INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE
sustainable solutions for ending hunger and poverty
Supported by the CGIAR

PROGRAM FOR BIOSAFETY SYSTEMS
A partnership program for biosafety capacity development

Food Security and World Changes and Trends since 1992

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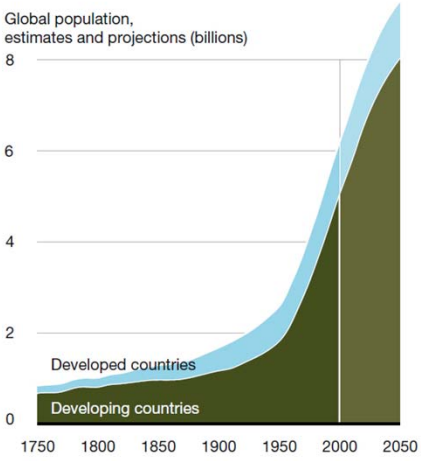
Demographic Changes



~7 billion in 2011
~ 9 billion by 2050
40% Increase in Asia

Demographic Changes

- Nearly one billion are food insecure
- One billion malnourished children under 5 years of age in Asia in 2000
- Over 90% of future population growth will occur in developing countries
- Competition for resources is increasingly global

Future food needs

FAO estimates that Food Production will have to increase

70%

while combating poverty and hunger

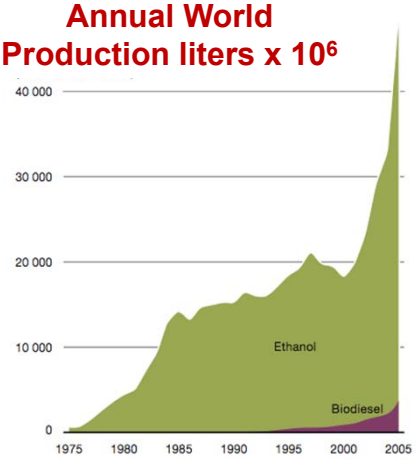
Source: FAO "How to Feed the World in 2050", Rome 2009

Challenges to meet this goal

I. Competition from Biofuels and Biomass demand
II. Dietary Changes
III. Availability of Arable Land
IV. Water Scarcity
V. Climate Change

I. Biofuels

Annual World Production liters x 10^6



Sharply Increasing Biofuel Production – diversion food/feed into biofuels

I. Biomass

- Biomass energy 77 % World renewal energy
- Sharp Increase in World Biomass demand, e.g. South Korea: 250 x increase in next 10 years

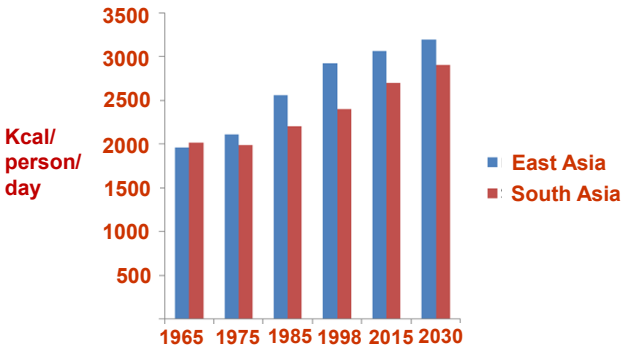
As a consequence

- Biomass plantations may also compete for the best lands with food crops, adversely affecting local food security and smallholder farming.
- Where biomass production is for export, no improvement in local energy security

Source: Cotula, Finnegan & MacQueen, 2011 IIED

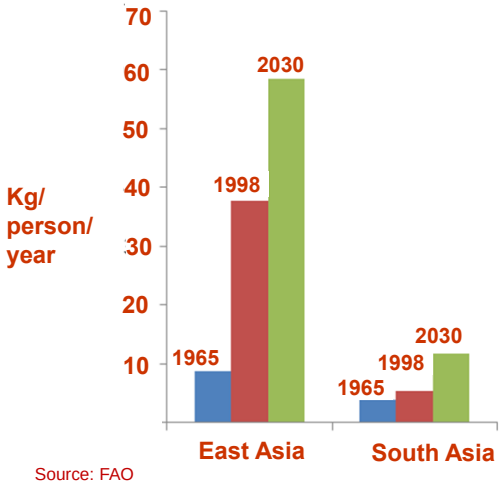
II. Dietary Changes

Calorie/Food Intake has been increasing



Source: FAO

II. Dietary Changes



Increase in Meat Consumption

Source: FAO

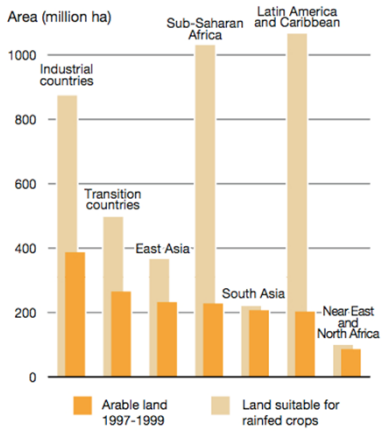
II. Dietary Changes

Income Growth in Developing Countries
→ Increased demand for high valued food, principally meat, fish

1 kg meat requires
- **~ 3 kg grain**
- **~ 16,000 liters water**

1 kg wheat requires
- **~1,300 liters water**

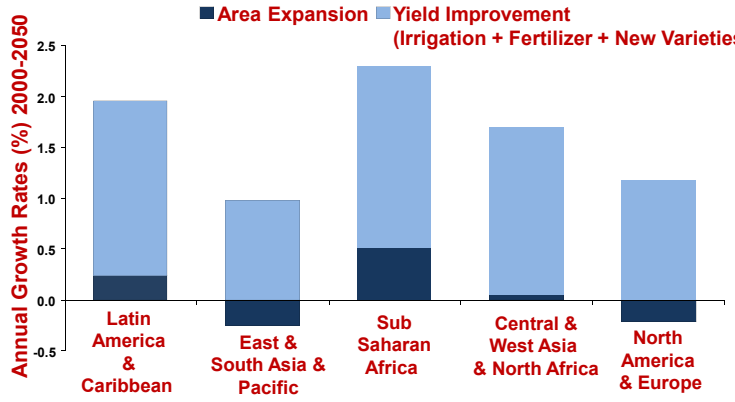
III. Land Availability



Limited Potential for cropland expansion in Asia , *irrespective* of conservation, water and other environmental issues:

Source: FAO

III. Land Availability



Projected Sources of Cereal Production Growth 2000-2050

Source: IFPRI IMPACT projections, September 2007

III. Land Availability

Land loss due to irrigation practices

•Pakistan 11% of arable land lost due to salinization from irrigation

IV. Water scarcity

- **In 1995, about 1.8 billion people were living in areas experiencing severe water stress**
- **In 2025, about two-thirds of the world's population – about 5.5 billion people – are expected to live in areas facing moderate to severe water stress**

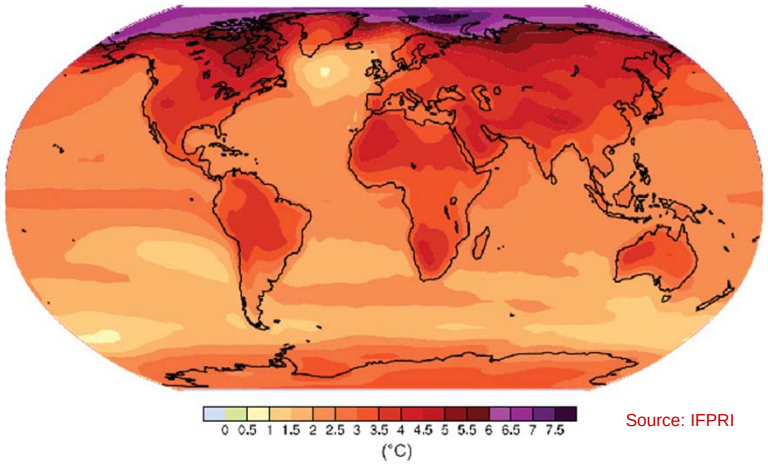
V. Climate Change

Compounding the Problem

- The Data
- The Consequences
  a. Rise in Sea Levels
  b. Increased unpredictability
  c. Change in Growing Season Length
  d. Yield Changes
  e. Price Increases
  f. Impact on Trade

V. Climate Change: the data Global Warming

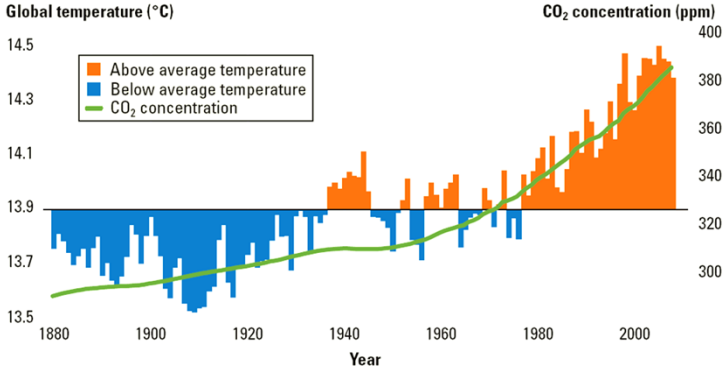
Predicted increase in surface temperature in 2090



Source: IFPRI

V. Climate Change: the data
Rising levels of °C and CO_2

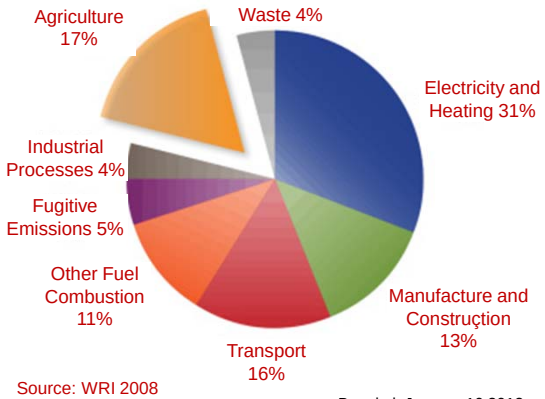
Figure FA.3 Global annual average temperature and CO_2 concentration continue to climb, 1880–2007



Source: Adapted from Karl, Melillo and Peterson, 2009

V. Climate Change: the data
The Role of Agriculture

Greenhouse gas Emissions by sector



Source: WRI 2008

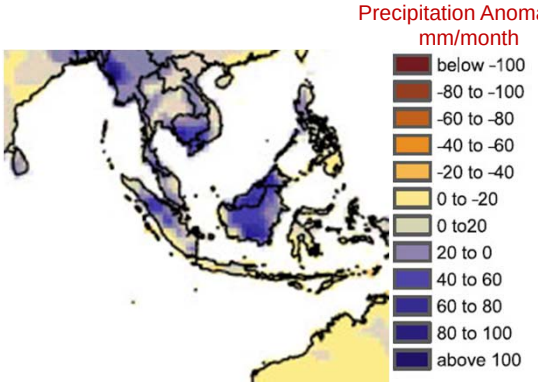
Agriculture is the second most important source of greenhouse gases

V. Climate Change: the data Greenhouse Gases

Agriculture is the second most important source of greenhouse gases

- The synthesis and use of nitrogenous fertilizers is the principal cause
- The nitrogen is converted into Nitrous Oxide in the soil
- Nitrous Oxide is 30-300 times worse than Carbon Dioxide

V. Climate Change: the data Change in Rainfall Patterns



One model of changes in patterns of rainfall for the end of the century

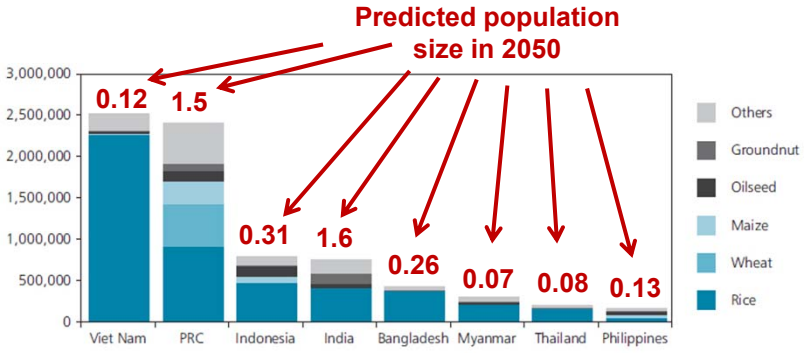
Source: Gumpenberger *et al*., Env. Res Letters 2010

V. Climate Change Consequences
a. Rise in Sea Level

Global warming would result in the melting of the polar ice-caps which will in turn cause a reduction in the availability of arable land

V. Climate Change Consequences
a. Rise in Sea Level

Hectares lost due to rise of 1 meter in sea level



Source: Asian Development Bank; UNPFA

V. Climate Change Consequences
a. Rise in Sea Level

a. Rise in Sea level degradation of other lands

- Increased salinization of coastal regions

V. Climate Change Consequences
b. Unpredictability

Increase in the frequency of floods

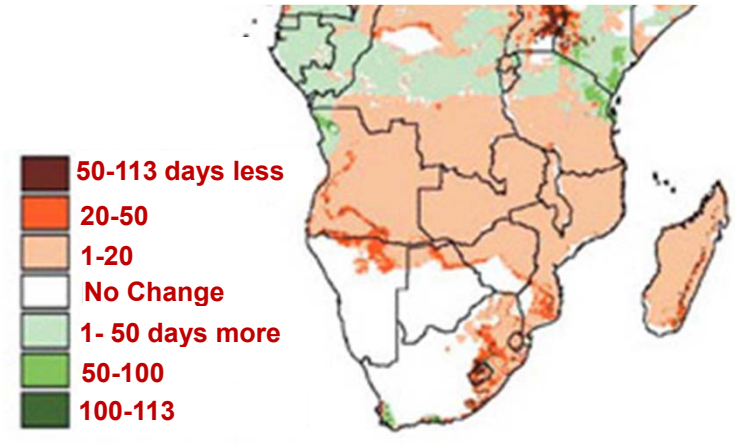
Source: P. Ronald U.C. Davis

Damage due to flooding: Thailand

V. Climate Change Consequences
b. Unpredictability

- and also of droughts

V. Climate Change Consequences
c. Growing Season Length



Source: WRI

V. Climate Change Consequences d. Yield

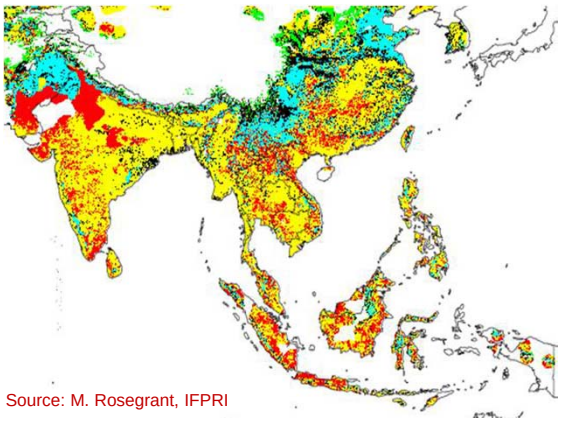
Many factors may involved, both positive and negative, *e.g.*

- CO_2 Fertilization – Positive Effect
- Heat stress: an increase of 1 °C in night-time minimum temperatures is associated with a loss in rice yield of 10% - Negative Effect

Source: Peng *et al*. 2004 PNAS 101:9971-9975

V. Climate Change Consequences d. Yield

Percentage change in Irrigated Rice production in 2050



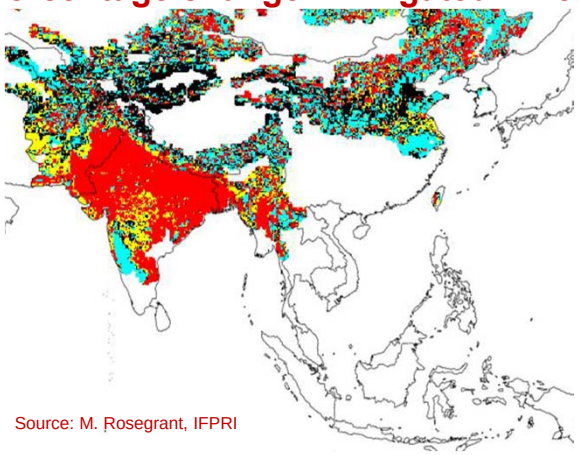
Source: M. Rosegrant, IFPRI

Average Reduction in Yield in Asia 27%

- 2000 old area lost
- Loss > 25%
- Loss 5- 25%
- Change within 5%
- Gain 5 - 25%
- Gain > 25%
- 2050 New Area Gained

V. Climate Change Consequences d. Yield

Percentage change in Irrigated Wheat production in 2050



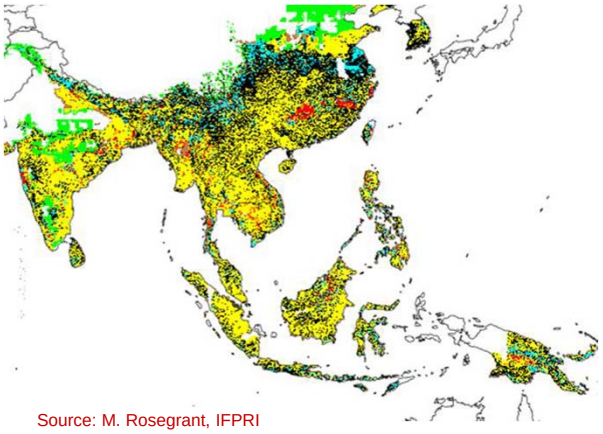
Average Reduction in Yield in Asia 46%

- 2000 old area lost
- Loss > 25%
- Loss 5- 25%
- Change within 5%
- Gain 5 - 25%
- Gain > 25%
- 2050 New Area Gained

Source: M. Rosegrant, IFPRI

V. Climate Change Consequences d. Yield

Percentage change in Irrigated Maize production in 2050



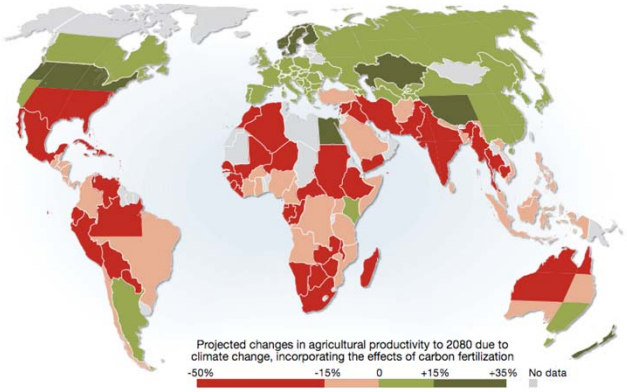
Average Reduction in Yield in Asia 17%

- 2000 old area lost
- Loss > 25%
- Loss 5- 25%
- Change within 5%
- Gain 5 - 25%
- Gain > 25%
- 2050 New Area Gained

Source: M. Rosegrant, IFPRI

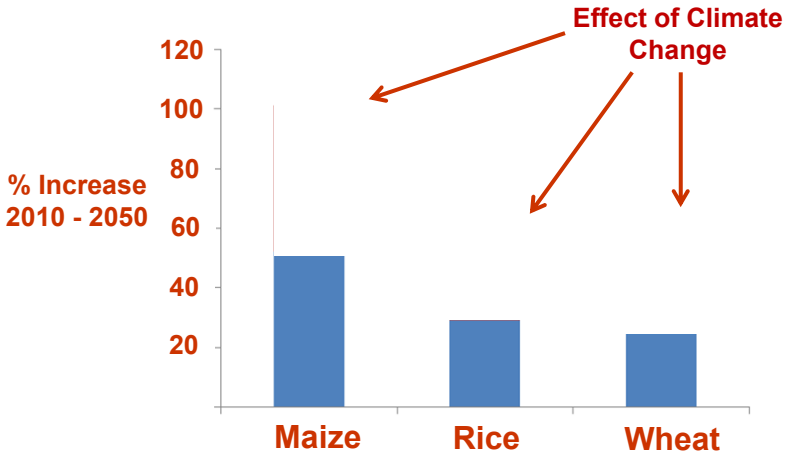
V. Climate Change Consequences
d. Yield

Positive effect in Temperate and Northern zones



Source: W. Cline, 2007; WRI

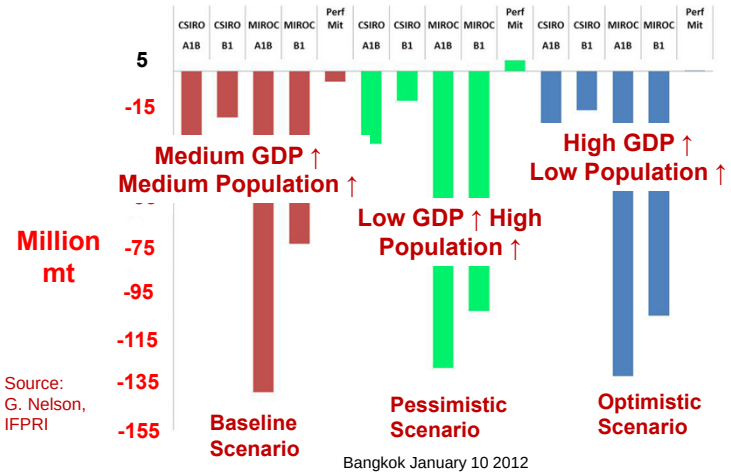
V. Climate Change Consequences
e. Price Increases



Source: G. Nelson, IFPRI

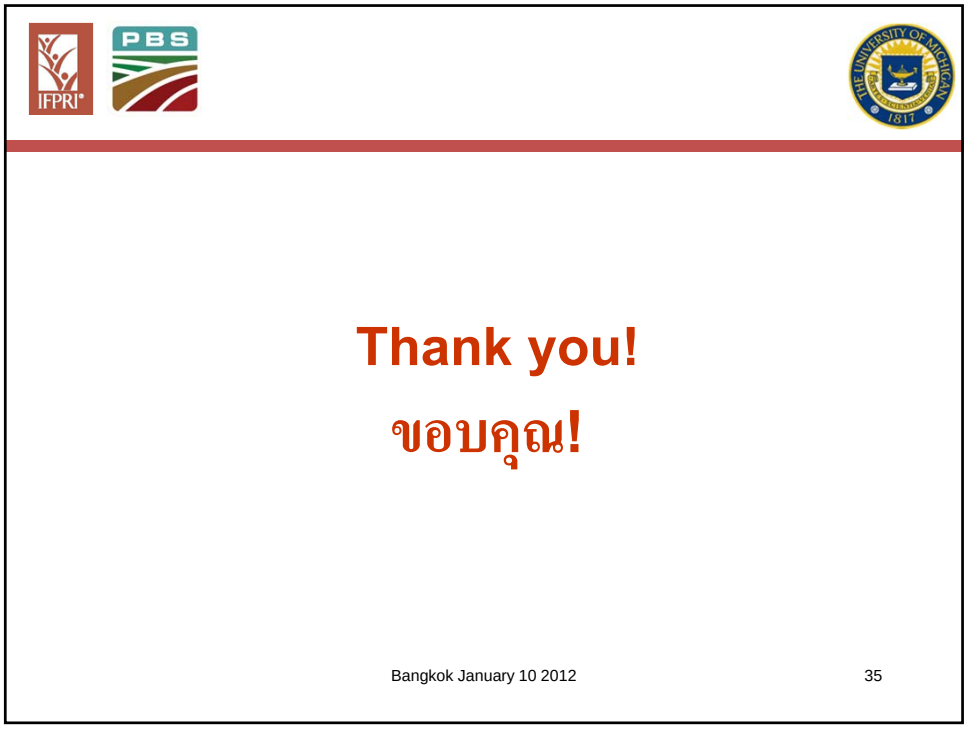
V. Climate Change Consequences f. Cereal Trade

Industrialized World 2010 -2050



Source: G. Nelson, IFPRI

Can Biotechnology offer a solution to these challenges?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Thank you!
ขอบคุณ!
Bangkok January 10 2012
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