



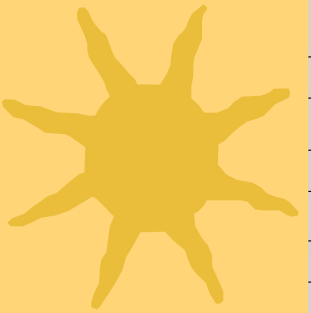
Climate Change, agriculture Water and Infrastructure



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Climate Change Symposium



Population-Environment- Health Outcomes

Program

Faculty Club-Seaborg Room

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Direct impacts on agriculture and water



Movement of warmer climate from the tropics to the Poles

Mexican climate will migrate to California.

The Sahel will expand

California climate will migrate to Oregon.

Most of Texas and Oklahoma will become a desert, and some areas in Russia will increase in productivity.



Increased snow melt flooding and changes of volume and timing of irrigation water



Climate change will enhance instability



- ★ Rising water levels
- ★ More extreme weather events
- ★ Damage to ecosystems
- ★ Increase vulnerability
- ★ Lead to political instability





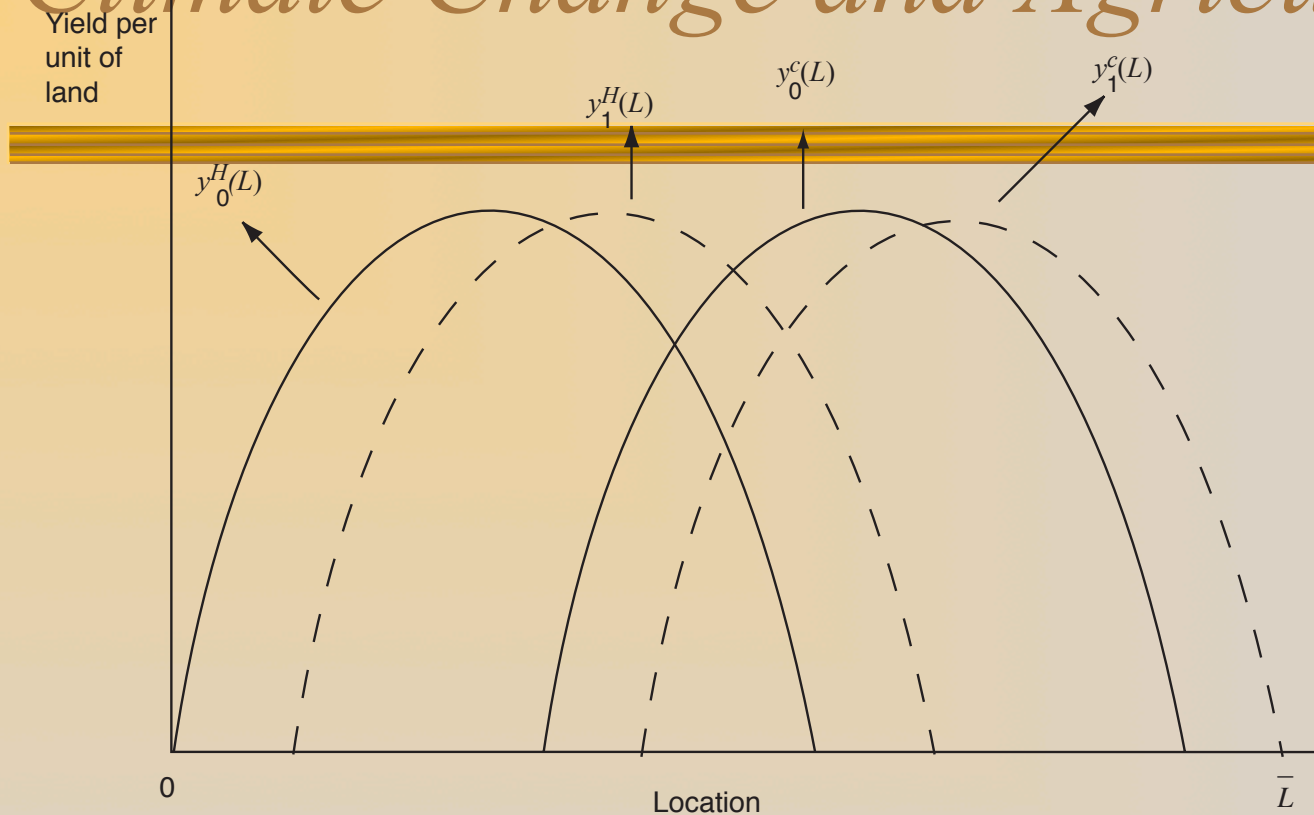
Response's to climate change



- ★ Adaptation-farmers will change inputs use and switch crops
- ★ Redesign and reconstruction of water systems
- ★ Some areas near the tropics will be deserted; some areas close to the Poles will be farmed.
- ★ The net aggregate effect effect may not be significant, but the regional effects may be substantial.



Climate Change and Agriculture



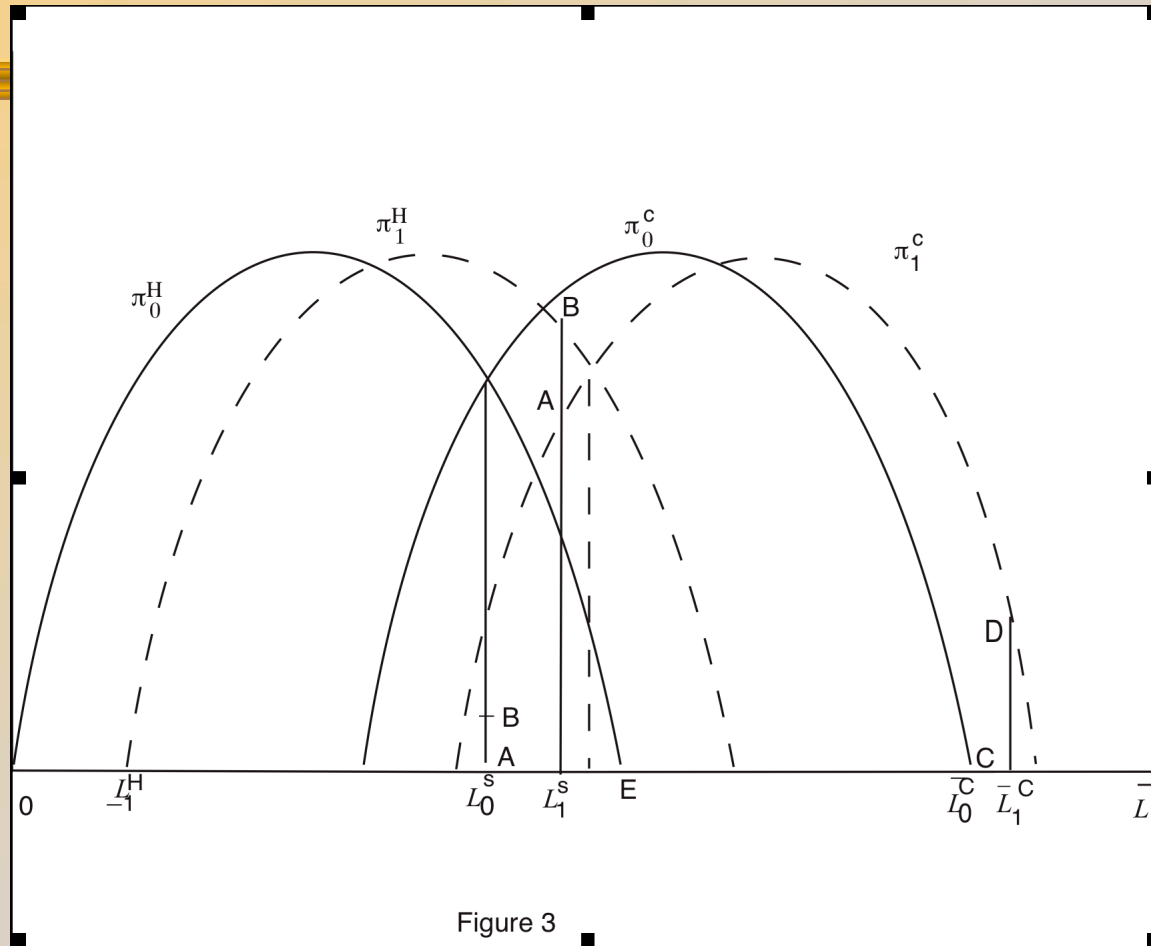
Hot crop near equator, cold one near poles.

Figure 1. Impact of Climatic Change on Yields (Ignoring Pest and Fertilization Effects)

With CC movement to the pole, settlement close to poles transition from cold to hot, desertification



Adjustment costs will hamper adaptation





Impact on biodiversity

- ★ Pest move faster than trees
- ★ Destruction is faster than natural adjustments
- ★ Adjusting farming system is time consuming & uncertain- it took 20-50 years
- ★ Natural tendency is to have quick solution resulting in few dominant varieties
- ★ But even this adjustment is likely to be slowed



Major forms of adaptation



★ Migration


★ Innovation



★ Adoption of new technologies/crops

★ Trade –

★ Inventories and stabilization



★ All require strong research planning and management capacity

★ Ability to dare and change



Importance of quantification

- ★ The assessment of impacts and design of adjustment policies that vary over space of time depends on understanding of
 - Impact of climate change on temperature rainfall –
 - Impact of these changes on yield distribution
 - How human choices can affect impacts
 - What are the behavioral patterns that are affect human choices
- ★ There are new opportunities to conduct multidisciplinary research

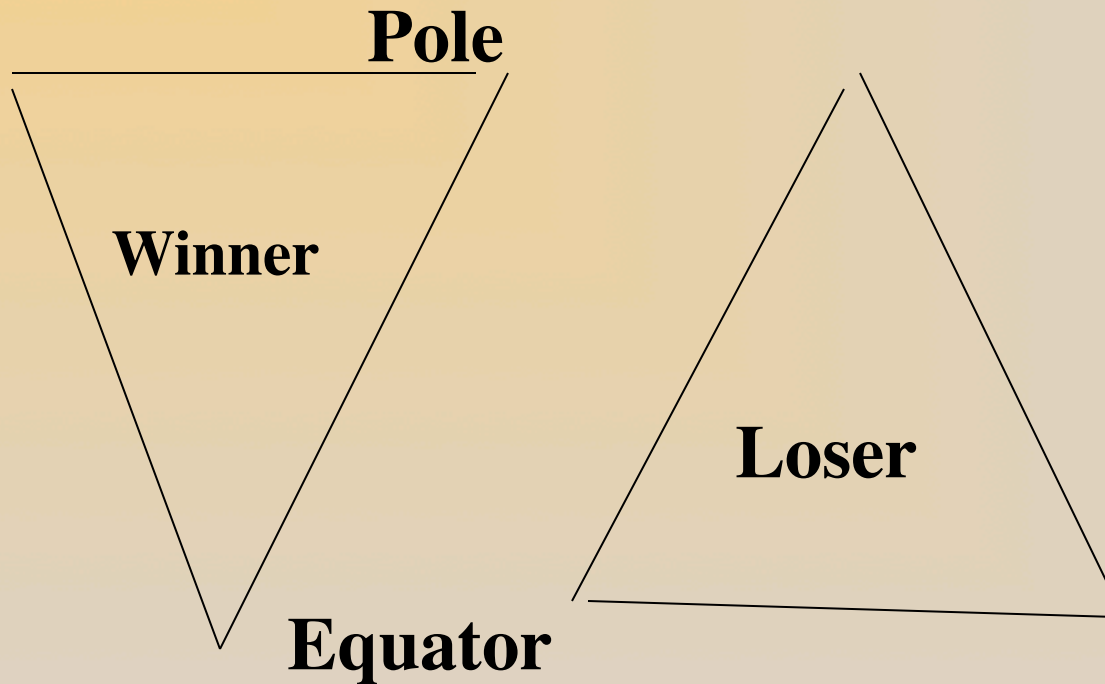
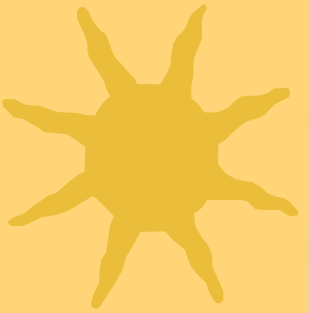


Transaction cost and uncertainty

- ★ Uncertainty about timing of change is a major problem-
uncertainty deters action.
- ★ Adjustment costs increase as the change **accelerates.**
- ★ Flood control, rising water levels and relocation require
Slow and costly adjustments
- ★ Immigration policies and land use regulations slow responses
- ★ **CC increases vulnerability to crisis - draught disease etc**
Quality of response is measured by ability to deal with extreme situation



Shape and location matter



- ★ Poorer countries with lower adjustment capacity and changing climate patterns will suffer most
- ★ Trade and aid will reduce effect of change



New environmental thinking

- ★ Traditional instinct is to preserve, protect, conserve
- ★ Ideal return to sustainability- some sort of steady state
- ★ That justifies policies to slow CC-carbon tax etc which I support
- ★ But the changes require adaptation
 - Zoning laws that ban or restrict farming needs to be modified to allow flexibility
 - Design of new infrastructure for protection and reallocation
 - Development of new crop varieties capable of adaptation to drought and higher temperatures



Tools that need to be emphasized

-
- ★ Biotechnology/GMO: crop adaptability
 - ★ Dams: flood protection, energy, storage
 - ★ Benefit cost analysis
 - Monetizing environmental amenities and resource depletion (user costs)
 - ★ Trading in water and other resources
 - Payment for ecosystem services-
 - ★ Emergency relief systems
 - ★ Insurance-avoid moral hazard



The importance of innovation and transfer

- ★. If population grows slower(faster) than food productivity, CC impacts are less (more) severe
- ★ International arrangements to handle emergencies and relocations will improve response to climate change.
 - Relocation of water and people
- ★ introduction of rapid assessment and response institutions that will - design strategies
 - develop and transfer technologies
 - help developing countries with implementation



Principles of Climate Change Policies

Incentives to develop capacity to deal with CC

- Pick up low lying fruits
 - Conservation
 - Improve precision
 - Emphasis on cost effective policies to delay CC
- Consider incentives and their impacts
 - Carbon pricing –may occur sometime- what's its impact?
- Emphasis on adaptive management-learn as you go
 - no regret policies.
 - Harmonized policies
- Emphasis increased R&D to develop resource-conserving technologies and monitoring technologies
- Weight expected benefits and cost





Mitigation provides new opportunities

- ★ Need to combine adaptation with mitigation
- ★ Biofuels- can be a new sector that will provide jobs – income and reduce GG emissions
 - Needs to be resource and GHG saving
- ★ Soil and tree carbon sequestration can be source of income- once an agreement is established



Need Research for

- ★ Design rapid response to floods, droughts
- ★ Design of water allocation and relocation policies and institutions
 - Under instability and variability
- ★ Design of flexible infrastructure to accommodate change
 - Under uncertainty about the its evolution



Research strategies

★ Learn from the past

- Responses to Hurricanes and disaster
- Effectiveness of project design strategies
- Factor affecting adaptation and adjustment to change

★ Experiment

- Try alternative technologies or water allocation strategies, at different location

★ Simulate

- Compare performance of alternative project design





conclusion



- ★ Climate change increase value of good management and flexibility
- ★ Will benefit from investment in research and international collaboration
- ★ Needs public buy in and willingness to sacrifice- requires education and building awareness



Methodological lessons

- ★ Identify the key questions and how economics can answer
- ★ Combine modeling data and econometrics
- ★ Operate at various levels micro/macro/global
- ★ There is a premium to multi-disciplinarity

