

Food Security and the Futures of Farms

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Dimensions of Food Security

- Household food insecurity
 - Caused mainly by poverty
 - The rich in no country go hungry, except in times of war, natural disaster or politically-imposed famine.
- National Food Security
 - Potential for self-sufficiency that is economically efficient and environmentally sustainable
 - To import food a country has to be able to sell the goods in which it has a comparative advantage
- Global Food Security
 - Land and water constraints
 - Potential for research to relax the physical constraints
 - Essential that public policy facilitate, not impede, agricultural development.

Rurality of Poverty

- Of the 1.4 billion people who live on less than \$1.25 per day, about 75% live in rural areas, and most of these depend on farming for their meager incomes.
- One of the Millennium Development Goals (MDGs) is to cut poverty in half by 2015.
- Most development agencies have a preponderance of their efforts in urban areas.
- Urban poverty is clearly a problem, but the MDG poverty reduction goal is unattainable unless more is done to reduce poverty in rural areas, where the majority of it is found.

Underperforming LDC Farms

- Agriculture in many low income countries has underperformed relative to its potential consistent with economic efficiency and environmental sustainability.
- Where this has occurred, the agriculture sector has contributed less to national (and global) food security and rural poverty reduction than it could have.
- It is essential to improve the agricultural sector's performance for all these reasons.

There Are Only Five Ways to Increase Farm Family Income

- Increase productivity in present crops
- Get access to more land (own or rent)
- Change to higher value per hectare crops
- One or more member(s) of the household get non-farm income (e.g. cottage industries, non-farm jobs; remittances)
- Leave agriculture all together (migrate to city or get full-time non-farm job within commuting distance)

Private Sector Job Creation Essential

- Only the private sector can create the jobs to solve the poverty problem...but needs positive investment climate.
- Government needs to provide legal environment and public policies that create a positive investment climate, such as
 - Macroeconomic & political stability
 - Rule of law
 - Definition and timely enforcement of contract sanctity
 - Definition of property rights, including ease of registration, transfer and enforcement thereof

Outmigration Essential

- Outmigration from agriculture to non-farm employment is a normal and essential part of national economic development—so that both those who leave and those who remain in agriculture have the potential to earn higher incomes.
- In the course of a country's economic development, first the fraction of the work force and later the absolute number of people engaged in agriculture must fall.

Other Essential Roles of Government in Economic Development

- Invest in people (human capital)
 - Universal primary school education
 - Quality health care
- Build (or cause others to build) infrastructure
 - Roads and other transportation
 - High cost transportation is a severe impediment
 - Telecommunications
 - Markets do not work well without information
 - Electricity supply

Still More Essential Roles of Government in Economic Development

- Invest in agricultural research
- Enforce anti-monopoly laws
- Consumer protection
 - E.g. food safety; honest weights & measures
- Collection and dissemination of statistics
- Others...

Supporting Farm Prices Is Weak Poverty Reduction Policy

- Supporting market prices is a weak tool for addressing rural poverty or facilitating agricultural development
 - Benefits are distributed in proportion to sales, so the largest farmers get the largest benefits, but they are rarely the people who suffer rural poverty.
 - Over time, these benefits inflate land values, so the ultimate beneficiaries are the largest land owners.
 - Hurts low income consumers who spend the largest fraction of their income on food.
- The most effective rural poverty reduction policies are direct needs-based payments (welfare) and rural development which creates non-farm jobs within commuting distance of where the rural poor live.

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, based on U.N. Population Office and U.S. Census Bureau analyses.

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

Note: Population in millions.

Source: World Bank. World Development Indicators 2008.

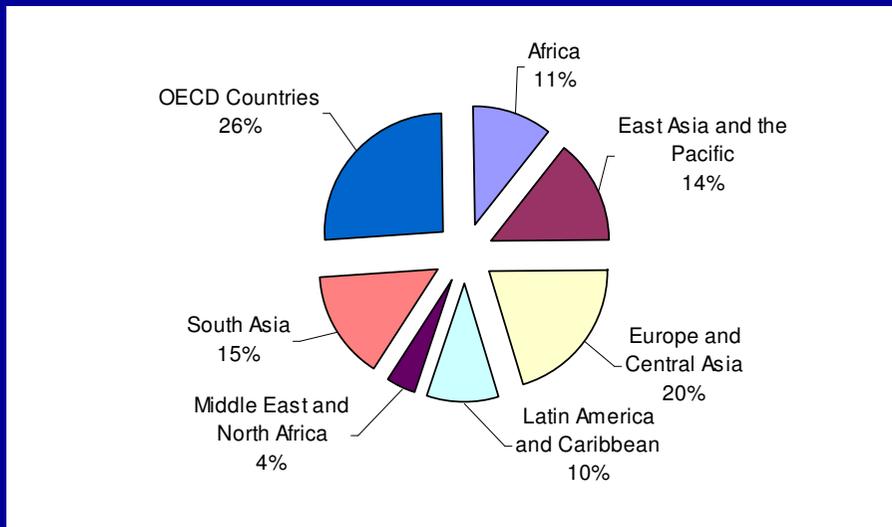
Projected World Food Demand

- World food demand double from 2000 to 2050
 - 50% increase from world population growth – almost all in developing countries
 - 50% increase from broad-based economic growth/poverty reduction in low income countries
- The World Bank has estimated that the number of people in developing countries living in households with incomes above \$16,000 per year will rise from 352 million in 2000 to 2.1 billion by 2030.
- How many presently low income consumers are lifted out of poverty will be the *most important* determinant of the future global demand for food.

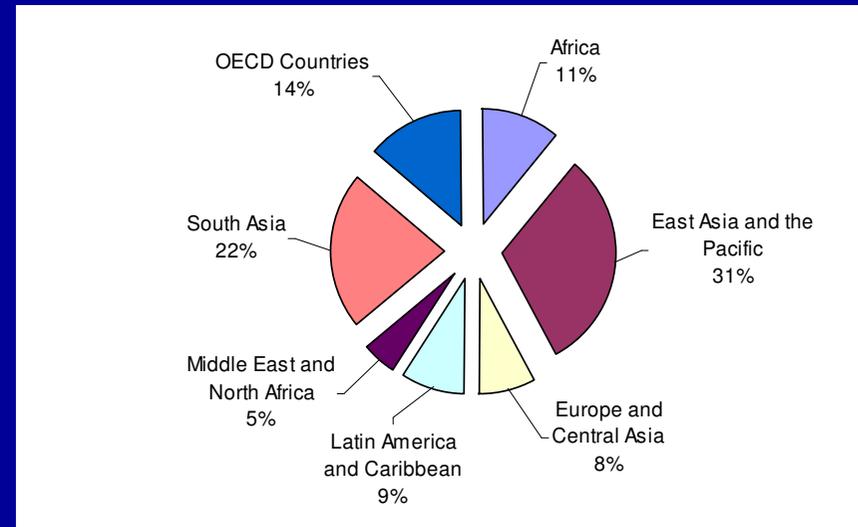
Growing Demands on Forests, Too

- The same forces of population and income growth that increase demand for food also increase demand for things made out of wood, e.g. paper, furniture, building materials; poles.
- In rich countries, growing demand for environmental amenities and preservation of (especially old-growth) forested areas.
- At the same time biofuels production has been claiming more and more land.

Larger Fraction of Ag Production to Move Through Trade



Distribution of Arable Land



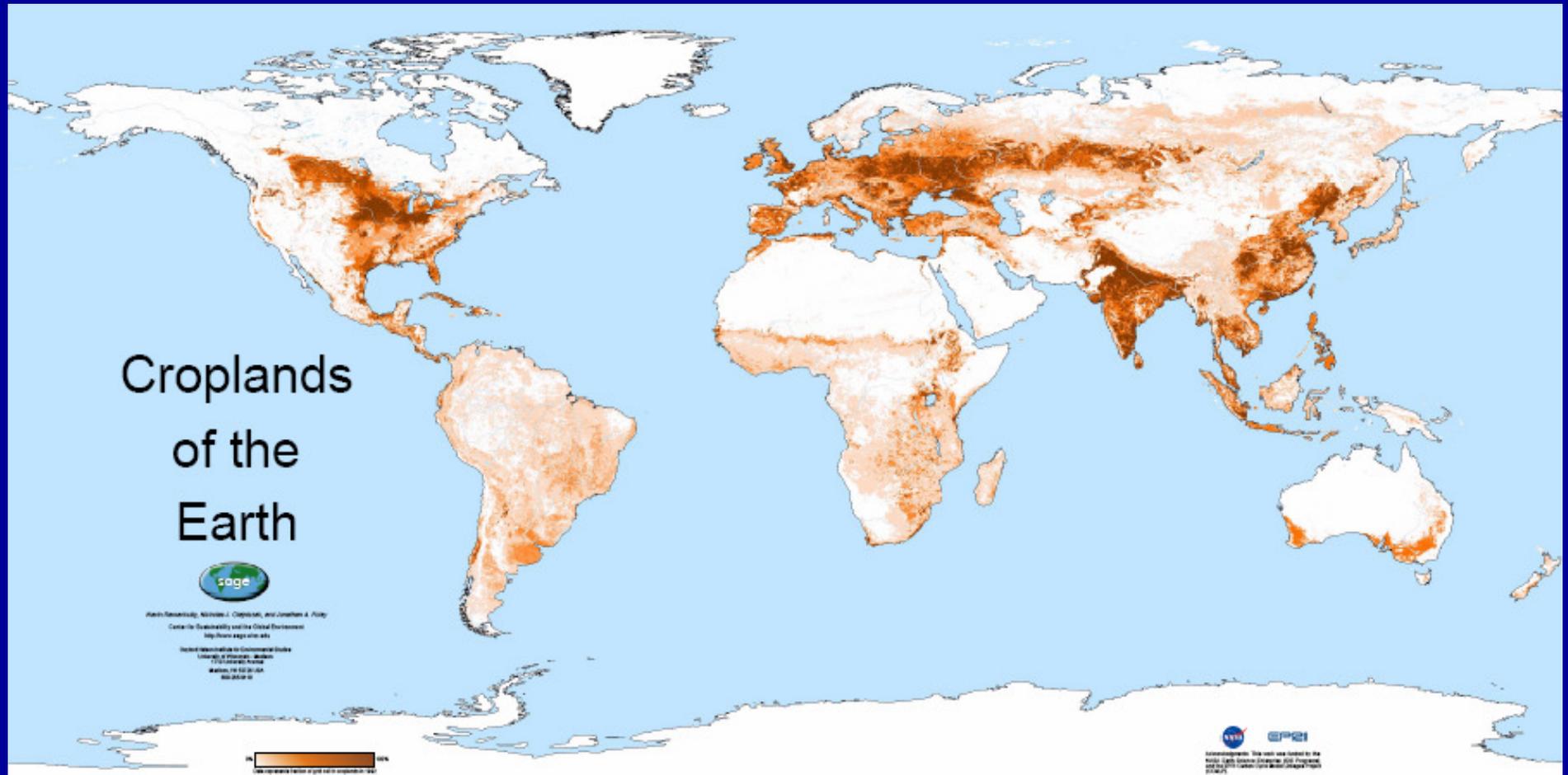
Distribution of World Population

- 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.

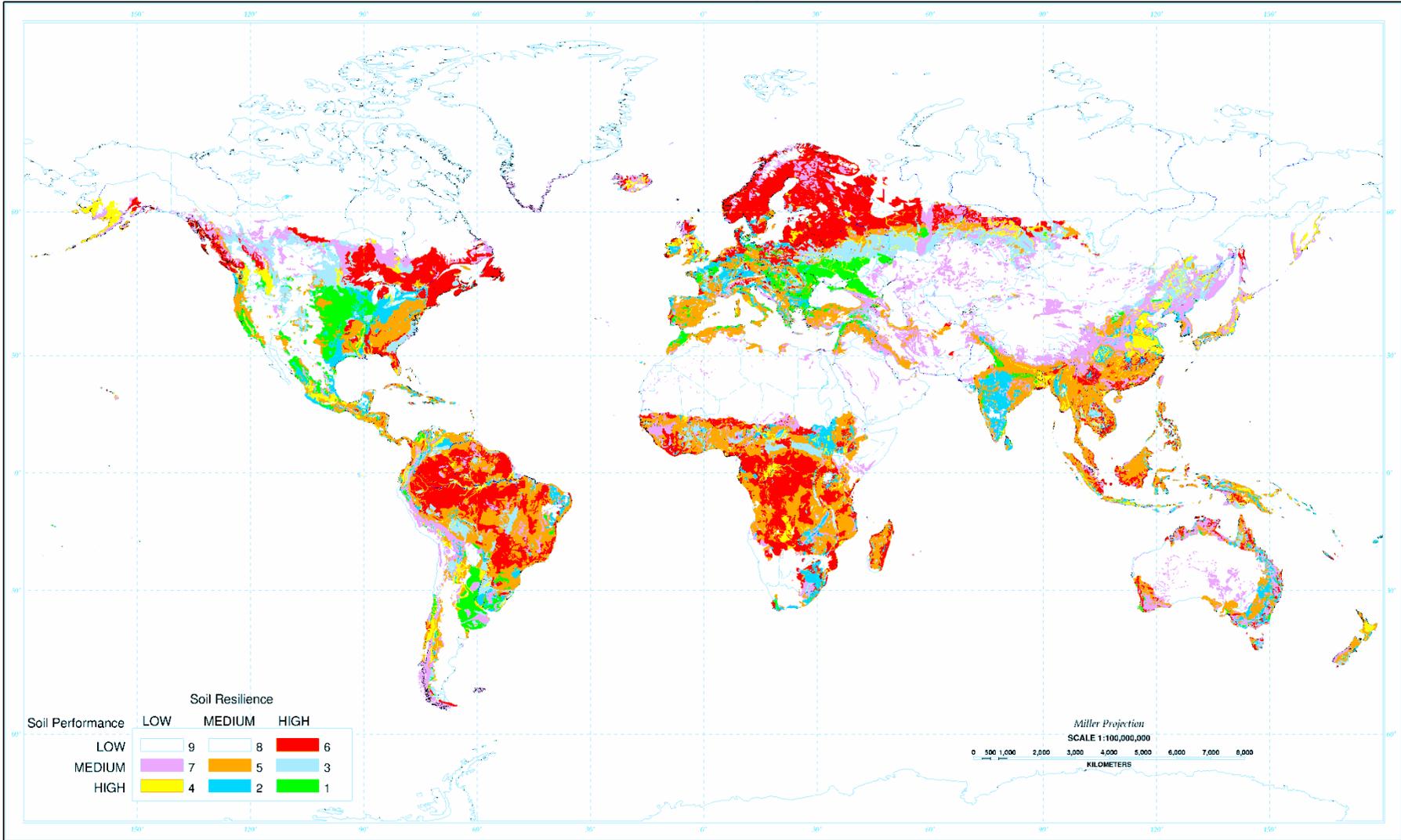
The Land Constraint

- 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.

Can Technology Enable Expansion of Arable Land Area?

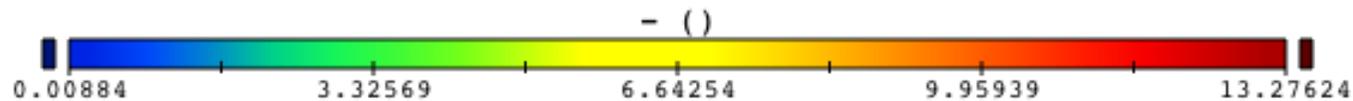
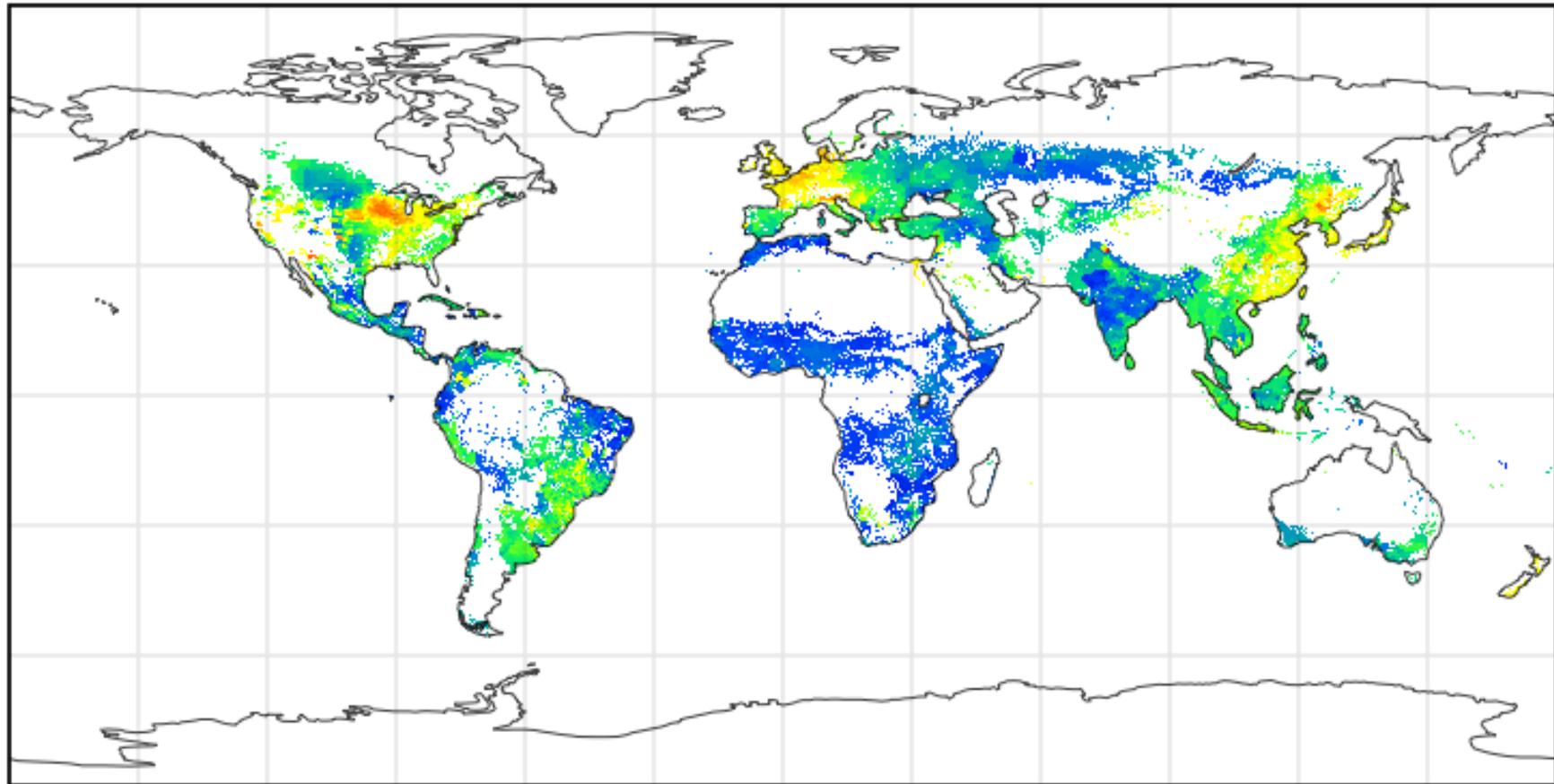


Inherent Land Quality Assessment



Country boundaries are not authoritative.

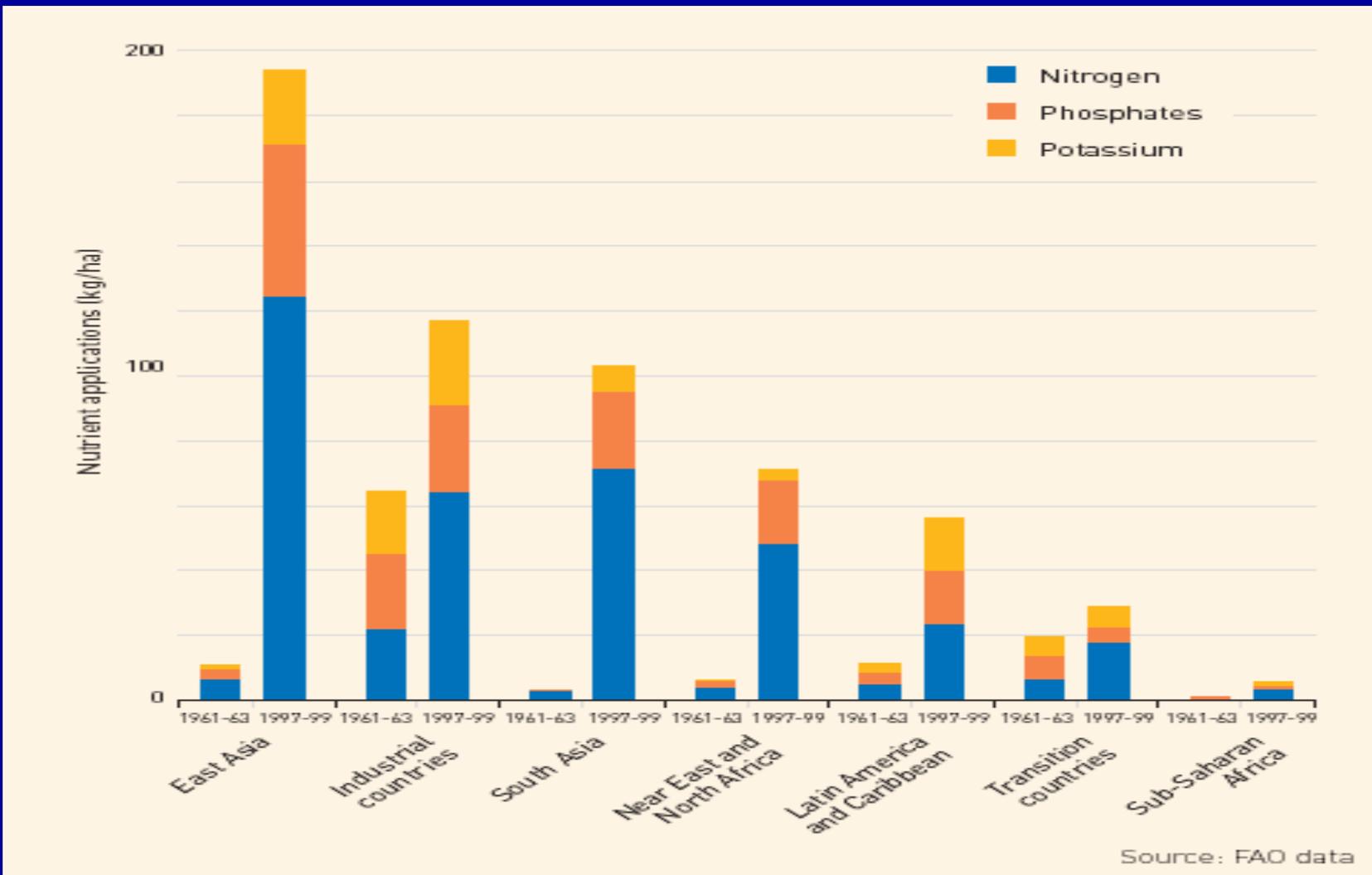
Grain Yields Around the World



Equiangular projection centered on 0.0°E

Data Min = 0.00884, Max = 13.27624

Fertilizer Use



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.

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.

Water A Growing Constraint

- Farmers use 70% of the fresh water used in the world. They are both the largest users and the largest wasters of water.
- Water is priced at zero to most farmers, signaling that it is much more abundant than in reality. Anything priced at zero will be wasted.
- With rapid urbanization, cities are likely to outbid agriculture for available water.
- The world's farmers need to double food production using less water than today. Biofuels will add further to this challenge.

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 Warming

- Need adaptive plant (and animal) breeding , just as has been done successfully to relax physical constraints in given 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.

Need Research to At Least 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

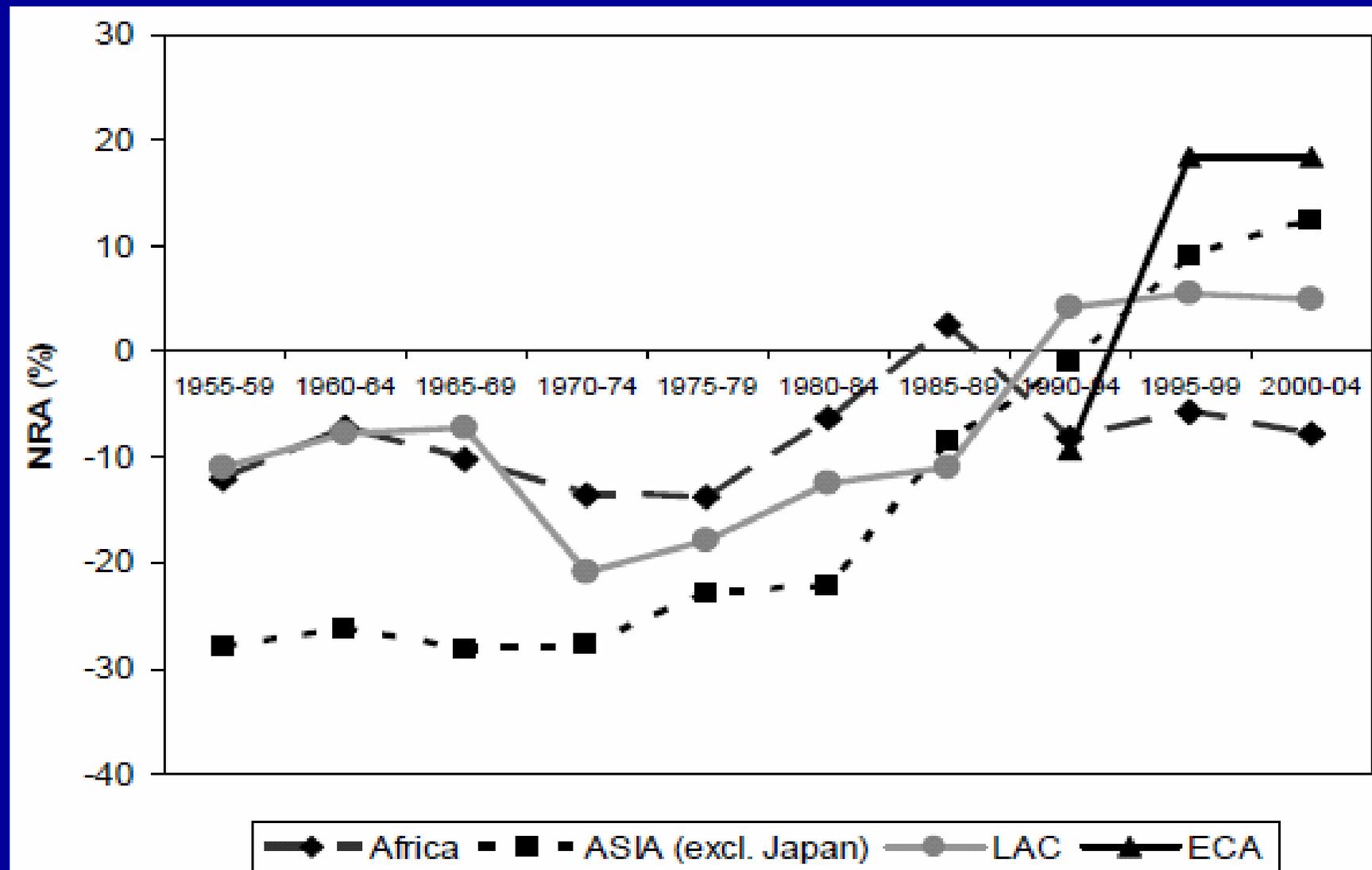
Long-Run Prospects

- 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 to double world food production by 2050 using less water and little more land than today & also produce feedstocks for biofuels production.
- Future world market price trend will depend on whether research increases land and water productivity faster than world demand grows.

Developing Countries' Own Policies Impede Their 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



Agriculture Has Been Off the Global Development Agenda

- Low world commodity prices in 1980s, in part due to OECD ag production & export subsidies, and 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.

Developing Countries Need from OECD Countries

- A more open trading environment that can stimulate faster economic growth
- Market access for goods in which developing countries have a comparative advantage
- Eliminate import barriers and domestic and export subsidies which depress world market prices and increase their variance
- Foreign aid and international lending for investment in necessary infrastructure, technology, know-how, etc. and to facilitate adjustment.
- Foreign direct investment