



Cornell University

The Food Security Challenge and Environmental Degradation

Christopher B. Barrett

Cornell University

May 19, 2016

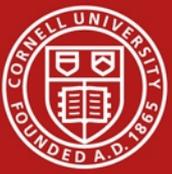
University of Chicago Symposium on
“Caring for our Common Home: Economics,
Environment and Catholic Social Thought”



Cornell University



Reducing poverty/hunger & conserving natural resources (biodiversity, forests, soils, marine resources, water, wildlife) and mitigating climate change are inter-linked moral/economic challenges of the highest order.



Cornell University

**These challenges are intrinsically linked:
Most (esp. extreme/chronic) poverty/hunger
occurs in rural areas, with bidirectional
causality, and mutual causation by broader
political economy forces.**



**Yet most policy/research focuses on just one
or the other of these at a time.**



Cornell University

Ex: food security challenge over next generation





Aggr. Food Demand Growth Is Largely Unavoidable

A more populous, urban, and wealthier world is inevitable and will demand 70-100% more food by 2050 than today.

Why?

- **Population growth** of ~2-3 bn people
- Population will **urbanize**, up from 50% to >70%
- **Income growth:** Marginal growth in food demand due to income growth in LDCs is 5-8x that in the US.

**Result: >90% of demand growth will be in Africa/Asia
And that is something to celebrate!**

Cannot reduce demand growth significantly

Reduced food waste reduction, over-consumption, food/feed/
biofuel competition, or dietary change away from ASFs

... Demand-side adjustment offers only modest gains

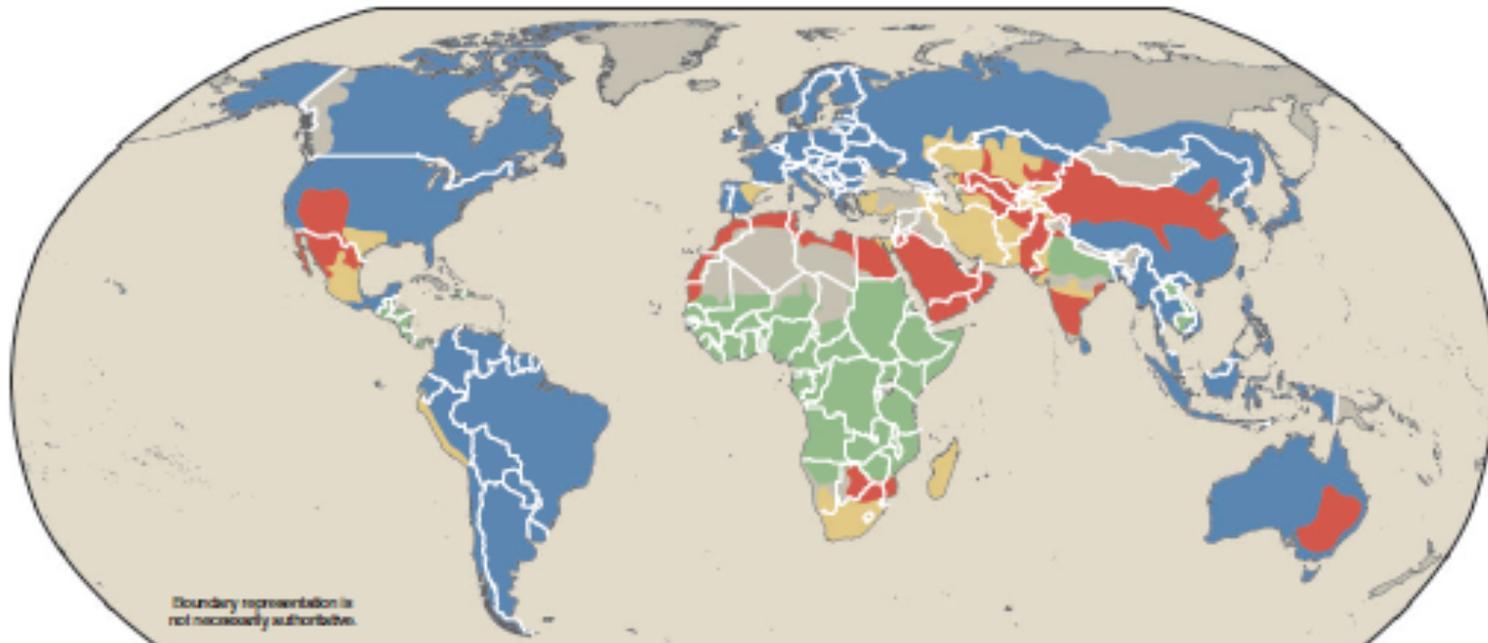


Must grow supply by 1 or more of 3 methods:

- 1) More inputs ... but extensification unlikely b/c**
 - Arable land essentially fixed without major (ecologically risky) conversion of forest, wetlands, or drylands
 - Limited capacity to expand ag frontier in Asia/MENA
 - Increasing competition for land from urban expansion and protected areas
 - Ag already accounts for ~70% of human water usage, > 80% in Africa and Asia
 - Climate change will aggravate water shortages in critical regions, esp. in tropics with fastest demand growth
 - Marine capture fisheries stable or declining



Projected Global Water Scarcity, 2025



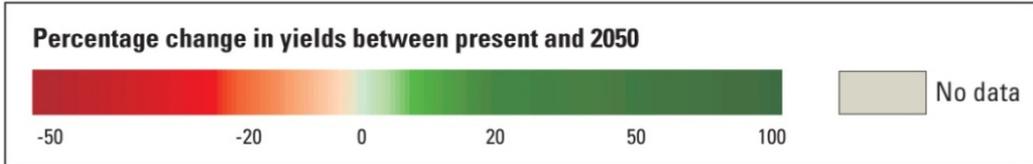
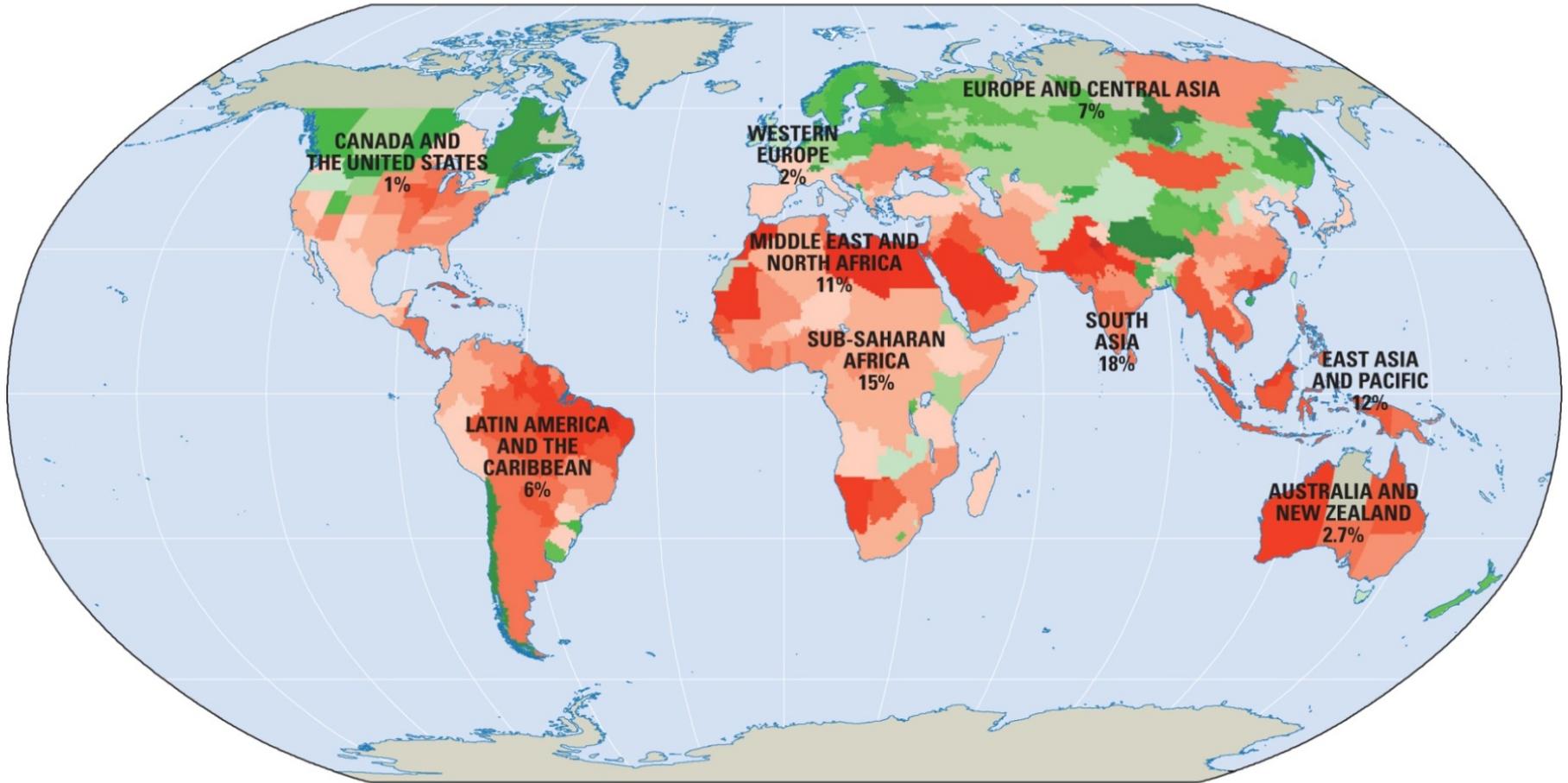
- Physical water scarcity:** More than 75% of river flows are allocated to agriculture, industries, or domestic purposes. This definition of scarcity — relating water availability to water demand — implies that dry areas are not necessarily water-scarce.
- Approaching physical water scarcity:** More than 60% of river flows are allocated. These basins will experience physical water scarcity in the near future.

- Economic water scarcity:** Water resources are abundant relative to water use, with less than 25% of water from rivers withdrawn for human purposes, but malnutrition exists.
- Little or no water scarcity:** Abundant water resources relative to use. Less than 25% of water from rivers is withdrawn for human purposes.
- Not estimated**

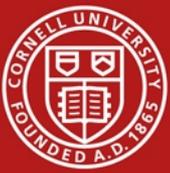
Source: *International Water Management Institute.*



Adverse expected yield change in 11 key crops due to climate change



Source: World Bank
WDR 2010



2) Improved efficiency given current inputs/tech.

But ...

- Smallholder 'inefficiency' mainly due to variable agro-environmental conditions and untargetable
- Inverse farm size-productivity relationship hard to exploit for yield gains b/c arises from market failures and behavioral mechanisms (e.g., edge effects)
- The true extent of waste in post-harvest food systems remains unclear, as does the question of whether it's cost-effective to reduce waste substantially



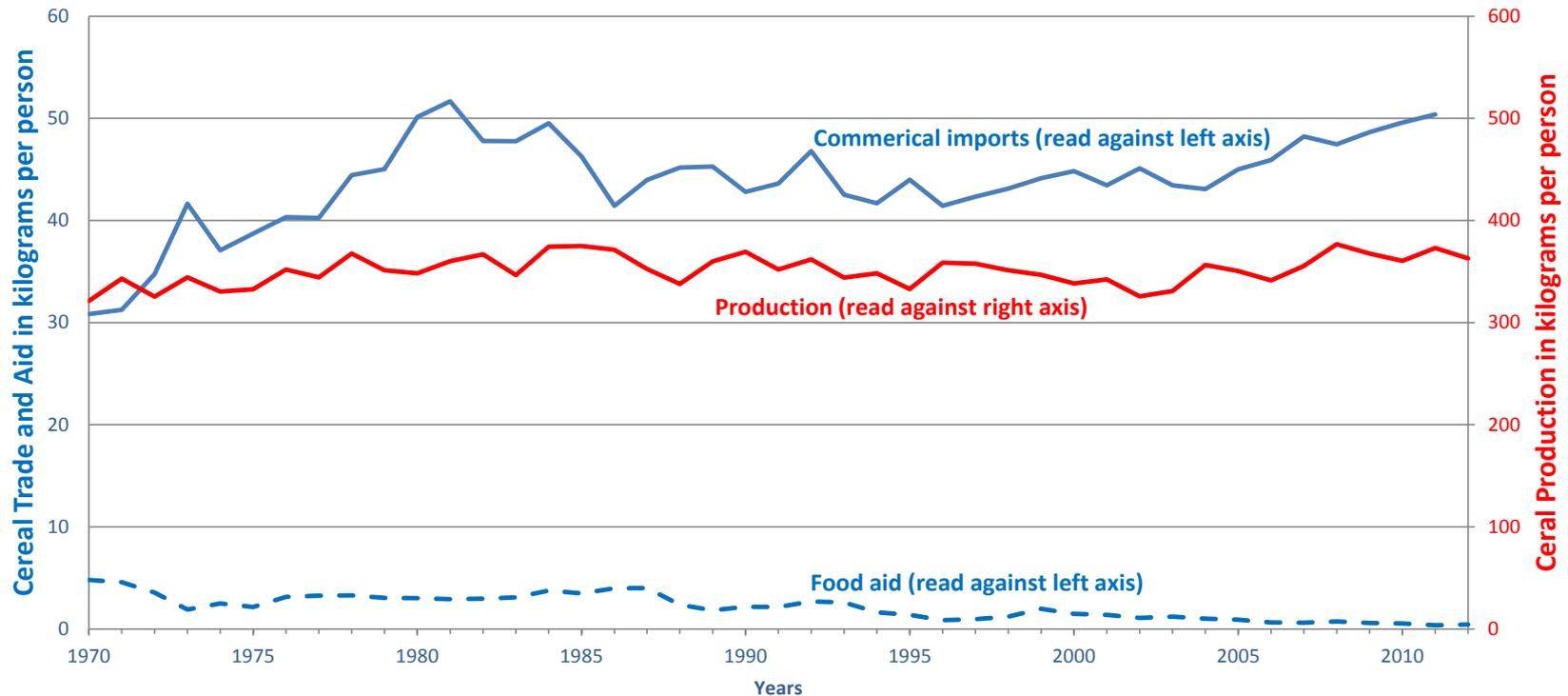
3) So must rely mainly on technological advances to resolve demand-supply growth imbalance. But ...

- Slowing growth in yields (esp. w/climate change)
- Challenge of widespread opposition to GMOs
- IP regimes and associated ‘gene grabs’ pose obstacles
- Site specificity due to agroecological heterogeneity
- Africa/Asia ag R&D capacity very limited
- Technological advance requires investment, and governments and philanthropies are essential but insufficient ... must rely heavily on the private sector.

The ‘technocratic paradigm’ is necessary ... but with a human face.



Global Annual Cereal Flows



Source: FAO, FAOStat database

Productivity growth must occur in Africa/Asia, where most demand growth will occur because **85-90% of food is consumed within the country where it is grown**, even with food trade growing faster than production.



But increasing food *availability* is only necessary, not sufficient, to improve food security.

- Improved *access is key* and depends mainly on poverty reduction and improved **social protection** measures to ensure that ample food gets distributed equitably.
- The biggest challenges surround *utilization* and especially **micronutrient deficiencies**, which are more widespread and respond more slowly to productivity/income growth than does macronutrient intake and associated undernutrition. Depends on maintaining healthy soils and reliable, clean water resources.
- So cannot focus just on cereals or even just staples ... must pay more attention to fruits and vegetables.

“Most of the people in the world are poor, so if we knew the economics of being poor we would know much of the economics that really matters. Most of the world's poor people earn their living from agriculture, so if we knew the economics of agriculture, we would know much of the economics of being poor.”

- Theodore W. Schultz (U. of Chicago)

Opening sentences of 1979 Nobel Prize in Economics lecture



Thank you for your time and interest!