

A satellite view of the Earth, showing the Middle East, North Africa, and parts of Europe and Asia. The image is centered on the Red Sea and Persian Gulf region. The text is overlaid on a semi-transparent white box.

(How) should climate change alter investment in agriculture and natural resource management?

David B. Lobell

FAO/WB meeting on Investing in agriculture and natural resources management in the context of climate change in East Asia and the Pacific

May 14, 2012

## Outline:

- 1) *General strategies for adaptation*
- 2) *What are relevant climate trends in the region, and which are worth worrying about?*
- 3) *What specific risks and opportunities do I see these trends presenting in the region?*

- "Adaptation" means different things to different people

- Most simply, it is a response to climate that improves outcomes

- Adaptation can be to:

- 1) *Current climate risks:*

The result of natural variability

- 2) *Anticipated future climate risks:*

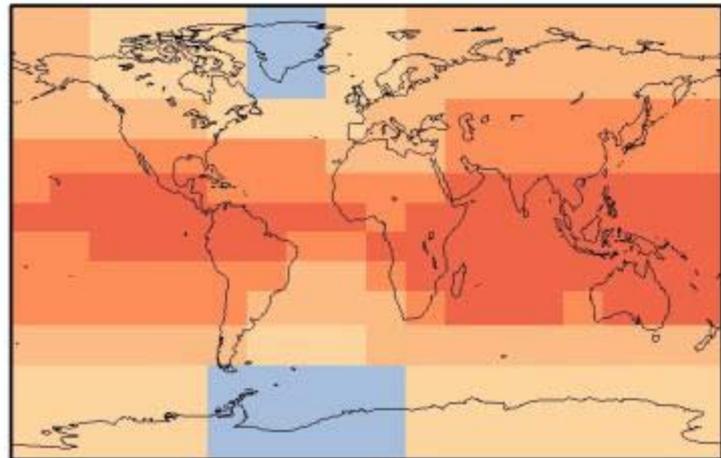
The result of anthropogenic climate change

- In many situations, natural variability will be the main source of climate risks over the next 20-30 years. In these cases focusing only on current risks makes sense
- But in some situations, it will be worth considering the trends.

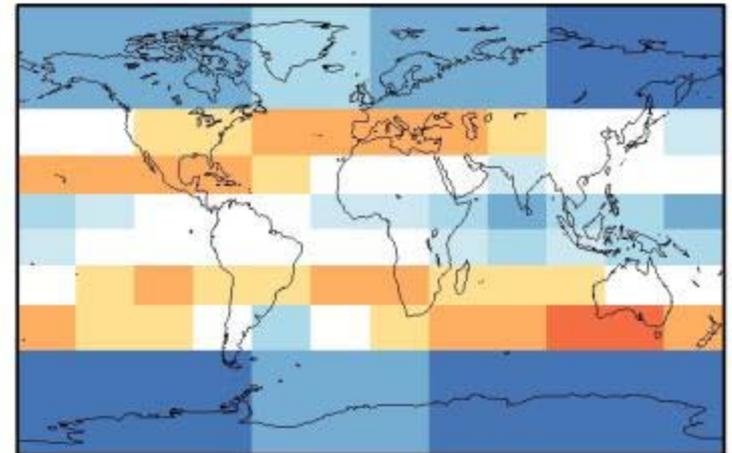
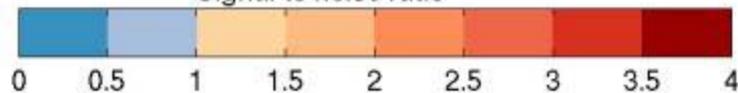
Signal to noise ratio for 20 year projections of T&P.  
(Noise = natural variability, Signal = climate change trend)

## Temperature

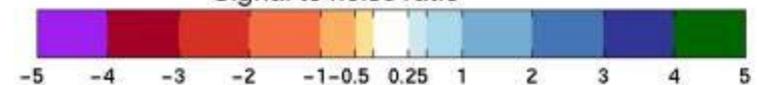
## Precipitation



Signal to noise ratio



Signal to noise ratio



Hawkins and Sutton  
(2009, 2010)

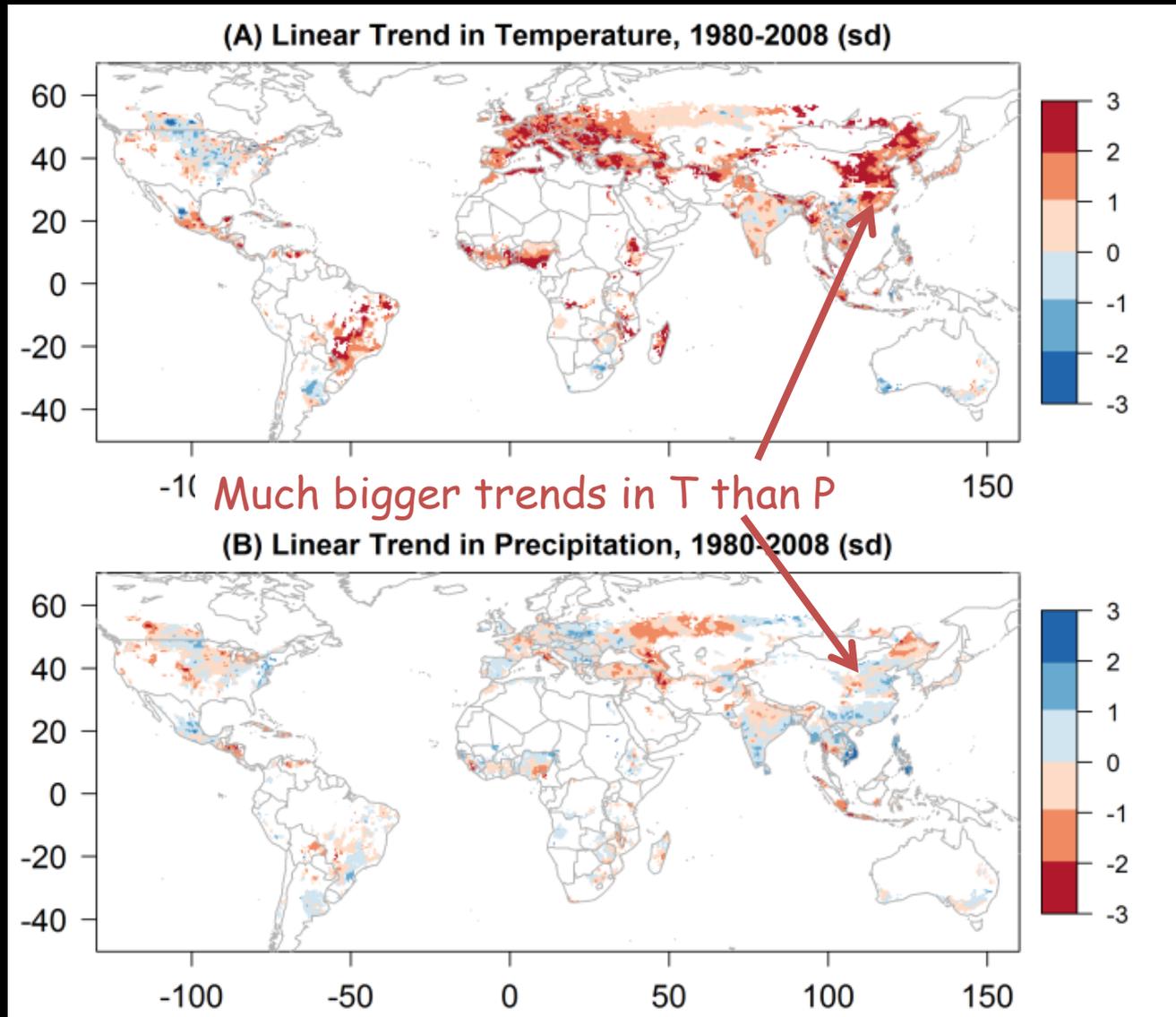
(<http://climate.ncas.ac.uk/research/uncertainty/index.html>)

- In many situations, natural variability will be the main source of climate risks over the next 20-30 years. In these cases focusing only on current risks makes sense
- But in some situations, it will be worth considering the trends.
- The goal today is to discuss anticipatory adaptation, recognizing that dealing with current risks are often the most worthwhile

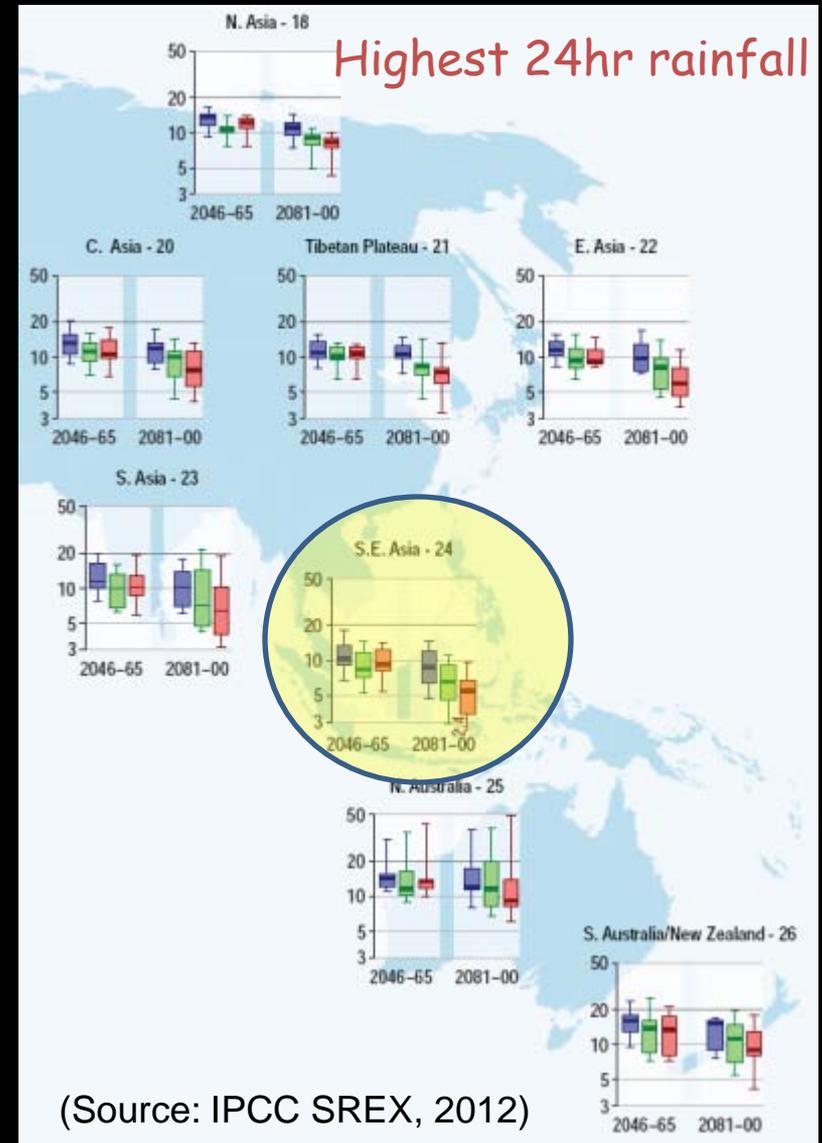
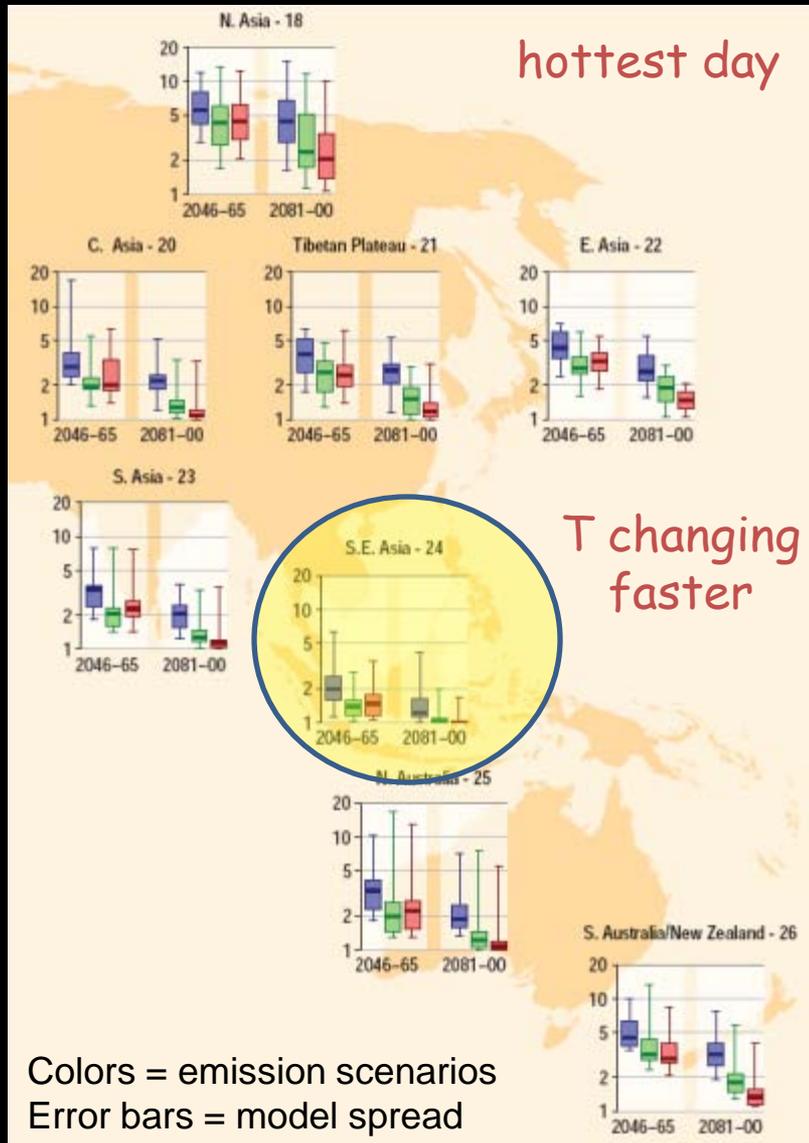
What trends are worth worrying about?



# (1) Increase in growing season temperature (which speeds crop development and water use)



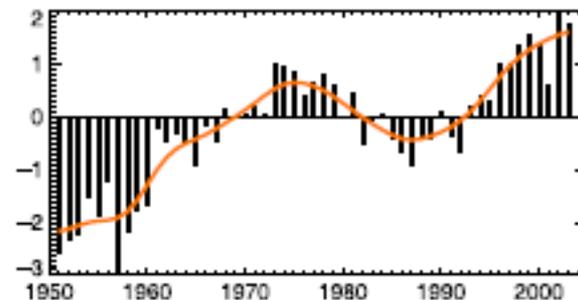
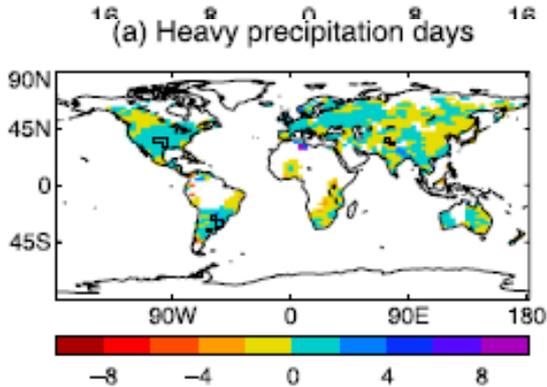
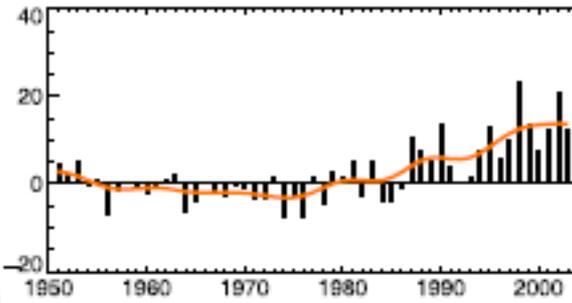
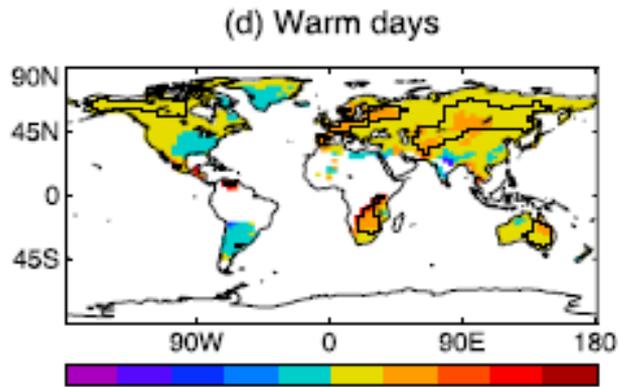
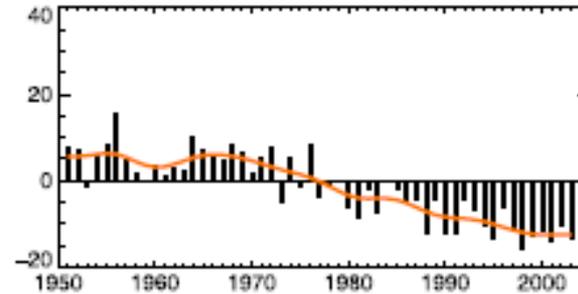
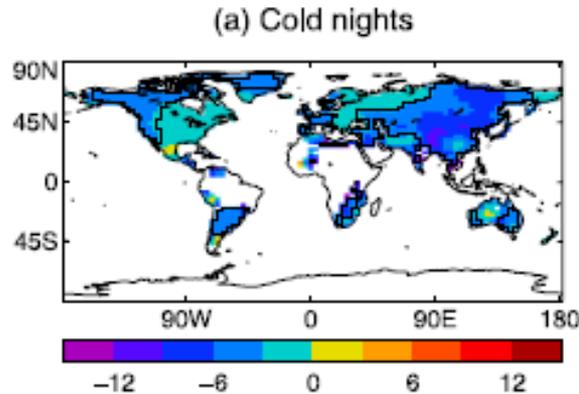
# (2) Extreme events for both heat and rainfall are becoming more common: Projected return periods for a 1 in 20 year event\* \*based on late 20th century climate



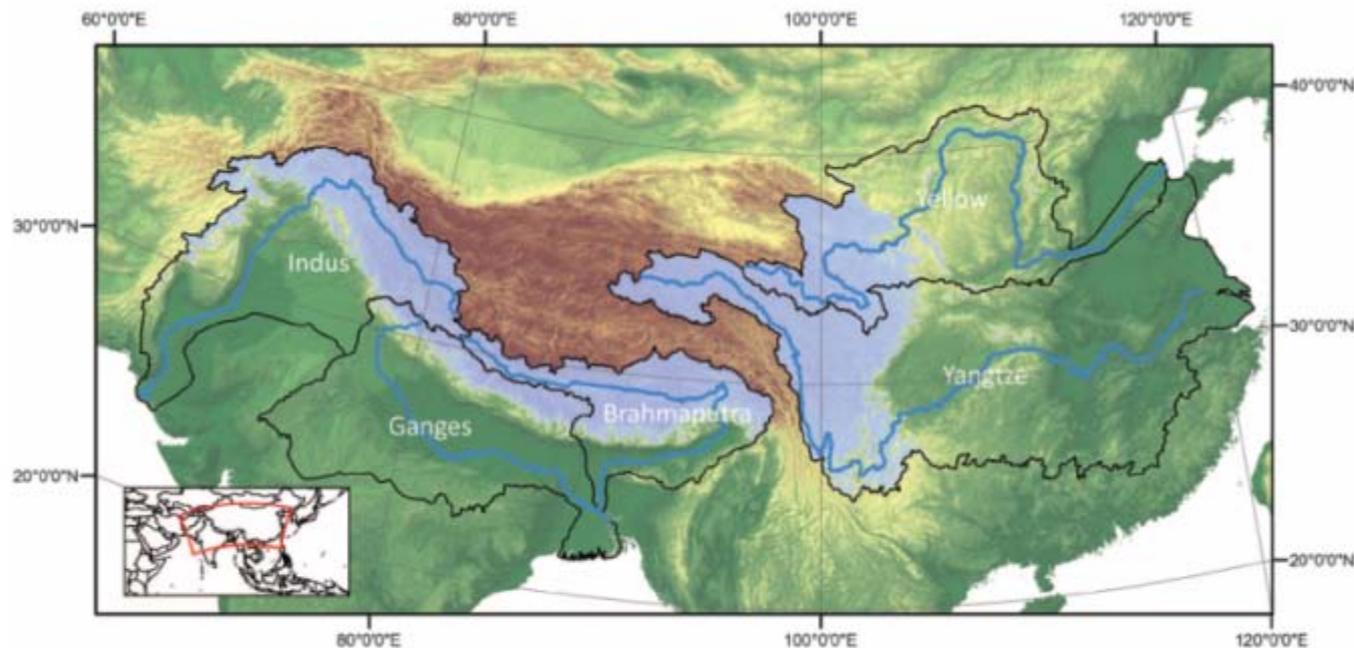
## (2) Extreme events for both heat and rainfall are becoming more common

Map of trends since 1950

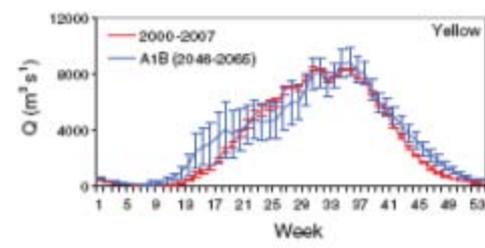
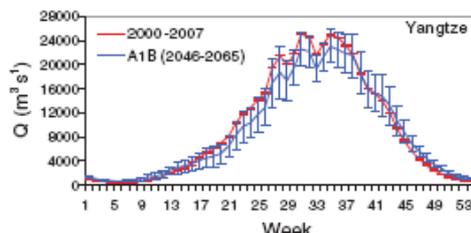
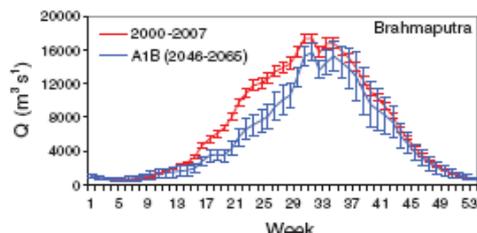
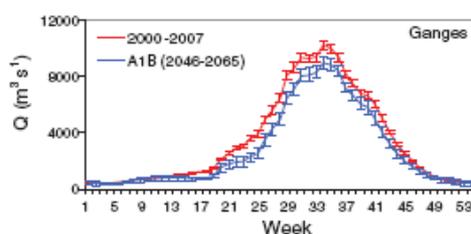
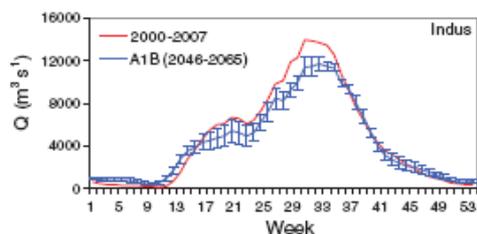
Time series of global average



### (3) Declines of upstream glacial water discharge (Immerzeel et al. 2010)



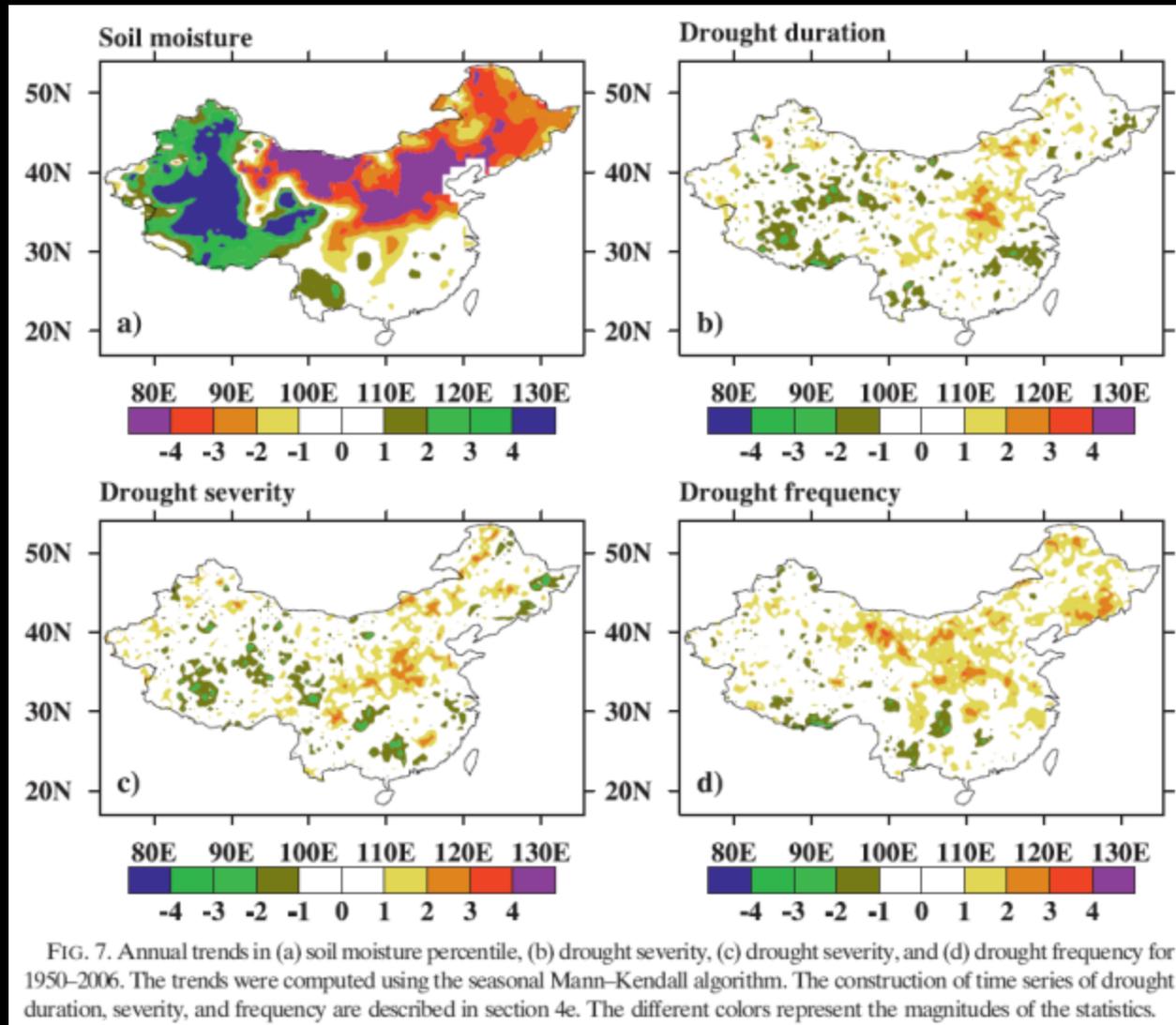
**Fig. 1.** Basin boundaries and river courses of the Indus, Ganges, Brahmaputra, Yangtze, and Yellow rivers. Blue areas denote areas with elevation exceeding 2000 masl. The digital elevation model in the background shows the topography ranging from low elevations (dark green) to high elevations (brown).



E Asia better off than S Asia,  
but still potential declines

## (4) Slow changes in drought probabilities (Drought still mainly related to climate variability)

Trends in drought-related measures, 1950-2006 (Wang et al. 2011)



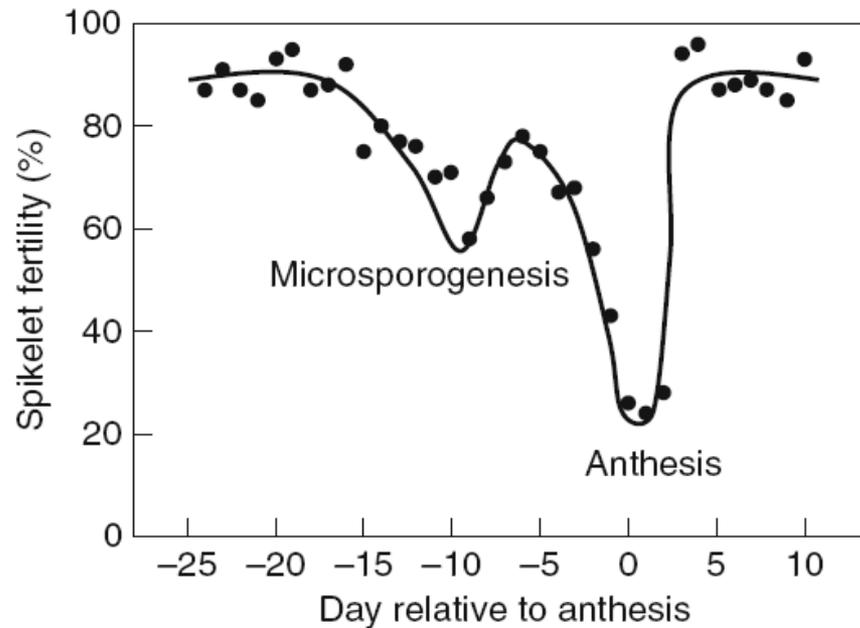
# What are key agricultural risks and opportunities?



<http://indica.ucdavis.edu/publication/reference/submergence-tolerance-research-overview>

# Risk 1: Effects of T extremes

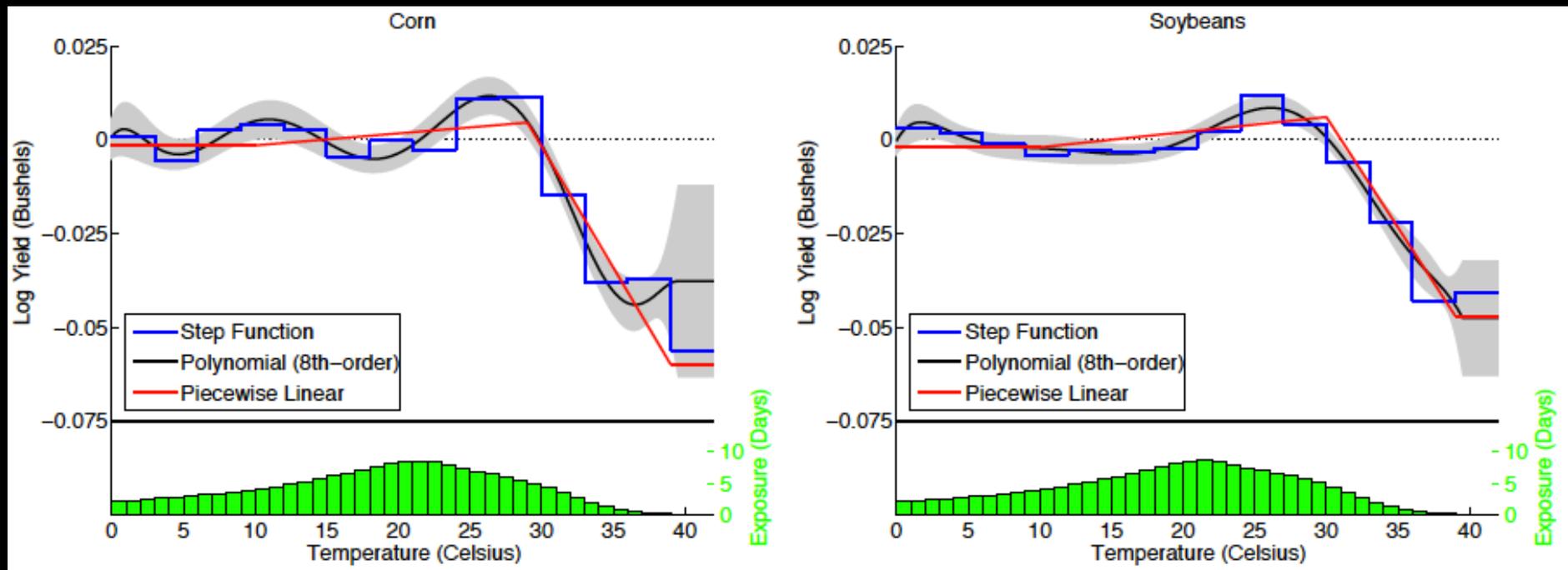
- Rice yields sensitive to high daytime T at critical stages
- Varieties with early flowering show promise in reducing this effect



**Figure 3** Spikelet fertility of BKN6624-46-2 exposed to high temperature of 35 °C during different stages of panicle development for 5 days (Yoshida *et al.*, 1981; redrawn by P. Craufurd).

# Risk 1: Effects of T extremes

- Rainfed corn and soybean yields also show sharp declines at high daytime T
- Not yet clear how this can be adapted to, but likely improved water management will be important



## Risk 2: Flooding of fields

- Increased heavy rainfall can increase flooding risks, with large crop damages
- In rice, new varieties with Sub1 genes show much greater tolerance

### Floods reduce rice supply

Published: [17/10/2011](#) at 01:52 PM

Online news: [Learning From News](#)

**Bangkok Post**

Rice production likely to fall 7 million tonnes. No export impact, but higher prices for Thai consumers possible.



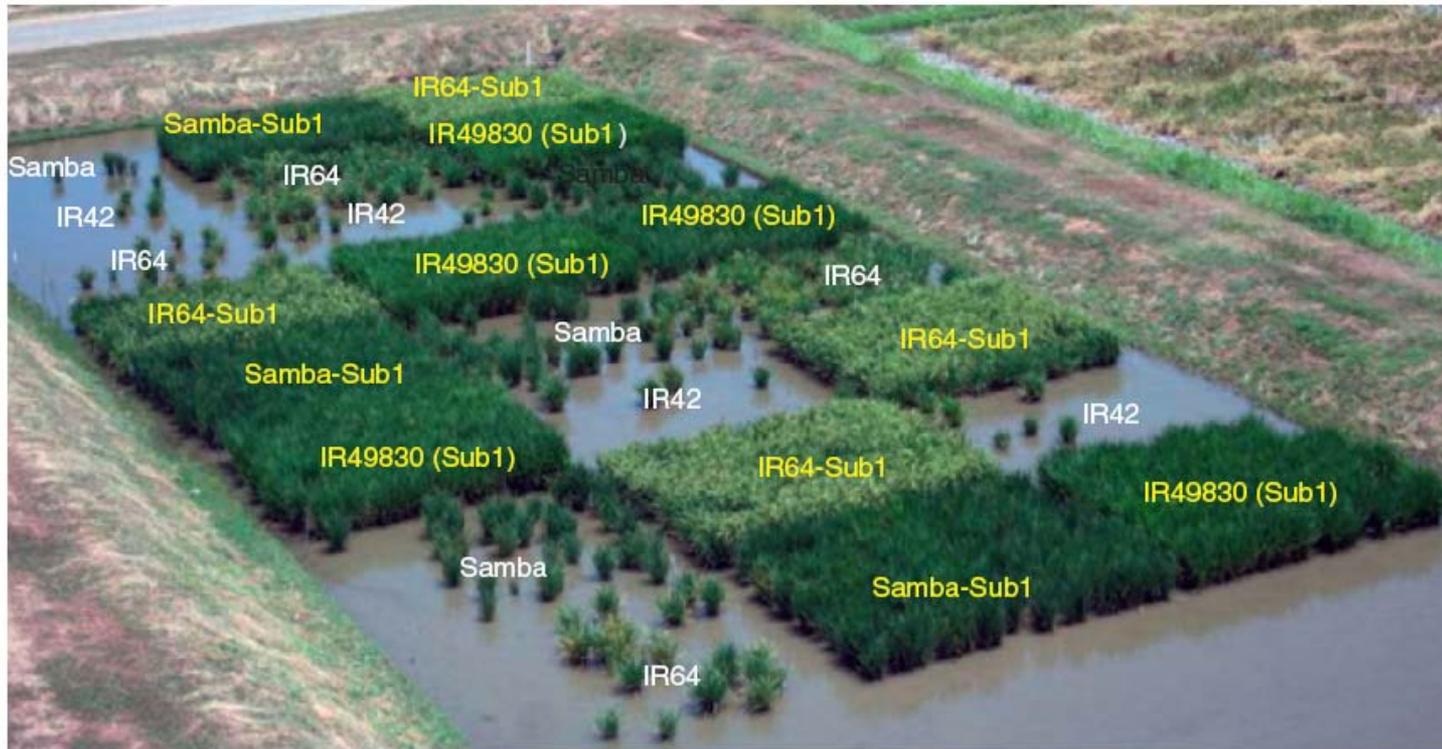
In photo above fields in Lop Buri are among the hundreds of thousands of rai now under water (Photo: PHRAKRIT JUNTAWONG).

[Click button to listen to Impact of Floods on Rice Exports to download](#)

**FLOODING: Damage to paddy may hit 7m tonnes, But officials claim exports won't suffer by Post Reporters**

## Risk 2: Flooding of fields

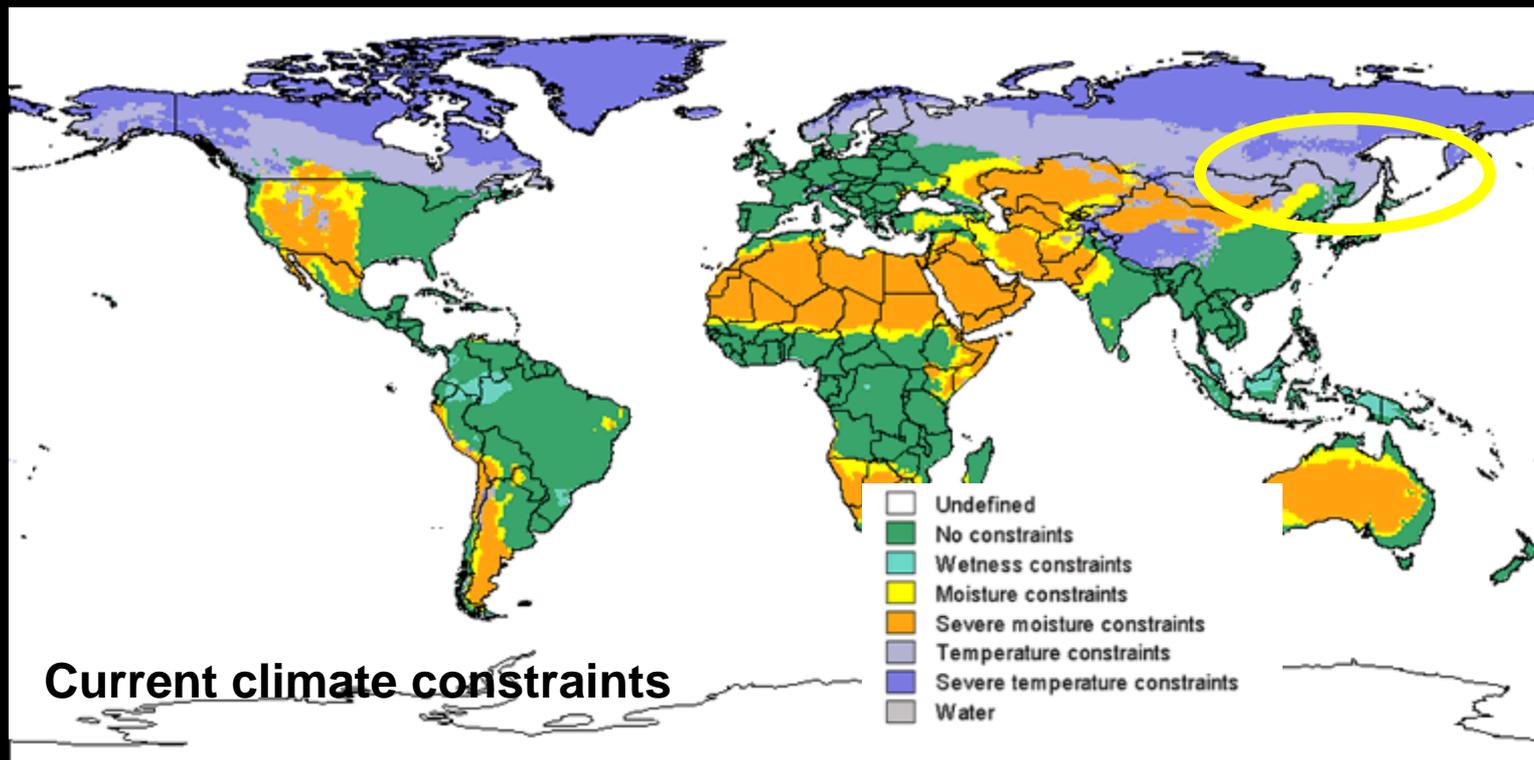
- Increased heavy rainfall can increase flooding risks, with large crop damages
- In rice, new varieties with Sub1 genes show much greater tolerance



**Figure 9** New Sub1 lines after 17 days submergence in field at IRRI.

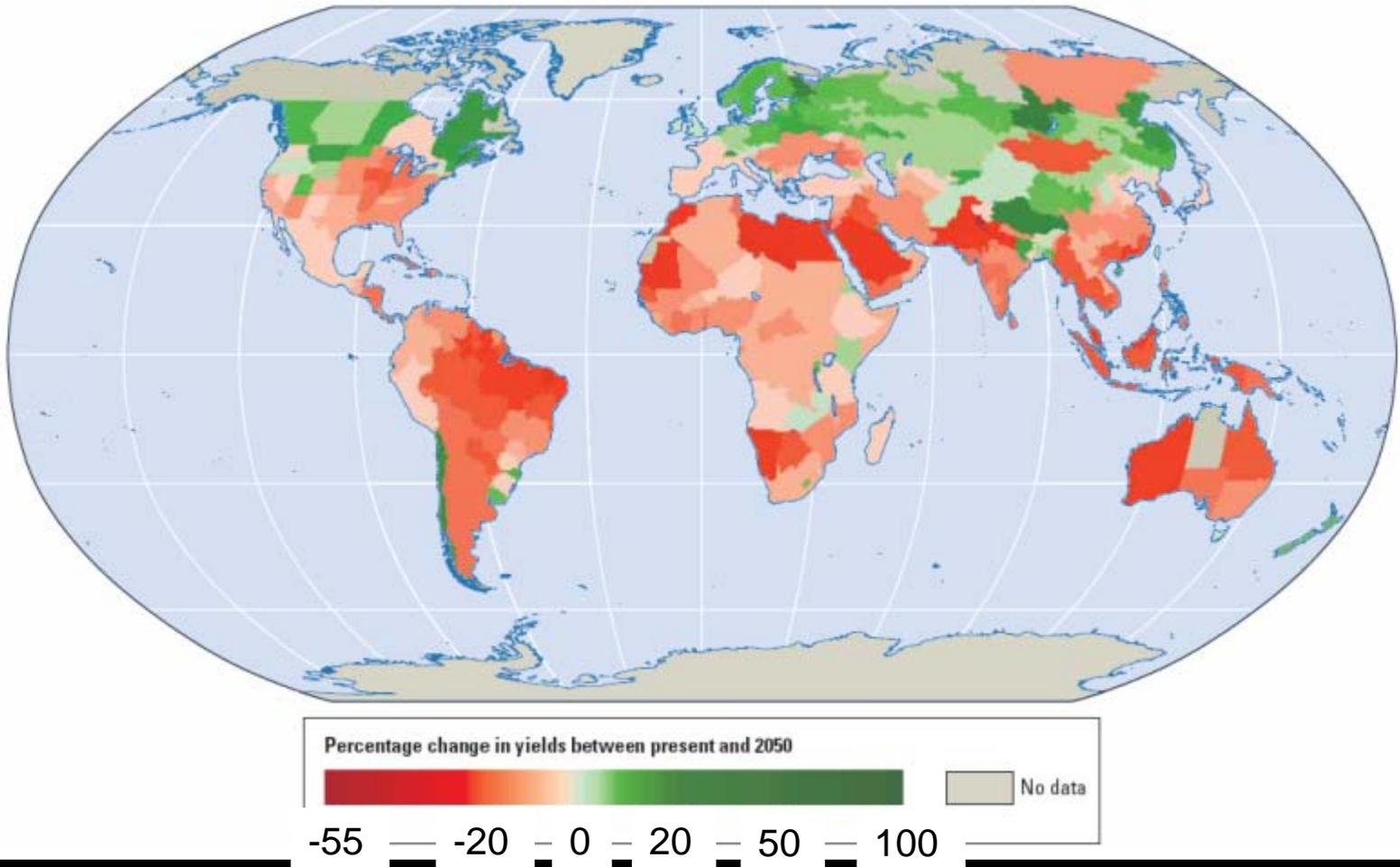
# Opportunity 1: High latitude agriculture

- Double cropping more feasible throughout North China Plain (e.g. wheat-maize, Wang et al. 2012)
- Northeast China becoming more suitable for maize growth



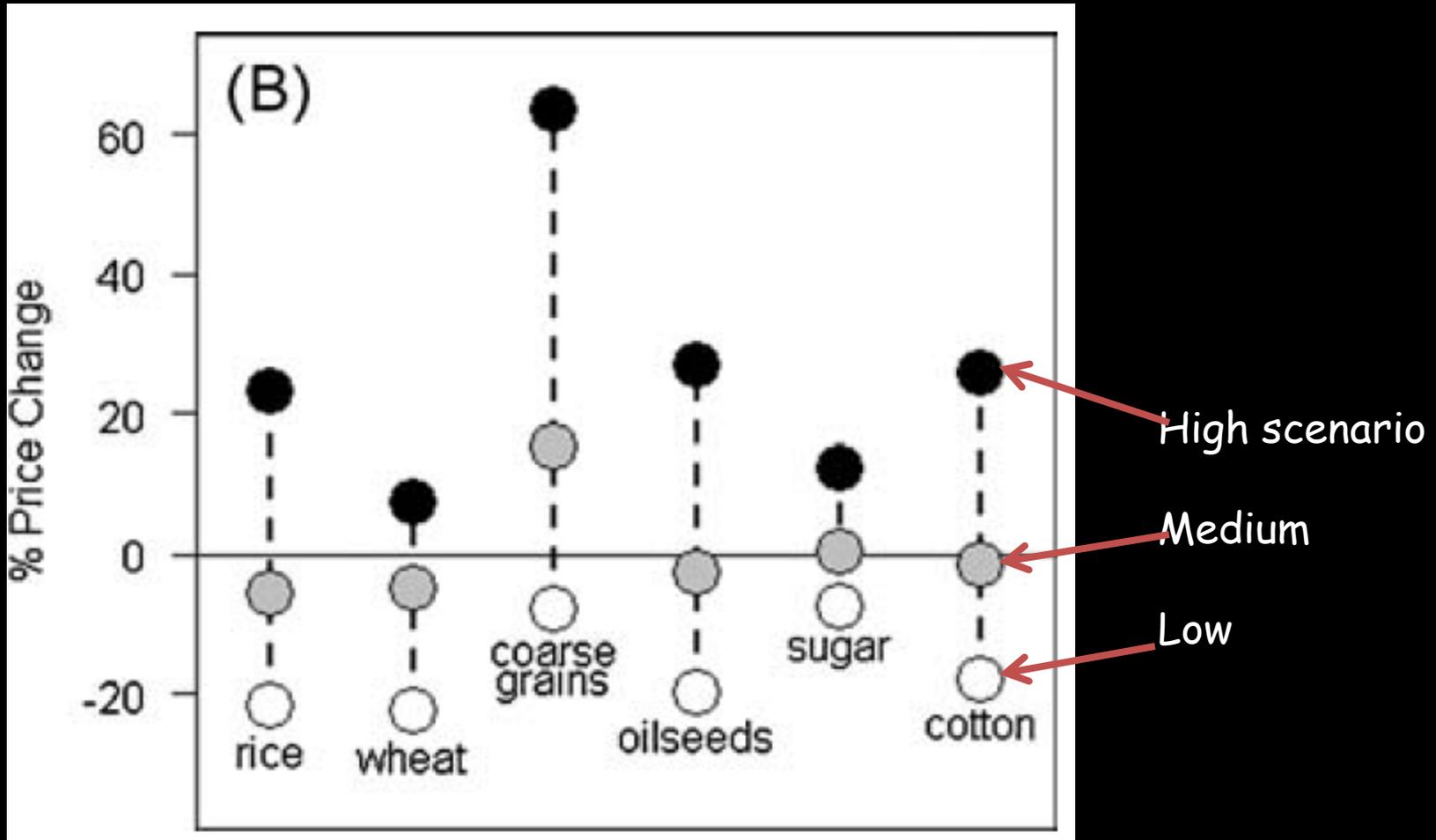
# Opportunity 2: Increase in export opportunities

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



# Opportunity 2: Increase in export opportunities

% Price Change for Major Commodities from Climate Change + CO<sub>2</sub> by 2030



# Suggestions for Discussion

- Start with the major types of investment decisions being considered (e.g., infrastructure, crop breeding, etc.)
- For each decision, ask whether climate trends are likely to be important relative to natural climate variability.

# Suggestions for Discussion

- Start with the major types of investment decisions being considered (e.g., infrastructure, crop breeding, etc.)
- For each decision, ask whether climate trends are likely to be important relative to natural climate variability. One simple framework I use is:

---

Likely importance of climate trends relative to variability  
Or

Likely need to focus on anticipatory actions

Characteristic of decision	LOW	HIGH
Type of cropping system	Rainfed	Irrigated
Time scale	10-20 years	50+ years
Spatial scale	Sub-national	Regional to Global

---

# Suggestions for Discussion

- Start with the major types of investment decisions being considered (e.g., infrastructure, crop breeding, etc.)
- For each decision, ask whether climate trends are likely to be important relative to natural climate variability.
- If not, then focus on improving capacity to deal with climate variability (more resilience, better warning systems).
- If yes, think about what additional efforts are needed that would not otherwise happen.
- THANKS for your attention!