Adaptation and food security

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Key messages

• Need to focus on food systems not just agricultural production
• Production responds to price as much as (or more than) biophysical conditions
• Prices set within a global market (and thus a global climate)
• Price driven by speculation, energy, demand, and climate
Food security...

... exists when all people, at all times, have **physical and economic access** to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life *(World Food Summit 1996)*
Modeling climate change and food security (in 1983)

Changes in crop yields change food security in very complex ways – shocks > oscillations, 20% decline doubles starvation.
Modeling climate impacts and adaptation: maize in Mexico (Conde, Liverman et al)

Adaptation (irrigation, fertilizor, crop variety and mix, planting dates) can prevent declines in production – but most farmers do not have access to these options and consumers cannot afford food if adaptation increases costs
Understanding climate adaptation in the field (Eakin)

Climate adaptation
• Replant
• Apply more or less inputs
• Switch crops
• Sell livestock or equipment
• Government programs
• Marketing strategies
• Migration and remittances
Food System ACTIVITIES

Producing food: natural resources, inputs, technology, …
Processing & packaging food: raw materials, standards, storage requirement, …
Distributing & retailing food: transport, marketing, advertising, …
Consuming food: acquisition, preparation, customs, …

Food System OUTCOMES Contributing to:

- Social Welfare
  - Income
  - Employment
  - Wealth
  - Social capital
  - Political capital
  - Human capital

- Environmental Welfare
  - Ecosystem stocks & flows
  - Ecosystem services
  - Access to natural capital

- Food Security
  - Food Utilisation
    - Nutritional Value
    - Social Value
    - Food Safety
  - Food Access
    - Affordability
    - Allocation
    - Preference
  - Food Availability
    - Production
    - Distribution
    - Exchange

Ericksen, P. Conceptualizing Food Systems for GEC Research (GEC: 2007)
Elements of food security

FOOD UTILISATION
- Nutritional Value
- Social Value
- Food Safety

FOOD ACCESS
- Affordability
- Allocation
- Preference

FOOD AVAILABILITY
- Production
- Distribution
- Exchange

Ericksen, P. Conceptualizing Food Systems for GEC Research (GEC: 2007)
* The real price index is the nominal price index deflated by the World Bank Manufactures Unit Value Index (MUV)
Causes of price rises in 2008-09

• Climate variability (drought in Australia, extreme weather in Europe) 10%?
• Biofuels (corn > ethanol, land > biofuels) 30%?
• Increased demand for dairy and meat, especially in Asia (grain fed to animals)
• Increased energy prices (gasoline, fertilizer) 20%?
• Lack of grain reserves
• Export bans
• Speculation in commodities
Chicago Board of Trade
Poverty and food insecurity

Chart 2
Paying more

Poor people tend to spend relatively more of their income on food, and therefore suffer more when food prices go up.

(food weighting within consumer price index, percent)

Source: IMF staff calculations.
Where are the hungry?

Total = 925 million

Developed countries 19
Near East and North Africa 37
Latin America and the Caribbean 53
Sub-Saharan Africa 239
Asia and the Pacific 578

Source: FAO.
Hunger in the U.S.

One in seven U.S. households hit by hunger issues in 2009.

Food security* by state

Food security by household

* "Food security" means that at a minimum, the ready availability of nutritionally adequate and safe foods and the assured ability to acquire acceptable foods in socially acceptable ways.

Source: USDA
Changes in growing season

Figure 1. Observed changes in growing season temperature for crop growing regions for 1980-2008. Values show the linear trend in temperature for the main crop grown in that grid cell, and for the months in which that crop is grown. Values indicate the trend in terms of multiples of the standard deviation of historical year-to-year variation. A value of two, for example, indicates that the expected growing season temperature in 2008 was two standard deviations above the expected value in 1980. Grid cells with less than 1% of land area covered by maize, wheat, rice, or soybean, are omitted for clarity. Lobell et al 2011 Climate Trends and Global Crop Production since 1980. Stanford Program on Food Security and the Environment Policy Brief
Crops prefer cooler temperatures

Effect of Temperature on U.S. Corn Yields
(Schlenker and Roberts, 2006)

30°C = 86 °F
35°C = 95 °F
Some positive changes

• Crops like higher levels of $CO_2$ all else being equal
• Some cold regions will become suitable for agriculture
• Farmers will adapt to new climates, by switching to new crop varieties, new locations etc.

• But beyond 2050 there are limits to adaptation
Impacts may be greater in tropics

- they are mostly warmer to begin with
- they are poorer and have less “capacity to adapt”

Global change in cereal production resulting from climate change

3 different climate models (Rosenzweig and Parry, 1994)
Projected impacts of climate change by 2030, for top 5 most important crops in each region.

Boxes represent 25th-75th percentile of model projections, whiskers 5th-95th, and dark line the median projection.

Number in parentheses is the overall rank of the crop/region in terms of importance to global food security.
Global impacts of a 4C increase

Change in length of growing period in 2090s
(Thornton et al 2010)
Real food price changes predicted over the next 20 years

Increase in world market export prices in 2030 relative to 2010

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

http://droughtmonitor.unl.edu/
Mexican buyer strikes big US corn deal
Severe Midwest drought raises doubts over supply

Cocoa at nine-month high in weather fear
Concerns over shortage of rain and stock in west Africa

Hedge funds bet on corn prices to soar
Figure tipped to rise to $9 a bushel as drought ravages crop

Fears grow for rise in food prices
Developing economies likely to face biggest risk

Rain shortfall in US Midwest lifts grains
Hot forecasts for corn and soybean-growing regions
Commodities

Get the latest prices and news with interactive charting options for key commodities. Click through to historic pricing and charting for individual commodity contracts.

Commodity performance

View Corn  Compare to Feeder Cattle  Time period 1 Year

Data delayed by at least 20 minutes.

Commodities news

Aug 07 2012 11:56 BST
Cash out of gold and send kids to college

Aug 07 2012 08:52 BST
Xstrata to cut costs and capital spending

Aug 07 2012 00:01 BST
BP to invest £60m in energy research hub

Commodity indices

S&P GSCI

↑ 1.13%
Today's change
657.67
Last
IFPRI recommendations re 2012 US drought

• Collaborative monitoring and prediction
• US and EU should halt biofuel from maize
• Avoid export bans and panic purchases
• Use national grain reserves and safety nets
• Protect World Food Program
• Invest in food security
Adapting food systems to a warmer climate

- Reduce waste and inefficiency (in food, water systems)
- Water infrastructure and advanced technology (dams, desalination)
- Plant breeding and GM for warmer climates
- Alternative foods and vegetarianism
- Insurance and disaster risk reduction
- Food and development aid
- Relocation
- Traditional agriculture
- Geoengineering

Where should limited funds be allocated?
Figure 2: Food losses and waste within the food system.