Warming and Crop Production in the US and Beyond

David B. Lobell
Food Security and Environment Program, Stanford University
dlobell@stanford.edu
1) Warming for the next 30-40 years will be independent of emissions
2) Temperatures and CO$_2$ levels are unprecedented in the history of agriculture.
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3) Rainfall changes are less certain, but a pattern of sub-tropical drying seems likely.

Average climate model projections of soil moisture change by 2080

(IPCC, 2007)
4) Most crops in most regions prefer cooler temperatures. In many areas, climate effects will outweigh the positive effects of CO$_2$ even in the short-term.

![Average Global Yields vs. temperatures, 1961-2002](image)

Lobell and Field, *ERL*, 2007
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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.

Lobell et al. 2008, *Science*
Warming effects on U.S. corn yields (%) assuming current varieties

Area-weighted Average Loss ≈ 30%

slide from Wolfram Schlenker, Columbia Univ.
5) A lot can be done to adapt to higher temperatures and potentially to higher \( CO_2 \), but current investment is relatively low.

- Shift to longer maturing varieties
- Planting date shifts
- New crop varieties
- Better and expanded irrigation
- Rainwater harvesting and conservation tillage
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Climate change and the poor

Adapt or die
Sep 11th 2008
From The Economist print edition

Environmentalists have long said the world should concentrate on preventing climate change, not adapting to it. That is changing.

To begin with, the money involved is just a puff of smoke. Back-of-the-envelope calculations suggest the cost of coping with climate change is in the tens of billions a year for poor countries (see table). The total pledged to date (cumulatively, not per year) is $300m, of which just 10% has actually been spent. China says rich countries should allocate 0.5% of their national incomes in official aid to help developing countries adapt. But most rich countries are failing to fulfil earlier promises to increase aid for other reasons, so that looks like a non-starter.

"I USED to think adaptation subtracted from our efforts on prevention. I won't say it's changed my mind, but I've become more open to the idea."
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**Figure 1—Flows of resources, benefits, and costs**

For more information:
http://fse.stanford.edu
dlobell@stanford.edu