

World Drivers of Agriculture, Food and Policy

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Outline

- Demand Drivers
- Globalization & Trade Drivers
- Production Drivers
- Policy Drivers
- Prospects

Global Demand Drivers

Megatrends in Demand

- The consumer is driving the entire food system, creating niche opportunities, but fads pass and niches fill fast.
- Increasing consolidation in processors and retailers
- High-income country markets of the past are shrinking.
- The future is in developing countries, where there are many more people to be fed and incomes are growing.

Projected Population Growth

Region	2010	2050	Change	Percent
World	6,892	9,485	+2,593	+ 38
High Income	1,237	1,326	+ 89	+ 7
Low Income	5,656	8,159	+2,503	+ 44
East & S.E. Asia	2,168	2,425	+ 257	+ 12
South Central Asia	1,755	2,620	+ 865	+ 49
Sub-Saharan Africa	865	1,831	+ 966	+117
Lat. America/Carib	585	729	+ 144	+ 25
N. Africa & W. Asia	444	708	+ 264	+ 59

Source: Population Reference Bureau. 2010 World Population Data Sheet.

Dynamics of Food Demand Growth

- 1.4 billion people live on less than \$1.25/day; 925 million of them suffer under-nutrition or hunger.
- 2.6 billion people live on less than \$2.00/day; by then, most hunger (calorie) problems solved.
- As their incomes rise from about \$2 to \$10 per day, people eat more meat, dairy products, fruits, vegetables & edible oils, causing rapid growth in raw ag commodity demand.
- After about \$10 per day, people buy more processing, services, packaging, variety, and luxury forms, but not more raw ag commodities.

*Poverty statistics (World Bank) as of 2005, before commodity price explosion.

Huge Growth in Food Consumption Expected from Economic Growth

Country	Population	%<\$1.25/day	%<\$2/day
China	1,326	15.9	36.3
India	1,140	41.6	75.6
Indonesia	228	21.4	53.8
Brazil	192	7.8	18.3
Pakistan	166	22.6	60.3
Bangladesh	160	49.6	81.3
Nigeria	151	64.4	83.9
Philippines	90	22.6	45.0

Source: World Bank. World Development Indicators 2008.
_Population in hundreds of millions.

Percent of Population Living in Urban Areas

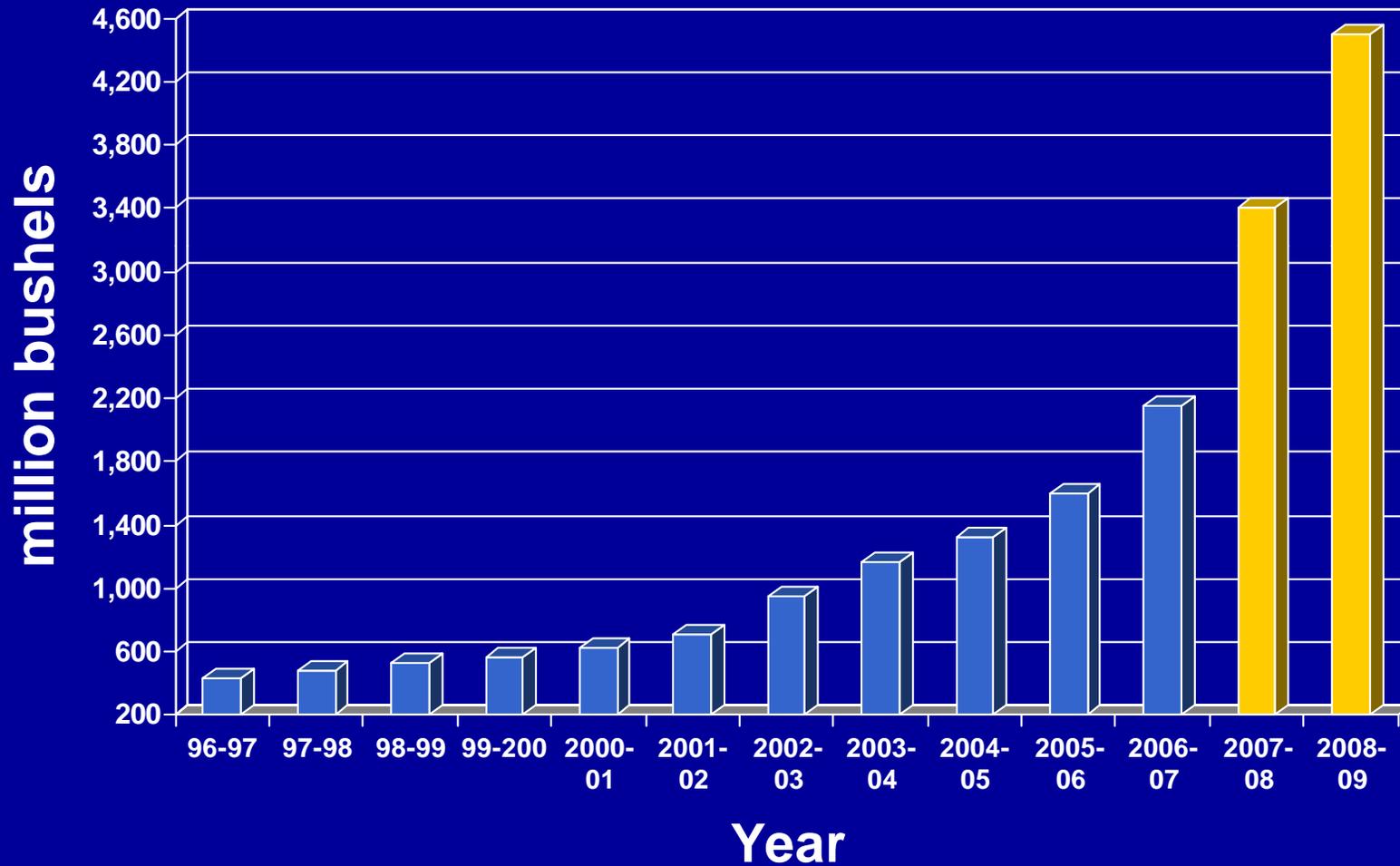
<u>Region</u>	<u>2007</u>	<u>2025</u>	<u>2050</u>
World	49	57	70
Africa	39	47	62
Asia	41	51	66
Europe	72	76	84
Lat Am/Carib	78	84	89
North America	81	86	90
Oceania	71	72	76

Source: U.N. Population Office. World Urbanization Prospects: 2007 Revision

Projected World Food Demand

- World food demand could double in first half of 21st century:
 - 50% increase from world population growth
 - from 6 to 9 billion – almost all in LDCs.
 - 50% increase from broad-based economic growth in low income countries
- The World Bank has estimated the number of people in developing countries in households with incomes >\$16,000/year will rise from 352 million in 2000 to 2.1 billion by 2030.
- **How many presently low income consumers escape from poverty is the *most important* determinant of future global demand for food.**

Corn Used for Ethanol



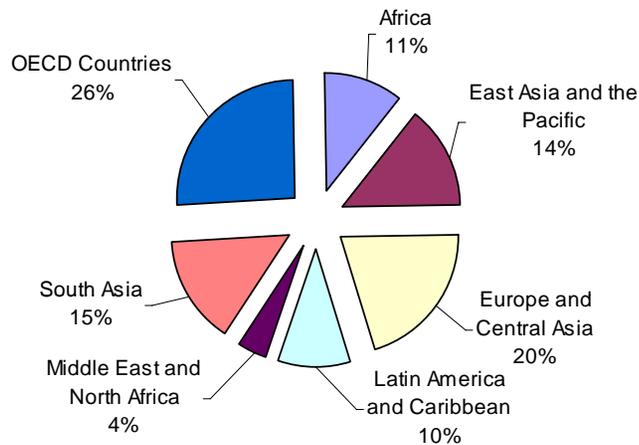
Source: Renewable Fuels Association.

Globalization of Agriculture

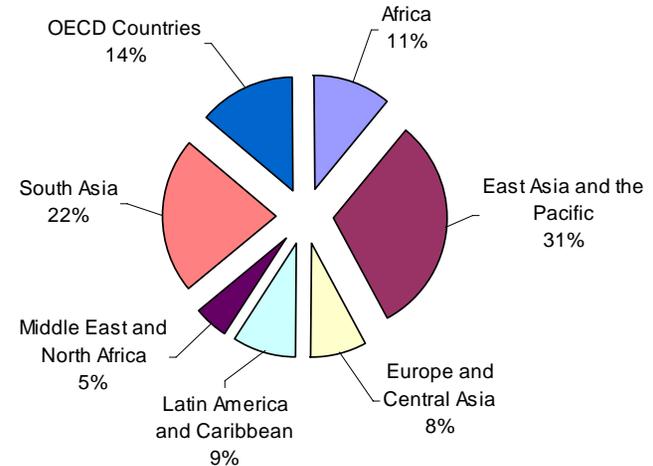
Globalization of Agriculture

- Fraction of world ag production that moves through trade is growing.
- Fraction that flows in value-added form is increasing faster than bulk commodities.
- Global supply chains mean that more trade is occurring within firms.

Larger Fraction of Ag Production to Move Through Trade



Distribution of Arable Land



Distribution of World Population

- With population growth, urbanization and broad-based economic development, many low-income countries' food consumption will outstrip their production capacity, and they will become larger net importers.

Global Supply Drivers

Agriculture Has Been Off the Global Development Agenda

- Low world commodity prices in 1980s, in part due to OECD ag production & export subsidies, incl. easy access to food aid.
- Crowded out by hot new donor issues, e.g. environment and HIV/AIDS.
- Lack of political clout of rural relative to urban areas in low income countries
- Ag development projects seen as riskier
- Transnational NGO activism against modern agriculture

Decline in ODA Investments in Agriculture Development

- Between 1980 to 2005, foreign aid to LDCs for ag development dropped from \$8 billion to \$3.4 bill./yr (from 17 to 3% of the whole)
- In the 1980s, 25% of US foreign aid went to agriculture; dropped to 6% by 1990 and 1% last year.
- Share of World Bank lending going to agriculture fell from 30% in 1978 to 16% in 1988 to 8% in 2006.

The Land Constraint

- There is at most 12% more arable land available that isn't presently forested or subject to erosion or desertification.
 - And degradation of many soils continues.
- The area of land in farm production could be doubled...
 - But only by massive destruction of forests and loss of wildlife habitat, biodiversity and carbon sequestration capacity
- The only environmentally sustainable alternative is to at least double productivity on the fertile, non-erodible soils already in crop production.

Croplands of the Earth

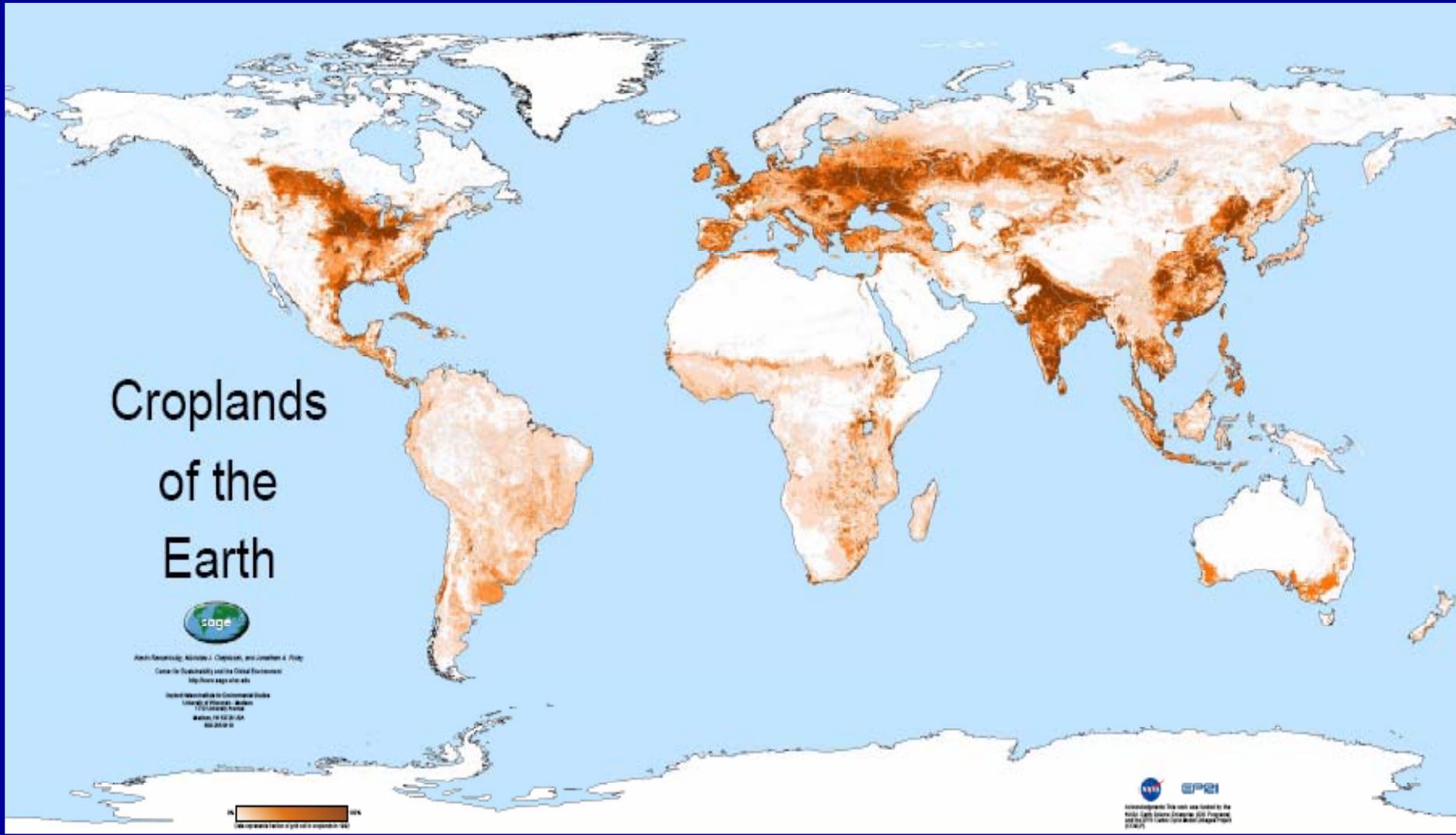


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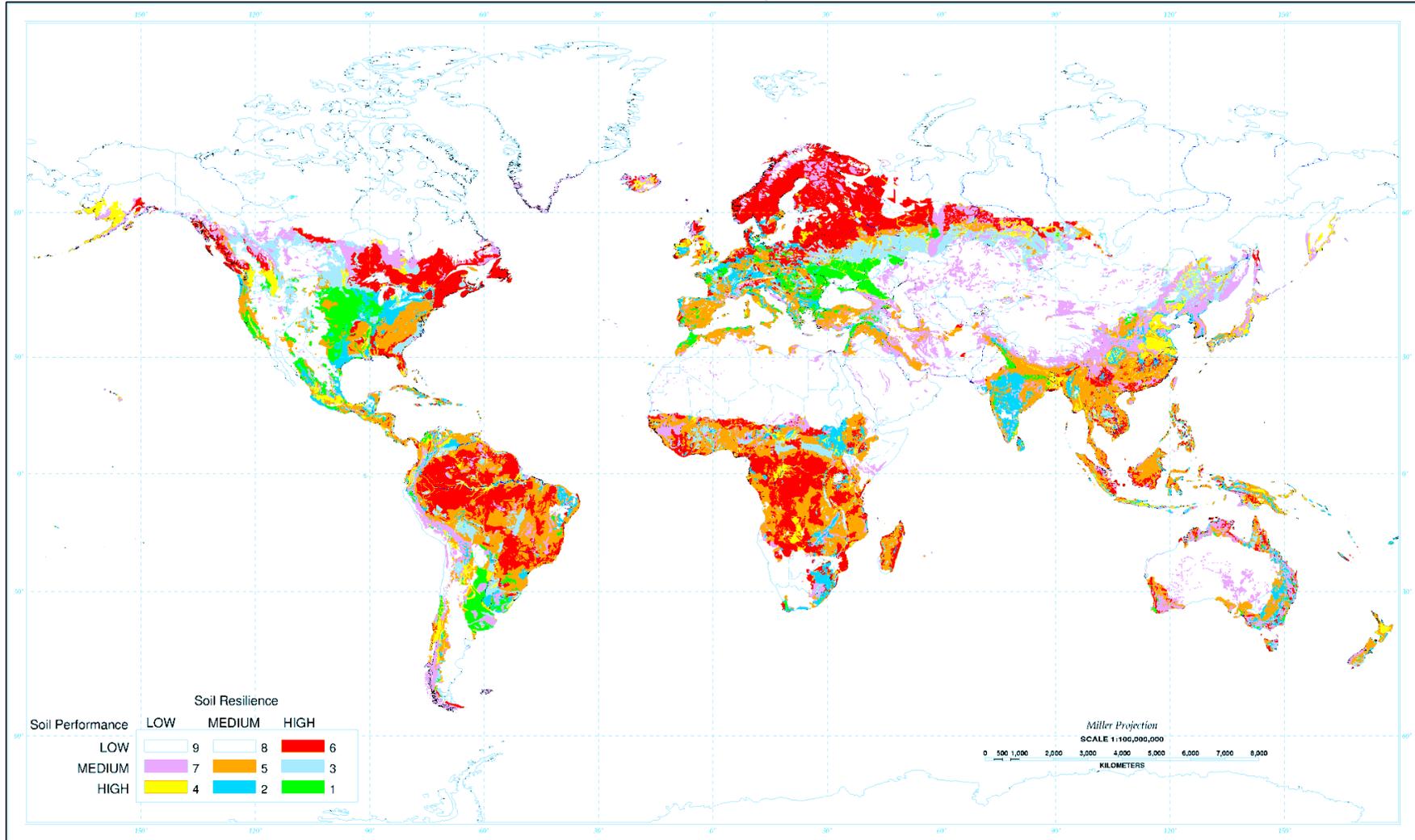
 
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How Much Can Cropland Expand?

U.S. Dept. of Agriculture
Natural Resources Conservation Service
Soil Survey Division
World Soil Resources

Inherent Land Quality Assessment



Country boundaries are not authoritative.

Washington DC, 1998

Climate Constraints

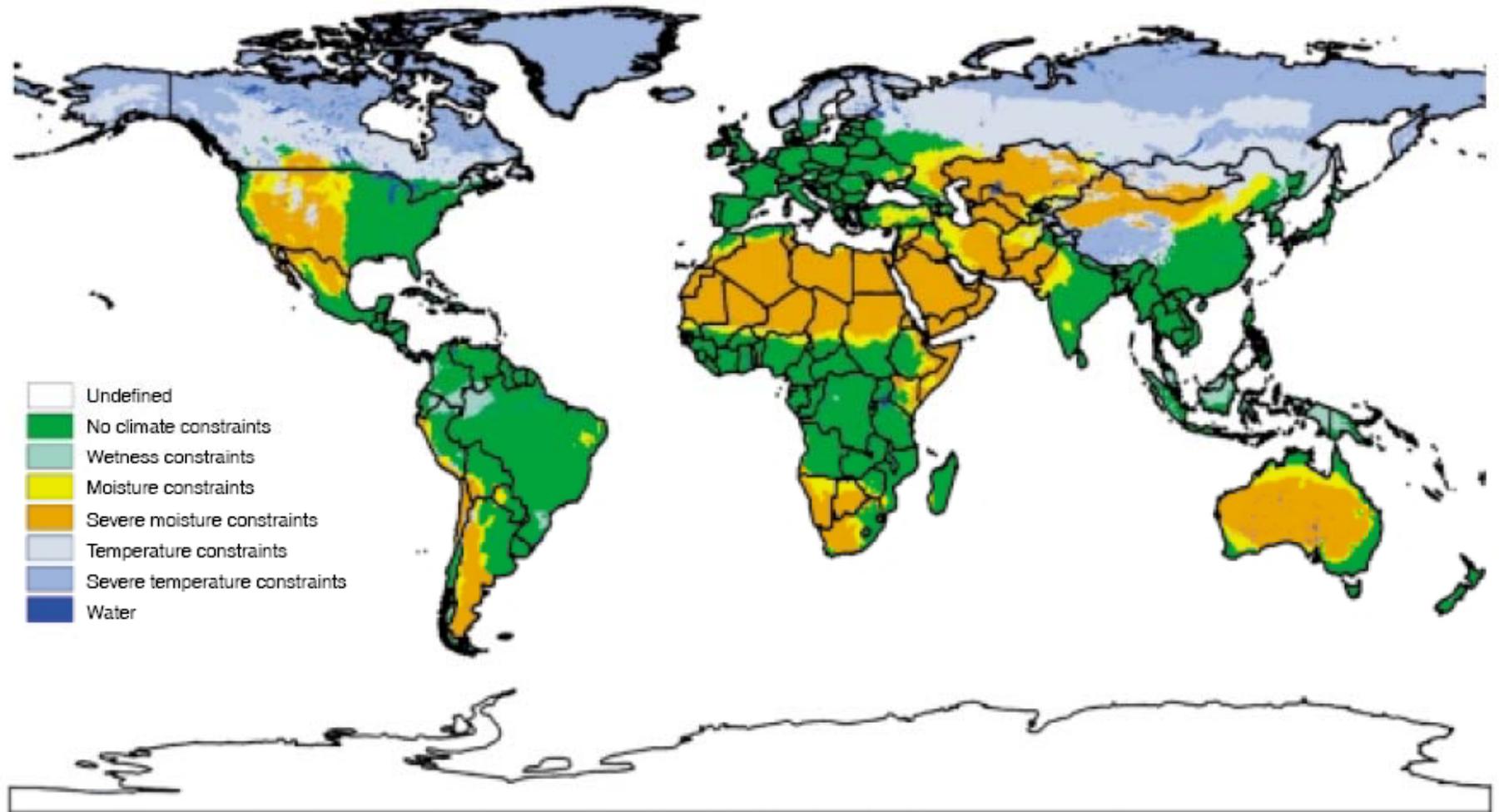
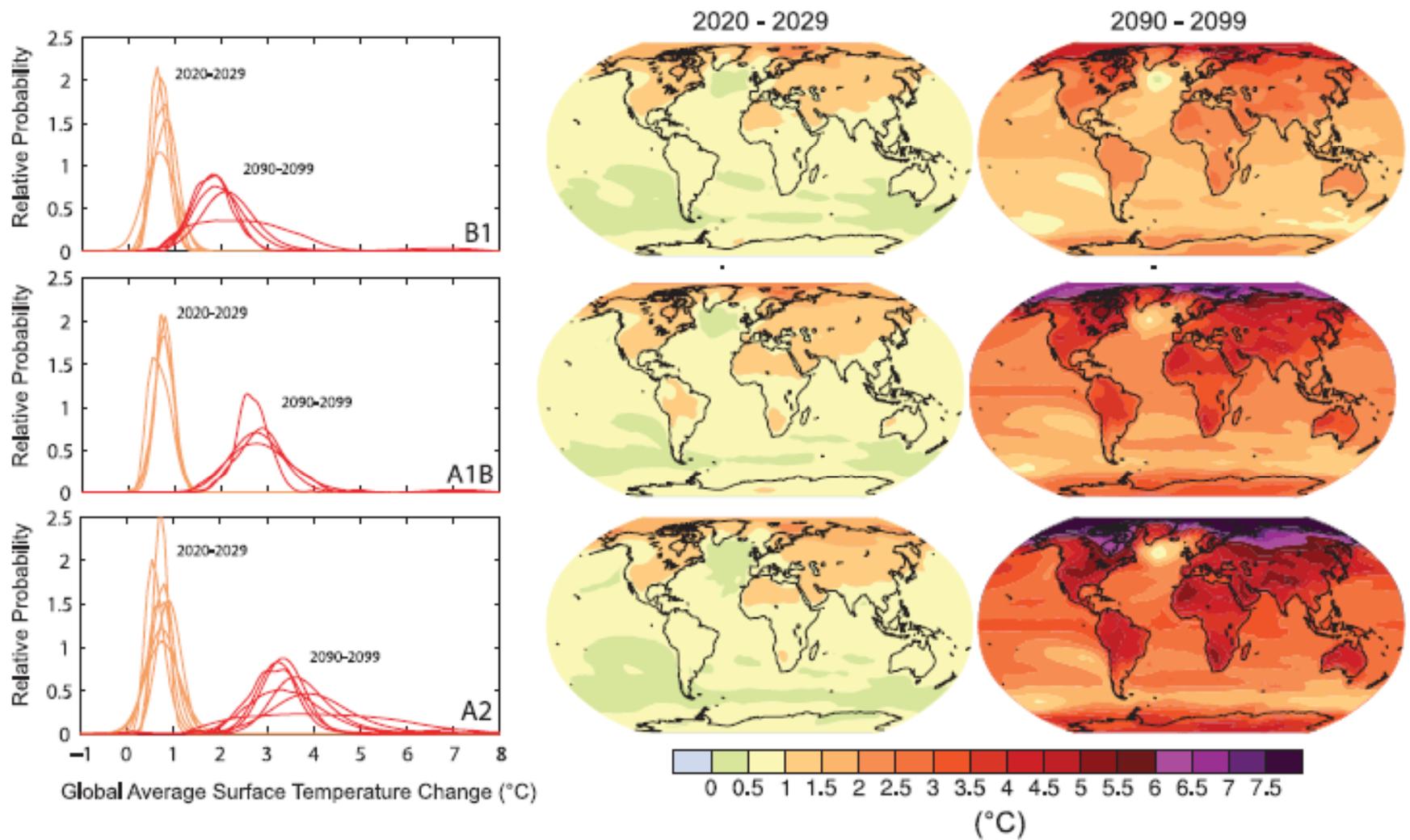


Plate E. Climate constraints.

Source: International Institute for Applied Systems Analysis

PROJECTIONS OF SURFACE TEMPERATURES



Source: IPCC 4 Working Group 1. Summary for Policymakers, p . 15.

PROJECTED PATTERNS OF PRECIPITATION CHANGES

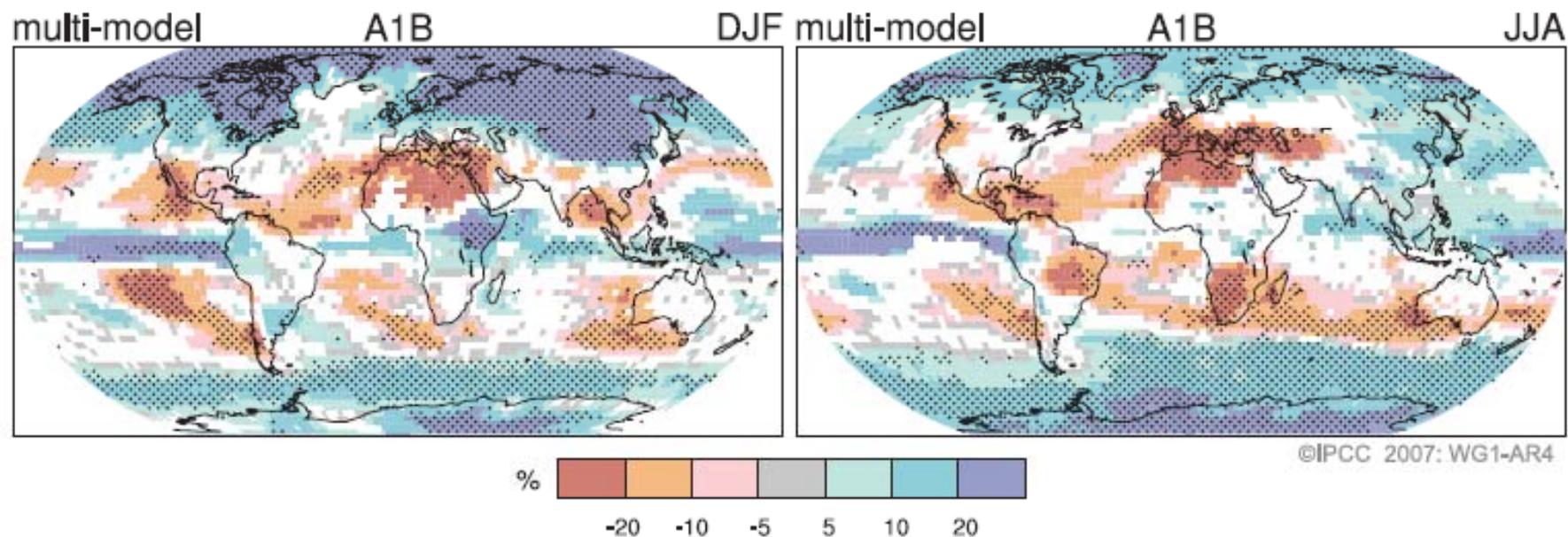


Figure SPM.7. Relative changes in precipitation (in percent) for the period 2090–2099, relative to 1980–1999. Values are multi-model averages based on the SRES A1B scenario for December to February (left) and June to August (right). White areas are where less than 66% of the models agree in the sign of the change and stippled areas are where more than 90% of the models agree in the sign of the change. {Figure 10.9}

Source: IPCC 4 Working Group 1. [Summary for Policymakers](#), p. 16.

Agriculturally Important Effects of Climate Change

- Warming greater over land than over water and greatest at higher latitudes.
- Increases spatial distribution of precipitation
 - Largest reduction in subtropics (especially on their poleward edges)
 - Largest increases in higher latitudes
 - Increase under monsoons
- Increased frequency of extreme events, such as droughts and flooding.

Adaptations Will be Required Due to Global Climate Change

- Need adaptive plant and animal breeding, just as has been done successfully to relax physical constraints in many regions for more than a century.
 - e.g. introduce more drought or heat tolerance.
- Change the mix of what crops are produced in a given geographic location.
- Rely more on international trade.

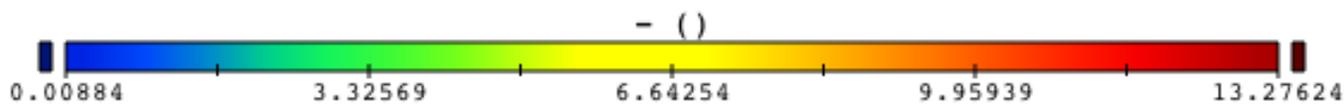
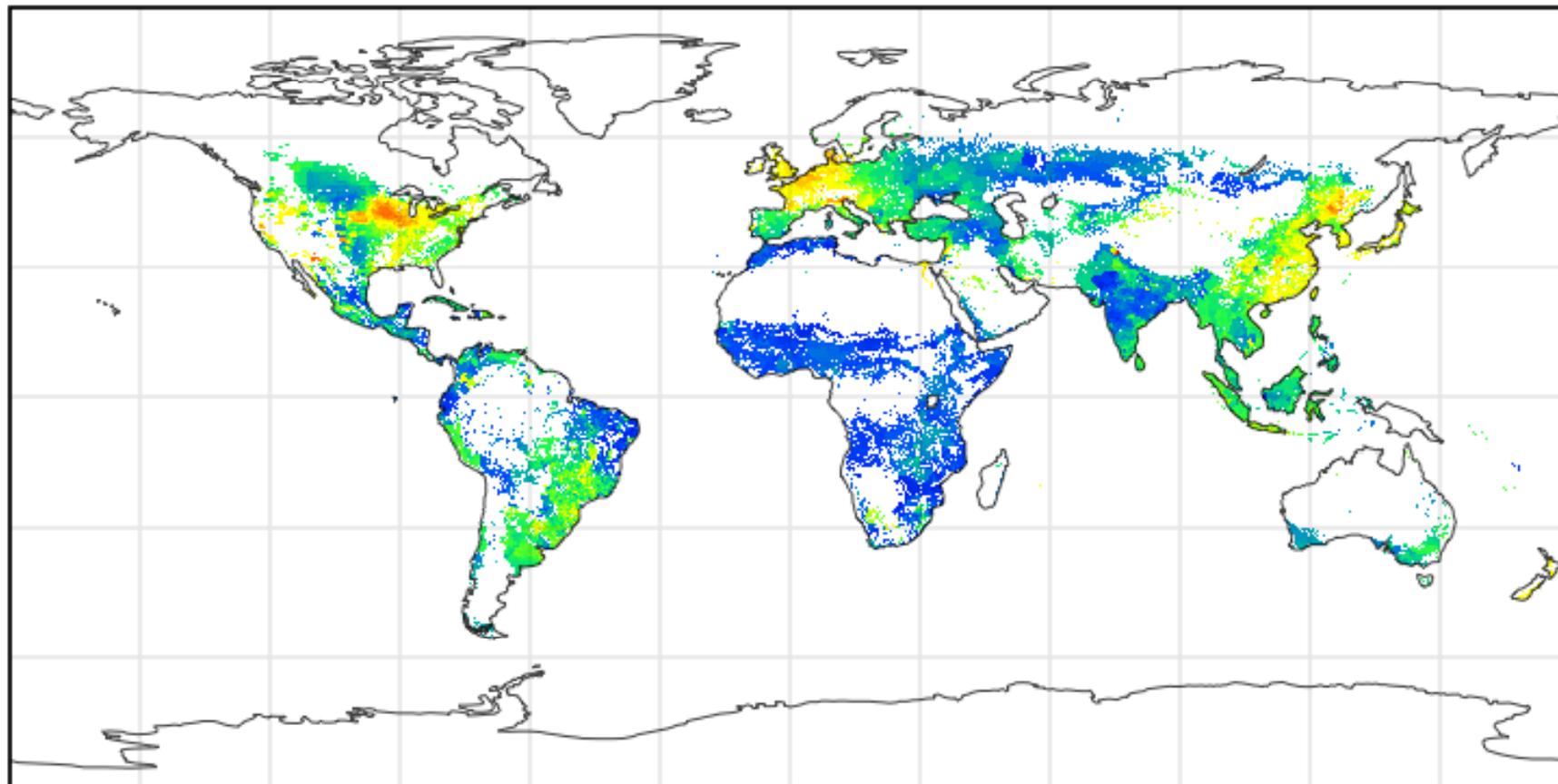
Water--A Growing Constraint

- Farmers account for 70% of the world's fresh water use.
- With the rapid urbanization underway, cities will outbid agriculture for available fresh water.
- The world's farmers, who are being called on to double food production, will have to do it using less fresh water than they are using today.
 - i.e., they will have to more than double the “crop per drop,” the average productivity of the water they use.
- This will require investments in research to develop water saving technologies and to increase the drought tolerance and water use efficiency of the crop varieties being grown.

Need to Double Food System Productivity

- Make presently unusable soils productive
- Increase genetic potential (of individual crops and/or farming system) (ditto for farm animals)
- Achieve as much of that potential as possible by:
 - Improving nutrition of that crop
 - Increasing water availability and control
 - Reducing competition from weeds for water, nutrients and sunlight
 - Reducing losses from disease and insects
- Reduce post-harvest losses

Grain Yields Around the World



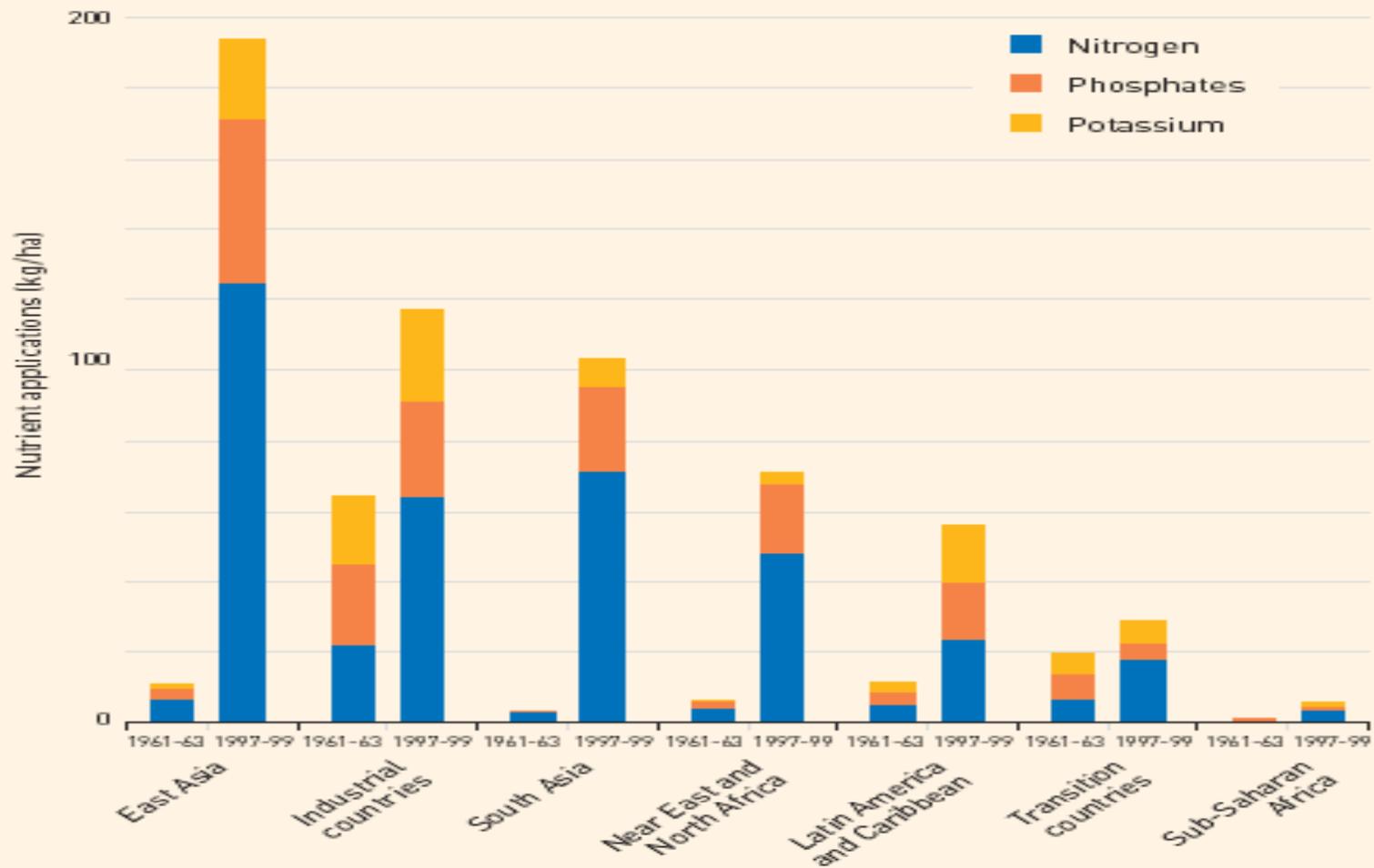
Equirectangular projection centered on 0.0°E

Data Min = 0.00884, Max = 13.27624

Sources of Observed Differences in Crop Yields in Different Locations

- Genetic potential embodied in the seeds of the crop being grown.
- Climatic conditions (level and variation in temperature and precipitation)
- Quality of soil (fertility, water holding capacity; resilience)
- Supplementation of soil fertility and precipitation with fertilizer and irrigation.
- Losses of yield potential from disease and insect infestations and competition from weeds.

Fertilizer Use



Source: FAO data

Agricultural Research Potential

- Make some presently unusable soils productive
- Increase genetic potential (of individual crops and/or farming system) (ditto for farm animals)
- Achieve as much of that potential as possible by:
 - Improving nutrition of that crop
 - Increasing water availability and control
 - Reducing competition from weeds for water, nutrients and sunlight
 - Reducing losses from disease and insects
- Increase yield stability in face of more frequent extreme climatic events
- Reduce post-harvest losses

Agricultural Research Potential

- Most productivity enhancement potential of Green Revolution technologies already exploited.
- But biotechnology opens new frontiers:
 - Improve nutritional content of grains, etc.
 - Increase tolerance to drought, wetness, temperature, salt, aluminum toxicity, (to increase yields and/or planted area under adverse or variable conditions)
 - Internalize resistance to diseases; viruses
 - Reduce pesticide use, esp. insecticides
 - Herbicide-resistant varieties
 - Slow down product deterioration

Public vs. Private Biotech Research

- Private sector role in biological ag research only took off after late 1970s when U.S. Congress & European parliaments cut appropriations and encouraged private sector to take on this role
- As tools of biotechnology were being developed, governments were reducing investments in ag research – both at home and in their foreign aid
- There is nothing inherent in biotechnology that says it must be done by private sector.
- A key question is how much will the public sector invest in adaptive ag research in the future, especially in developing countries.

More Sources of Observed Differences in Grain Yield in Different Locations

- Existence of markets to supply farmers inputs that embody improved technologies (and available credit) and buy their outputs
 - Requires a business friendly investment climate
- Remunerative input and output prices
 - Reflect public policy and state of transport and communications infrastructure.
- Knowledge and skill of farmers.

Policy Drivers

World Agriculture in Disarray*

- Most high income countries have subsidized their agriculture, distorting relative returns to various outputs and inducing larger total investment in agriculture relative to other sectors.
- Many low-income countries' food policies have turned the terms of trade against agriculture to keep urban food prices low, reducing the incentive to invest; agriculture underperforms relative to its potential.
- Protectionist import policies and export subsidies have further distorted what is produced where.

*Title of a famous book by D. Gale Johnson

OECD Producer Support Estimates

(Percent of Gross Receipts)

<u>Country</u>	<u>1986-88</u>	<u>2004-06</u>
Switzerland	77	66
Japan	64	55
European Union	41	34
Canada	36	22
United States	22	14
Mexico	28	14
Australia	8	5
New Zealand	10	1
OECD average	38	29

Source: OECD Agriculture Directorate

Single Commodity Transfers in OECD Countries, % of Gross Receipts

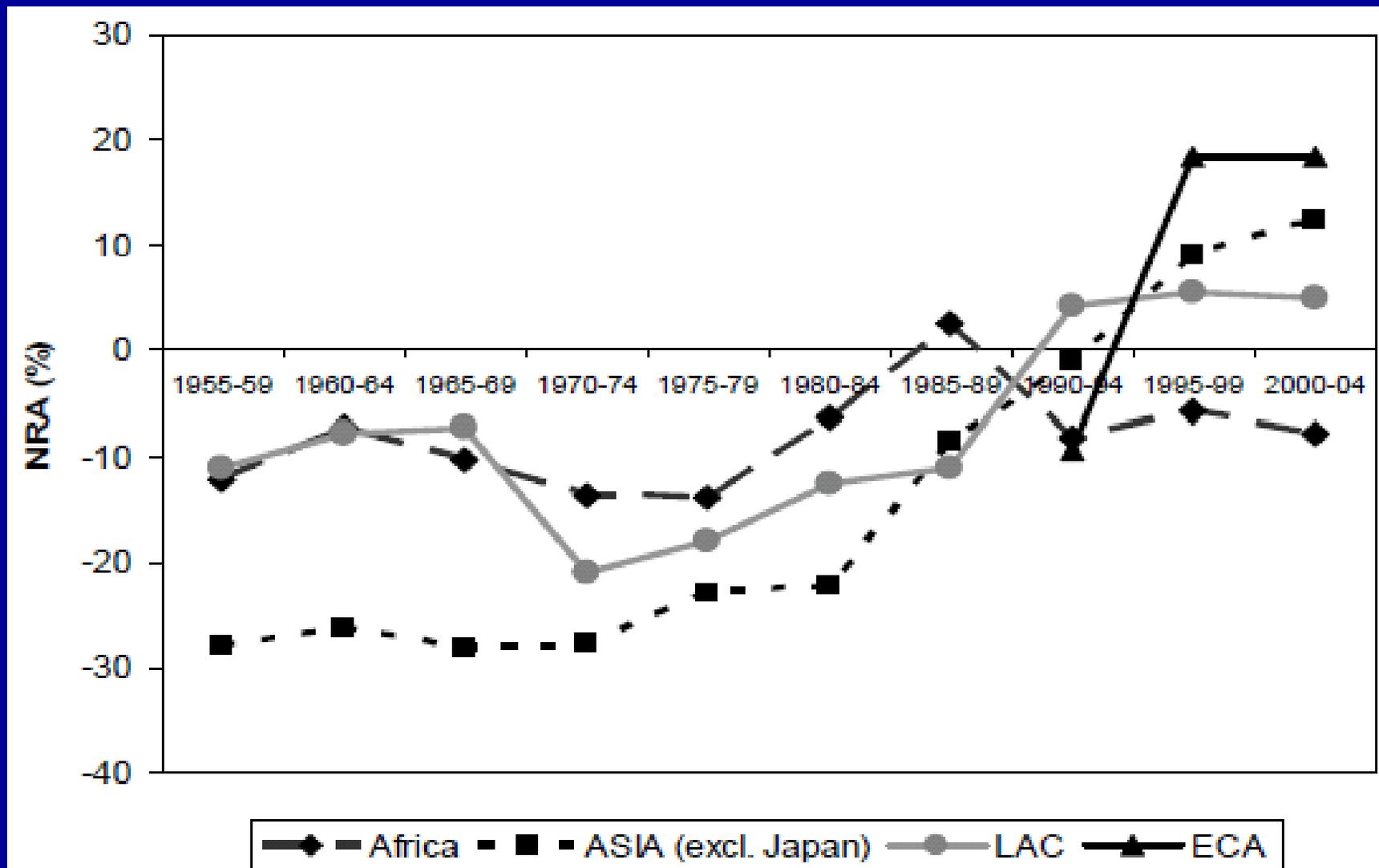
<u>Commodity</u>	<u>1986-88</u>	<u>2004-06</u>
Rice	75	65
Sugar	62	44
Milk	56	25
Beef	27	19
Pork	12	18
Corn	12	3
Wheat	32	4
Soybeans	1	2
Overall	35	21

Source: OECD Agriculture Directorate

Developing Countries' Policies Have Impeded Their Ag Development

- Corruption and/or macroeconomic instability
- Lack of definition or enforcement of property rights and contract sanctity
- Underinvestment in public goods, such as rural infrastructure, education and R&D.
- Cheap food policies to keep urban consumers quiescent – often reinforced by food aid or subsidized exports from OECD
- Lack of technology adapted to local agro-ecological conditions (soils, climate; slope)

Anti-Agricultural Bias Dropping in Developing Countries -- Except in Africa



Historic Confluence of Agricultural Policy Decisions?

- Rethinking in Canada
- 2012 Farm Bill (will set U.S. agricultural policy for 2013-2018)
- EU deciding post-2013 CAP; Japan?
- Is agriculture back on the global development agenda?
- WTO Doha Round negotiations, which will set the future rules for agricultural trade, will not finish before 2012 or 2013.

Similar Themes Across OECD

- Ag policy decisions will be made under tight government budget constraint following bailout from financial crisis of 2008.
- Volatility of agricultural commodity prices and in turn farm revenue.
- Should there be limits on payments to large farmers?
- Concerns of urban consumers are encroaching on ag policy decisions.

Hot Food & Ag Policy Issues

- Enhance health & nutrition; reduce childhood obesity; alleviate hunger around the world.
- Modernize food safety system; consolidate into one federal food safety agency?
 - Implement traceability
- Climate change & other environmental priorities; carbon tax? reward farmers for carbon sequestration? reduction in greenhouse gas emissions?

More Hot Policy Issues

- Effect of global economic slowdown, input prices & financial crisis on farmers
- Renewable energy, esp. 2nd generation biofuels; future of biofuels industry?
- Animal welfare regulations
- Transport Policy (adequacy of infrastructure)
- Trade Policy
 - Complete Doha Round trade negotiations
 - Bilateral trade agreements
 - Brazil cotton case

Whither Exchange Rates?



Source: IMF. International Financial Statistics. (normalized so 2002=1.000).

Big Food and Ag Trade Issues

- Reduce tariffs, especially tariff peaks.
- Quantitative restrictions to imports (TRQs)
- Reduce subsidies linked to production of specific commodities (“amber box”)
- Ban export subsidies & export embargoes
- Ensure SPS barriers are science-based.
- Harmonization of standards
- Streamline customs procedures

Two Fundamental Philosophical Questions Re Future Farm Policy

- Of the public investments allocated to agriculture and rural areas, how much should go to farmers as individuals & how much should be invested for the greater good of agriculture and the rural areas?
- Of the fraction that goes to farmers as individuals, how much should be linked to the production of *specific* commodities & how much should be decoupled from what the farmer produces?

Can Farm Support Programs be Justified in the Future?

- If average farm family income and wealth are higher than for the average non-farm family, it is not credible to make the case for farm support programs on the basis of low farm family incomes.
- The only credible case will have to be built around the greater inherent riskiness of agriculture & why taxpayers should provide a safety net under farm revenue.

Revenue Insurance?

- There are overlaps & redundancies among present U.S. commodity support programs, disaster payments and subsidized crop insurance.
- It is likely that the political process, reinforced by campaign contributions, will ensure continuation of some form of agricultural support programs in the future.
- If so, could all programs be rolled into one whole farm revenue insurance program?

Long-Run Prospects

- Since Malthus, prophets of doom have argued population growth will increase food demand faster than agricultural production can grow.
- Public and private sector investments in agricultural research have increased productivity faster than demand growth, with resulting 150-year downward trend in real price of grains.
- Need big increase in world food production by 2050 using less water and little more land than today and also produce biofuels feedstocks.
- Future world market price trends will depend on whether ag research increases land and water productivity faster than world demand grows.

Growing Agricultural Trade

- The world's arable land is not distributed around in the world in the same proportions as is population. (No way for Asia or North Africa & Middle East to be self-sufficient.)
- Agriculture in most LDCs underperforming relative to its potential, but disincentives declining.
- With population growth & broad-based economic development in LDCs, growth in their food demand will outstrip production potential & more of world ag production will move through trade.
- Greater trading opportunities for LDCs would accelerate their economic growth and accelerate growth in their food consumption and imports.
- Need a successful WTO Doha Round.

Many Types of Policies Affect Agricultural Sector

- Commodity programs
- Trade policy
- Science policy
- Macroeconomic Policy (thru exchange rate, inflation rate and interest rates)
- Credit Policy
- Tax Policy
- Energy Policy
- Environmental policy
- Food safety policy
- Competition Policy
- Animal welfare policy
- Health insurance
- Immigration policy
- Rural and economic development policy
- Others?