



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Supporting Profitability with Climate-Smart Agriculture

Gerald C. Nelson

Professor Emeritus,
University of Illinois, Urbana-Champaign

USDA's 2015 Agricultural Outlook Forum
"Smart Agriculture in the 21st Century"
February 20, 2015

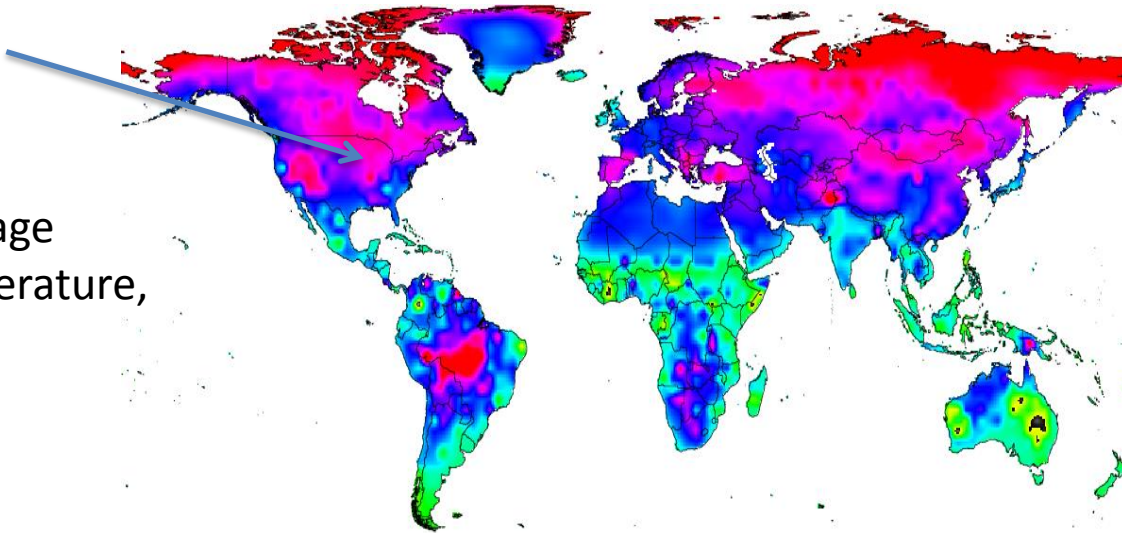
Climate change affects profitability

- Reduced and more variable yields from weather changes
- More pests and diseases
- More costs from adaptation expenses
- Higher prices for products
- GHG mitigation payments/charges

CLIMATE CHANGE AFFECTS YIELDS

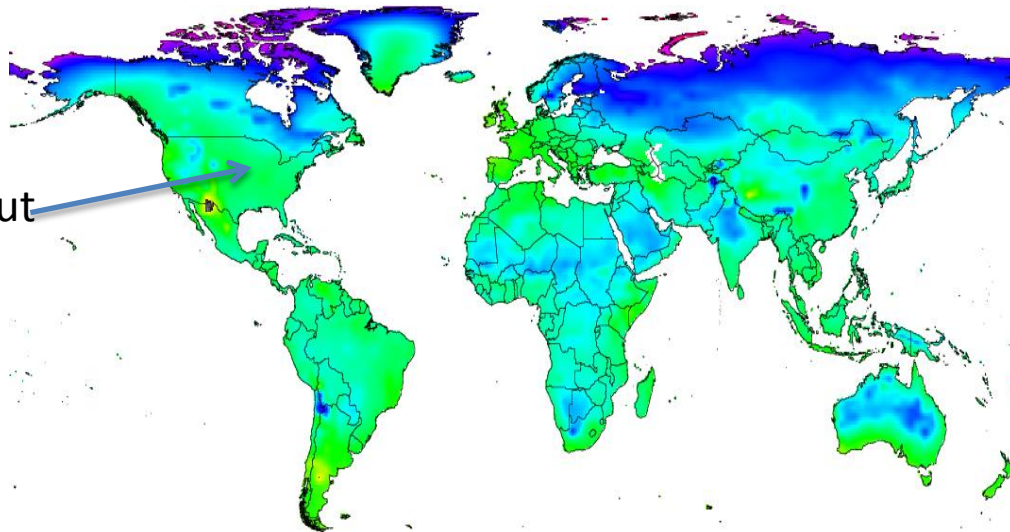
Temperatures increase with climate change

About
10°F



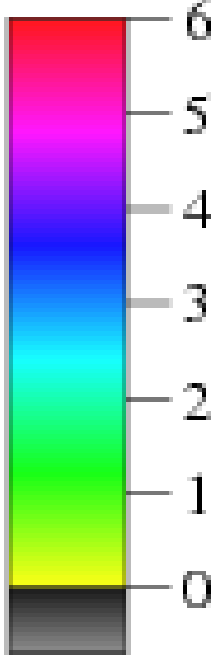
MIROC climate model, RCP 8.5

About
4°F



GFDL climate model, RCP 8.5

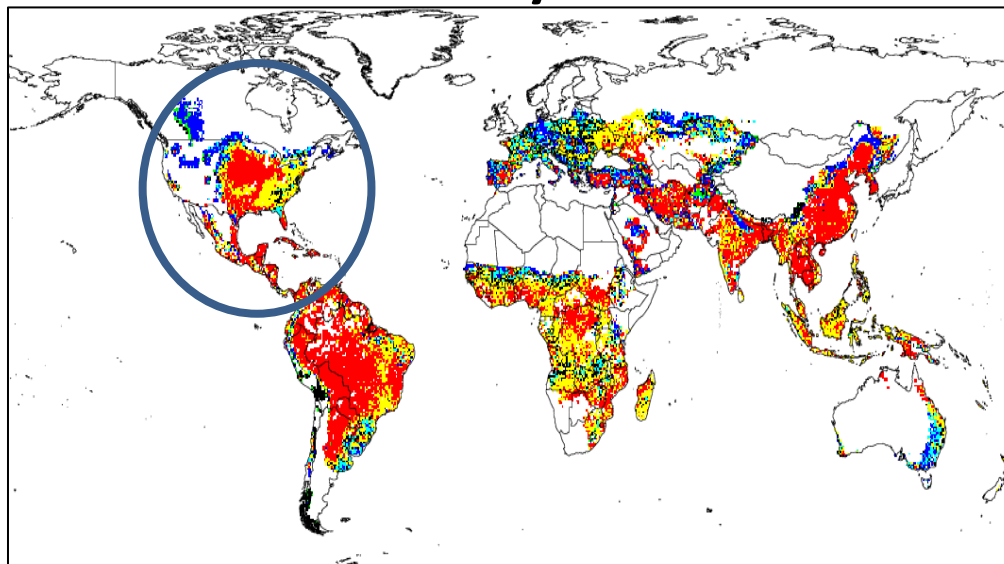
(Change in average
maximum temperature,
2000 – 2050 °C)



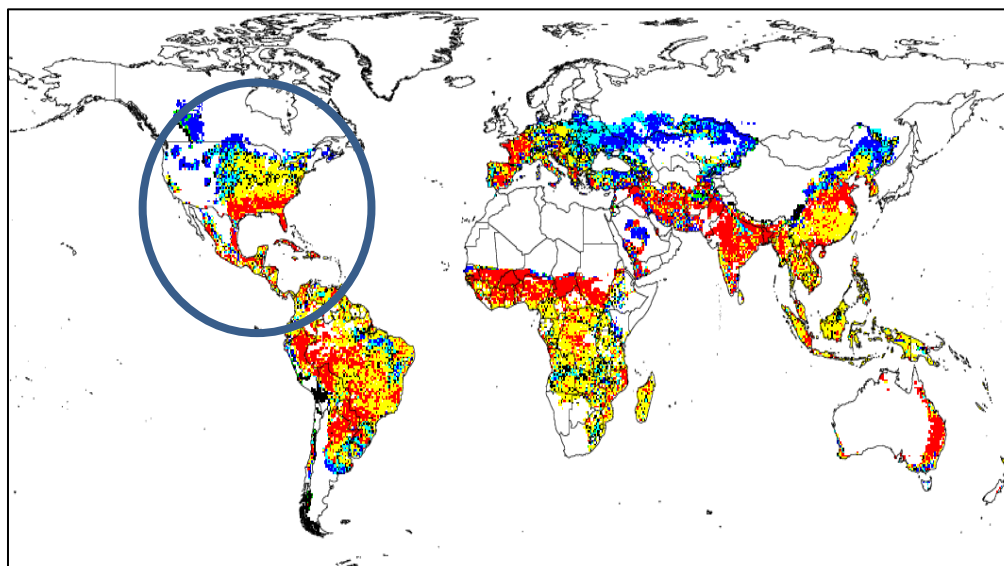
Rainfed corn yield change is mostly negative with today's varieties

Yield change, 2000
– 2050 weather

- old area lost
- loss > 25% of base
- loss 5–25%
- change within 5%
- gain 5–25%
- gain > 25%
- new area gained

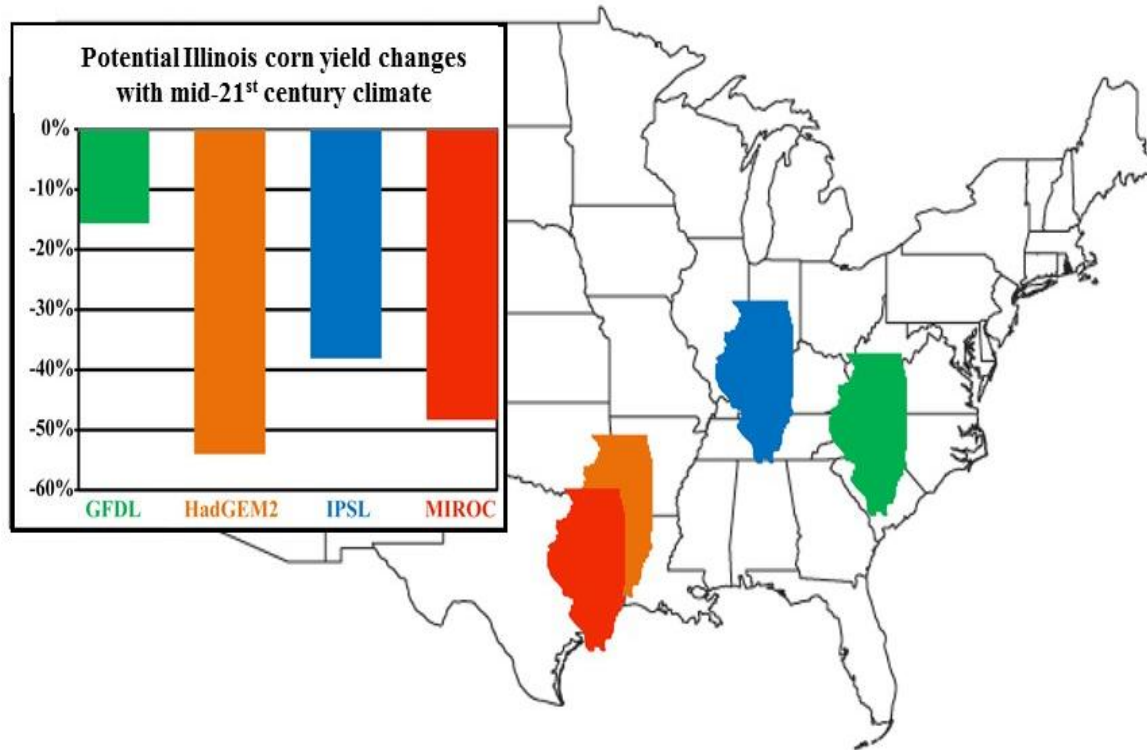


MIROC climate model, RCP 8.5



GFDL climate model, RCP 8.5

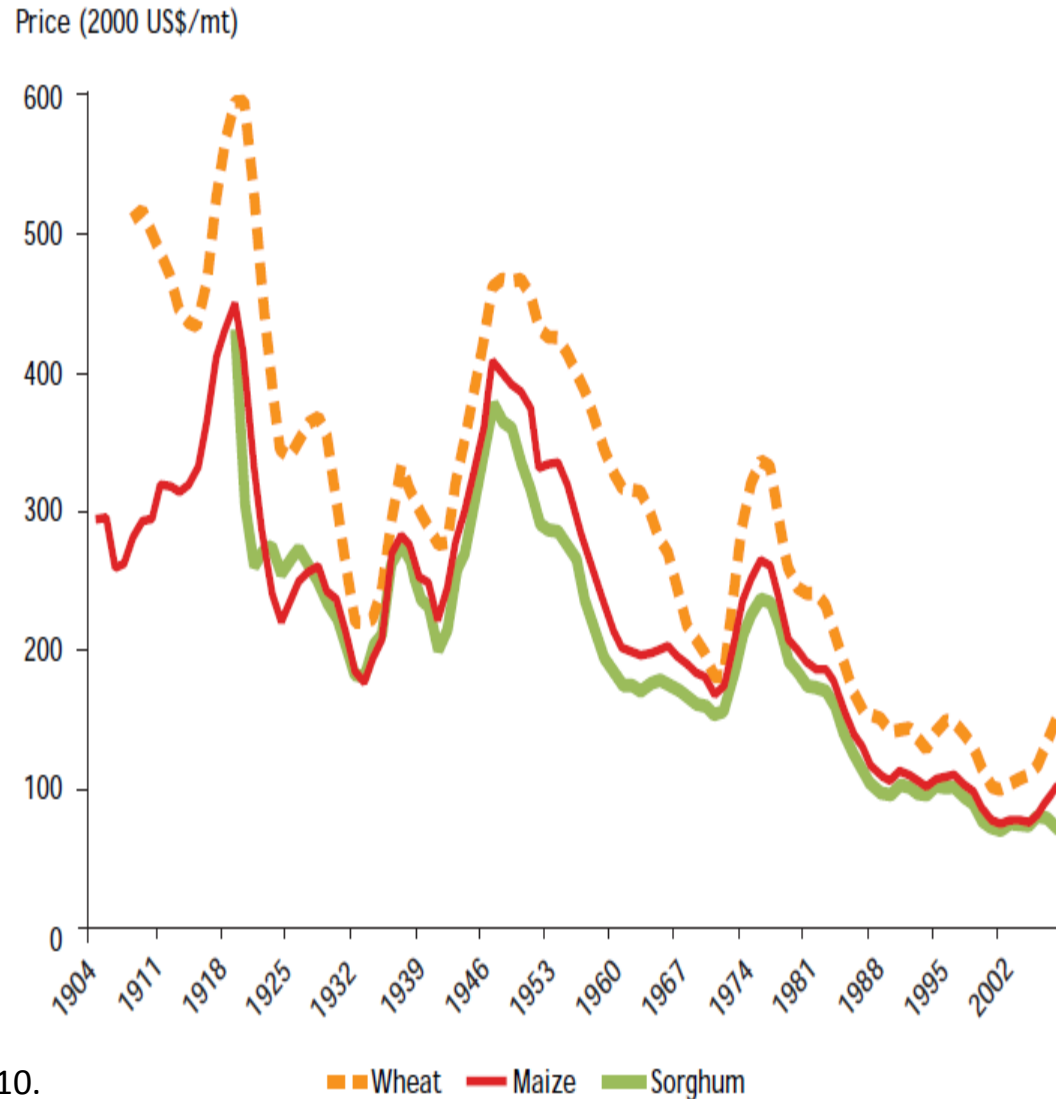
Another take on climate change uncertainties: Illinois will get hotter but could get wetter or drier



Source: Gustafson, et al., 2015, under review

**THE PRICE TRENDS OF THE 20TH
CENTURY ARE LIKELY TO REVERSE WITH
CLIMATE CHANGE**

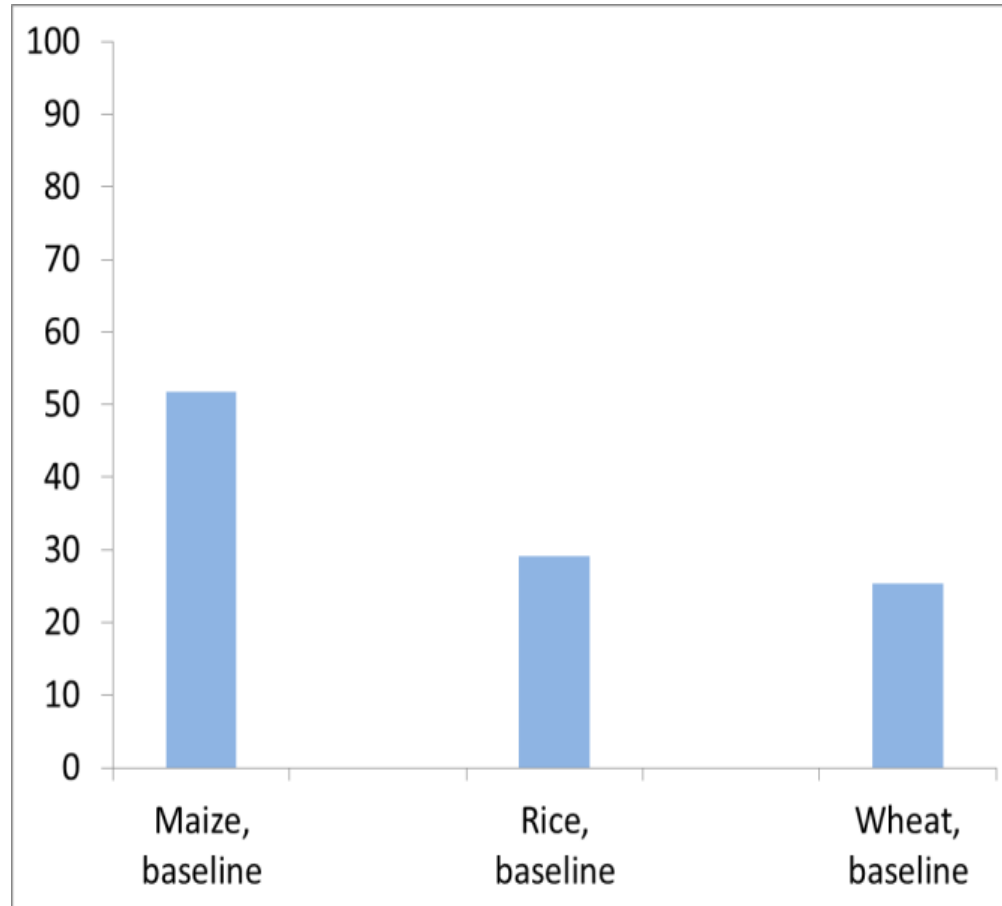
Crop prices declined throughout the 20th century



Source: Nelson et al, 2010.

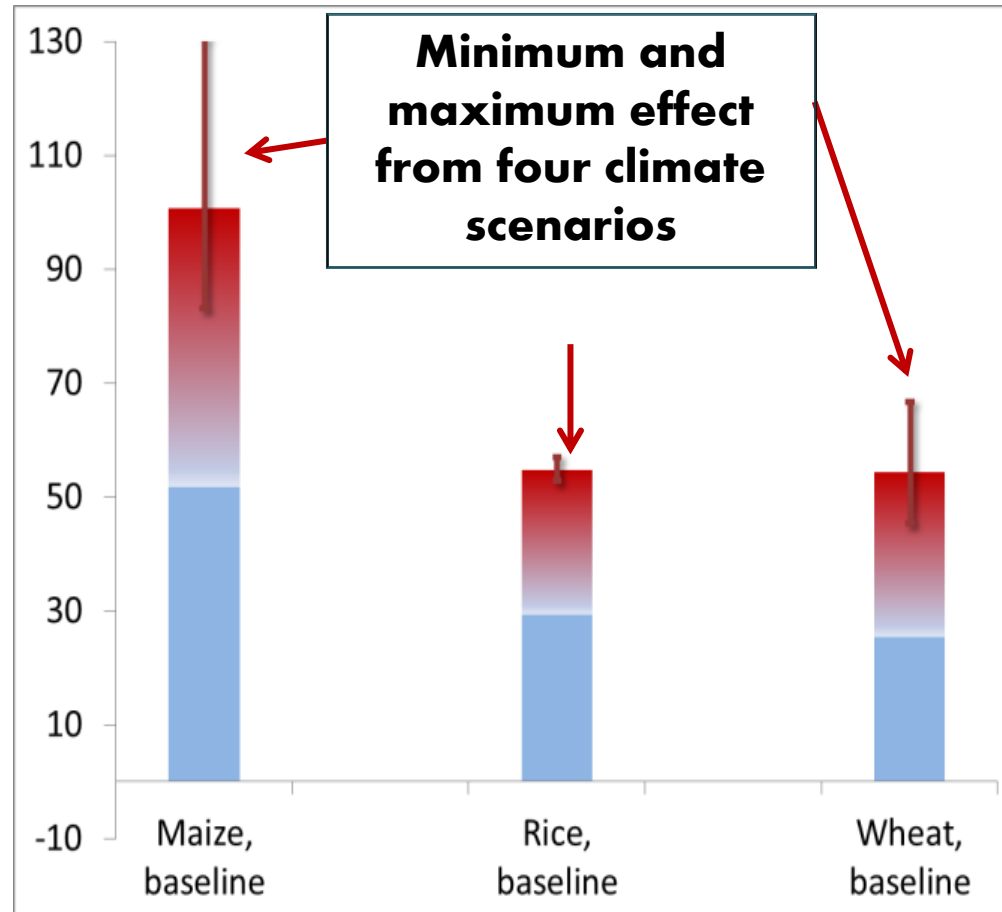
Income and population growth will likely push prices up in the 21st century

(price increase (%), 2010 – 2050, Baseline economy and demography)



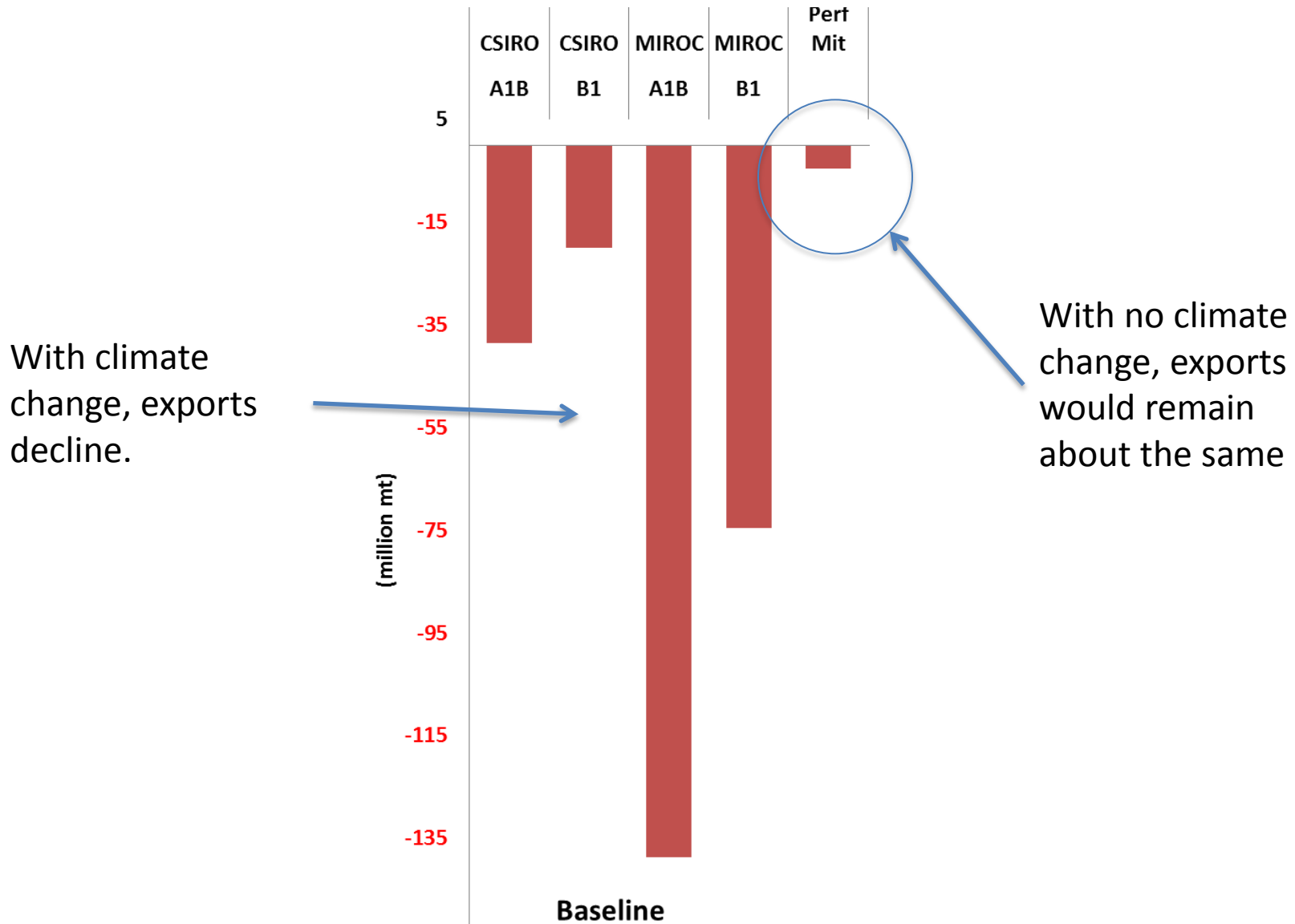
Climate change will push them up more

(price increase (%), 2010 – 2050, Baseline economy and demography)



CLIMATE CHANGE ALTERS GLOBAL CEREAL TRADE

Change in Net Exports of Cereals from Developed Countries (2010-2050, million mt)



Responding to Climate Change for Profit Today and Tomorrow

- Short run – plan for today’s weather
- Medium run
 - Get best science about range of potential changes in weather *in your area* (means and variability)
 - Explore options for low hanging fruit (change in variety, crop mix, easy management practices)
- Long run
 - Plan capital investments that are robust to a range of potential weather changes
 - Consider activity changes that are weather-robust

Examples

- Iowa
 - Climate change has already meant more early season heavy rains
 - Responses – more tile drainage; improved seed treatments; more capacity for rapid planting
- Illinois
 - Climate change has meant longer growing season
 - Response – more double cropping
 - “in double cropping areas, growers have the season to produce a crop that can nearly rival full-season beans if the weather cooperates, so it pays to invest in the right agronomy” (Dr. Daniel Davidson, <http://ilsoyadvisor.com>)

What about the West?

- Prepare for more water scarcity
 - Give water rights holders economic incentives to conserve
 - Recognize that water can flow uphill if attracted by enough money
 - Find profitable low-water products and management techniques
- Prepare for higher temperatures
- Prepare for more weather extremes

POLICY ACTIONS TO IMPROVE PROFIT

Selected Policy Recommendations from the 2014 Chicago Council Report*

1. Bolster location-specific research on climate change impacts and solutions, increase funding for data collection, and partner widely
2. Include climate change adaptation in trade negotiations

* Advancing Global Food Security in the Face of a Changing Climate,
Available at <http://bit.ly/1j6YFhK>

**1. BOLSTER RESEARCH ON CLIMATE
CHANGE IMPACTS AND SOLUTIONS,
INCREASE FUNDING FOR DATA
COLLECTION, AND PARTNER WIDELY**

Recommendations

- Fund more and varied biological research on adaptation and mitigation
 - But don't lose track of need for greater productivity
- Develop more sophisticated models and collect better data
- Upgrade and strengthen university and private-sector partnerships
- Recognize/take advantage of the global nature of the problem

Progress

- USDA Foundation for Food and Agricultural Research
 - Public-private partnership for agricultural research
 - \$200 million from federal sources to be matched by \$200 million from non federal sources
- USDA Regional Climate Hubs
 - Bringing information to the decision-making scale
- USAID Innovation Labs
 - Applying US university intellectual prowess to food security challenges
- Growing number of university-based food security initiatives
- International
 - Global Research Alliance on Agricultural Greenhouse Gasses
 - Climate Smart Alliance

Examples of specific research topics

- Tolerance to higher temperature and ozone
- Resilience to increased variability
- More varied farming practices that leverage system dynamics
- Management strategies for combating pests and diseases
- Increased productivity and food use of orphan crops

Examples of blue sky research opportunities

- Transfer nature's improved photosynthesis to more plants (C3 to C4)
- Convert annual crops to perennial
- Adapt more crops to exploit the nitrogen-fixing advantages of legumes
- Incorporate the biology of salt tolerance in more crops

Some specific data needs

- Weather
- Water availability, quality, and future water requirements
- Land cover and land use
- Biological performance of crops and livestock in varying environments

Improved modeling for priority setting and evaluation:

What is the ROI in research?

- Not possible to fund all opportunities
- Research benefits pay off in the future
- Models allow assessment of potential benefits versus costs
- Improved modeling now can make future investments more productive

**2. LEAD EFFORTS TO PLACE CLIMATE
CHANGE AND FOOD AND NUTRITION
SECURITY AT THE CENTER OF
INTERNATIONAL TRADE AGREEMENTS**

Recommendations

- Include controls on export restrictions in international negotiations
 - Trans Pacific Partnership (TPP)
 - Transatlantic Trade and Investment Partnership (TTIP)
 - African Growth and Opportunity Act (AGOA)
- Incorporate climate change adaptation and resilience in the WTO work program on food security

Progress

- Crystal ball is fuzzy, but
 - TPP closer than TTIP
 - Congress and administration in discussions about fast track authority
 - AGOA up for reauthorization this summer
- Export ban regulation?

For additional information

- Nelson, G. C. (2014). *Advancing Global Food Security in the Face of a Changing Climate*. Chicago: Chicago Council on Global Affairs - <http://bit.ly/1j6YFhK>
- Nelson, G. C., van der Mensbrugghe, D., Ahammad, H., Blanc, E., Calvin, K., Hasegawa, T., ... Willenbockel, D. (2014). Agriculture and Climate Change in Global Scenarios: Why Don't the Models Agree. *Agricultural Economics*, 45(1), 85–101. doi:10.1111/agec.12091
- Nelson, G. C., Valin, H., Sands, R. D., Havlík, P., Ahammad, H., Deryng, D., ... Willenbockel, D. (2014). Climate change effects on agriculture: economic responses to biophysical shocks. *Proceedings of the National Academy of Sciences of the United States of America*, 111(9), 3274–9. doi:10.1073/pnas.1222465110
- Nelson, G. C., Rosegrant, M. W., Palazzo, A., Gray, I., Ingersoll, C., Robertson, R., ... You, L. (2010). *Food Security, Farming, and Climate Change to 2050: Scenarios, Results, Policy Options*. Washington, D.C.: International Food Policy Research Institute. doi:10.2499/9780896291867
- Nelson, G. C., & Van der Mensbrugghe, D. (2014). Public-sector Agricultural Research Priorities for Sustainable Food Security. IFPRI and FAO, Washington, D.C. and Rome.