern NGOs, a think tank and a private sector organisation, lending us wide development and climate expertise.

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Six precepts for decision-makers developing policy responses to climate change impacts on food security

1. Climate change impacts on food security will be worst in countries already suffering high levels of hunger and will worsen over time
2. The consequences for global under-nutrition and malnutrition of doing nothing in response to climate change are potentially large, and will increase over time
3. Food inequalities will increase, from local to global levels, because the degree of climate change and the extent of its effects on people will differ from one part of the world to another, from one community to the next and between rural and urban areas
4. People and communities who are vulnerable to the effects of extreme weather now will become more vulnerable in the future and less resilient to climate shocks
5. There is a commitment to climate change of 20-30 years into the future as a result of past emissions of greenhouse gases that necessitates immediate adaptation actions to address global food insecurity over the next two to three decades
6. Extreme weather events are likely to become more frequent in the future and will increase risks and uncertainties within the global food system

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Thank you

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