IFMA 17

FOOD, FIBER AND ENERGY FOR THE FUTURE

INTERNATIONAL CONFERENCE

World Agriculture in Perspective

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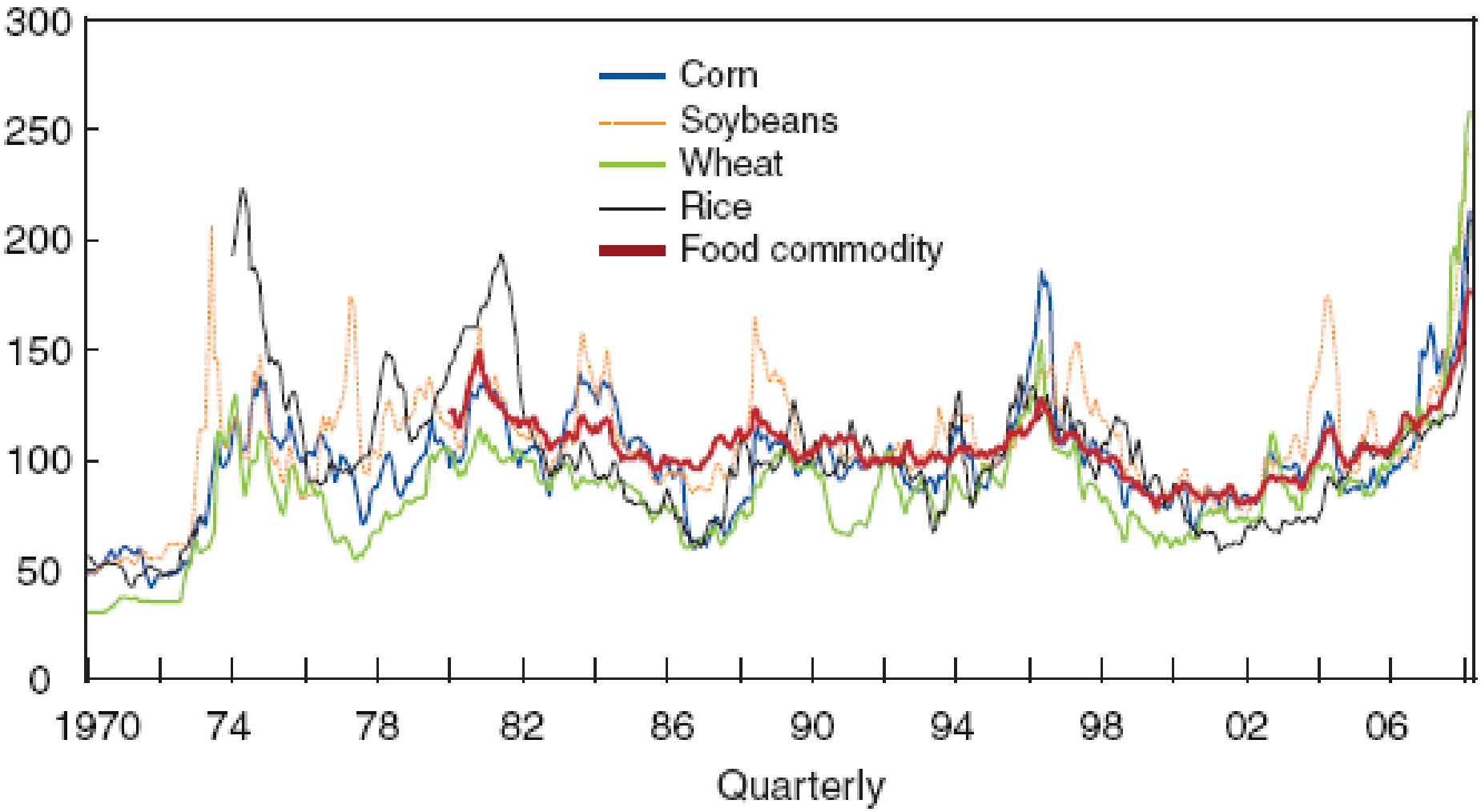
Agriculture's Uniqueness

- Biological lag of months to years from input to output, during which price insensitive.
- Entire year's production is harvested in one or a few short interval(s) each year.
- One input in production, weather, is a random variable not under farmer's control.
- Ag commodity prices are more volatile than prices in rest of economy & often overshoot
- Each year's revenue is the product of two random variables: price times yield.

Food commodity price spikes since 1970



Source: International Monetary Fund: International Financial Statistics.

Agriculture's Uniqueness (cont'd)

- Roles of land & sunlight in prod'n. require production to be geographically dispersed.
- Modern ag production is more capital intensive than manufacturing.
- Finite supply of land makes it residual claimant.
- Throughout a country's economic development, role in GDP & employment must drop.
- Its product, food, a necessity of life that has to be consumed daily by every consumer.

Many Types of Policies Affect the Food & 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
- Regulatory policy
- Rural and economic development policy
- Homeland security policy

The Paradox of Hunger Amid Plenty

- There's plenty of food produced in the world today, but a billion people go hungry.
- Hunger is caused by the inability of individuals or households to access the available supply:
  - due to lack of purchasing power
  - except in times of war, natural disaster, or politically imposed famine.
- To address the latter, need emergency food aid
- To solve the basic world hunger problem, we must solve the poverty problem.
  - Foreign aid (literally international welfare payments or gifts of food) can be a stop-gap.
  - Job creation is the only long-term solution (Remember "teach a man to fish or give him a fish")

Projected Population Growth

Region	2008	2050	Change	Percent
World	6,705	9,352	+2,647	+ 40
High Income	1,227	1,294	+ 67	+ 6
Low Income	5,479	8,058	+2,579	+ 47
East & S.E. Asia	2,144	2,459	+ 315	+ 11
South Central Asia	1,683	2,605	+ 922	+ 55
Sub-Saharan Africa	809	1,698	+ 889	+110
Lat. America/Carib	577	778	+ 201	+ 35
N. Africa & W. Asia	422	670	+ 248	+ 59

Source: Population Reference Bureau. 2008 World Population Data Sheet, based on U.N. Population Office and U.S. Census Bureau analyses.

Dynamics of Food Demand Growth

- 1.4 billion people live on less that $1.25/day; 70% rural; 1 billion suffer under-nutrition.
- 3.1 billion people live on less than $2.50/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 numbers as of 2005, before commodity price explosion.

Huge Growth in Food Consumption Expected from Economic Growth

Country	Population	%<$1/day	%<$2/day
China	1318	9.9	34.9
India	1132	34.3	80.4
Indonesia	232	7.5	52.4
Brazil	189	7.5	21.2
Pakistan	169	17.0	73.6
Bangladesh	149	41.3	84.0
Nigeria	144	70.8	92.4
Philippines	85	14.8	43.0

Source: World Bank. World Development Indicators database (2007)

Percent of Population Living in Urban Areas

Region	2007	2025	2050
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 by 2050
  - 50% increase from world population growth – all in developing countries
  - 50% increase from broad-based economic growth in low income countries
- The World Bank estimates 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.

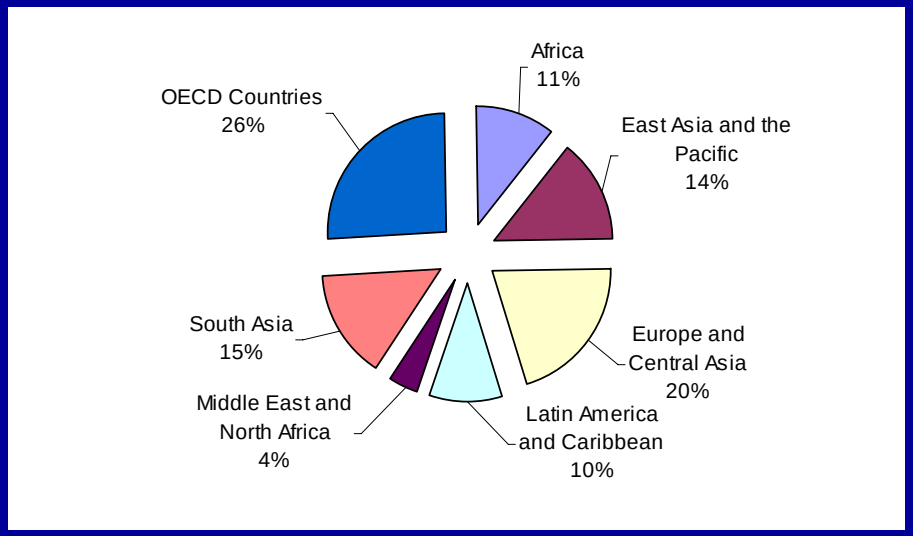
Biofuels Driving Ag Outlook

- Production of ethanol in the U.S. and biodiesel in Europe comprise the biggest shock to world agriculture since 1970s.
- Creating large demand for corn and edible oils, which is pulling land out of other crops and new lands into production.
- Higher feed grains prices reducing profitability of livestock and poultry industries.
- When will we have technology for producing ethanol economically from cellulosic feedstocks? Can they be produced on inferior soils?

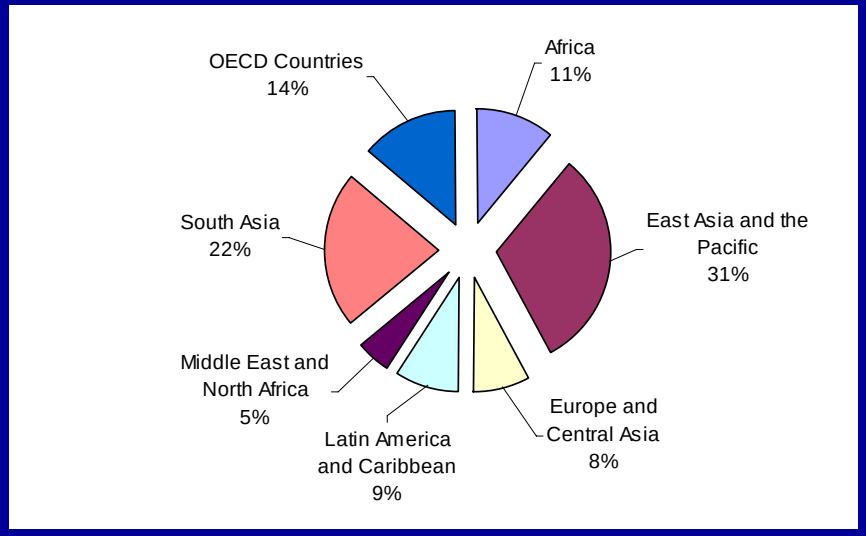
Growing Demands on Forests, Too

- 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 is claiming more and more land.

Larger Fraction of Ag Production to Move Through Trade



Distribution of Arable Land



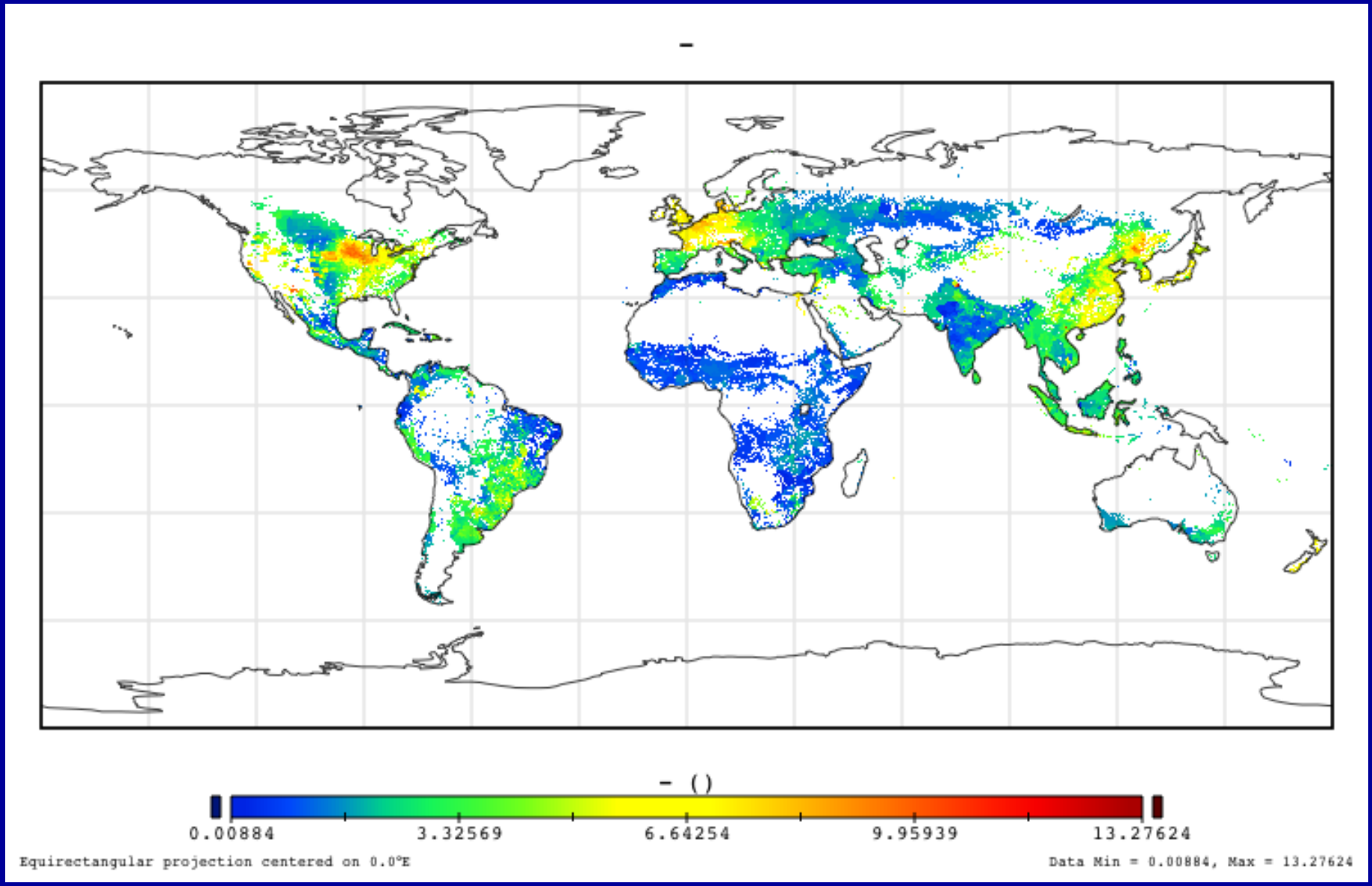
Distribution of World Population

- 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.

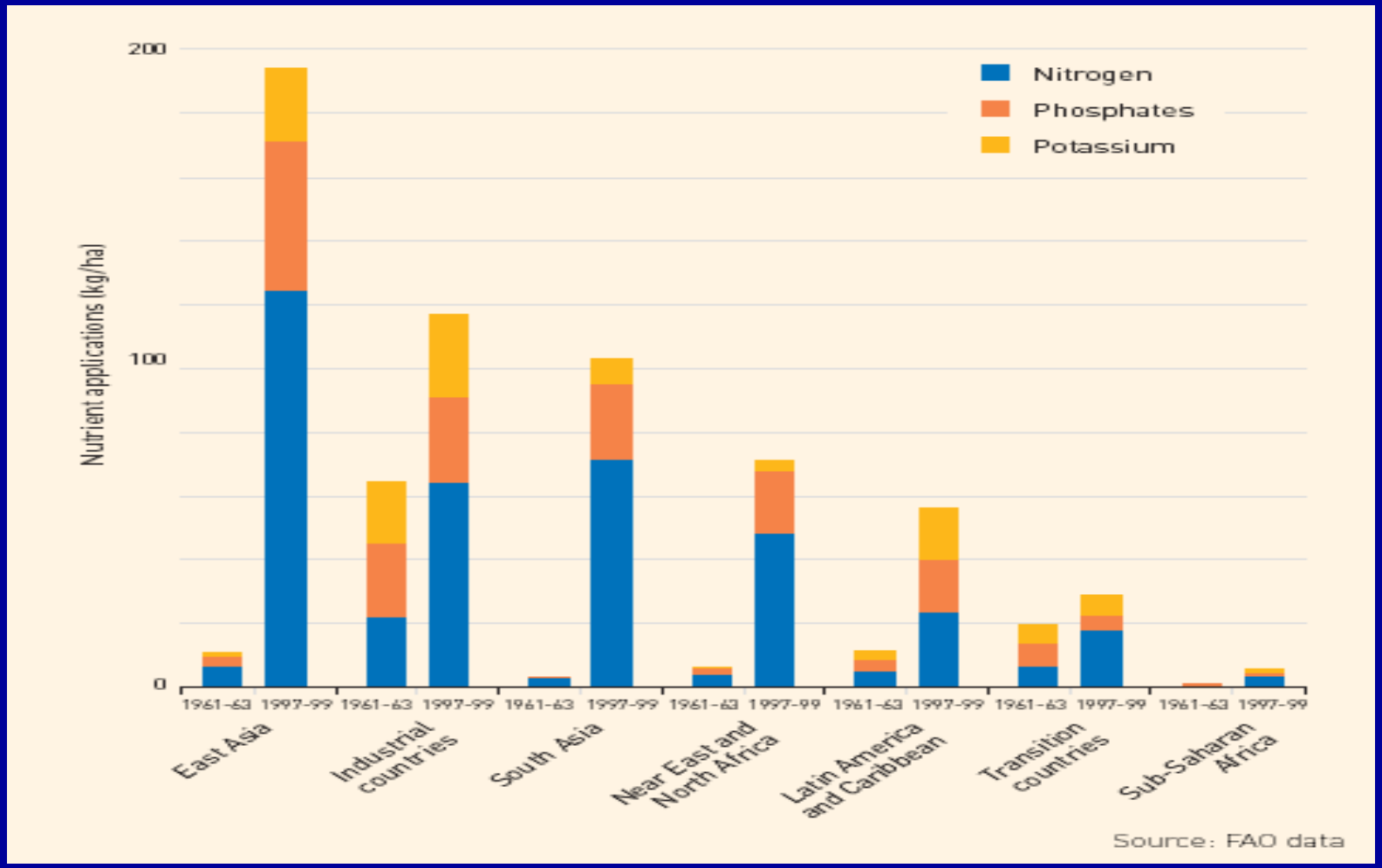
The Land Constraint

- 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.

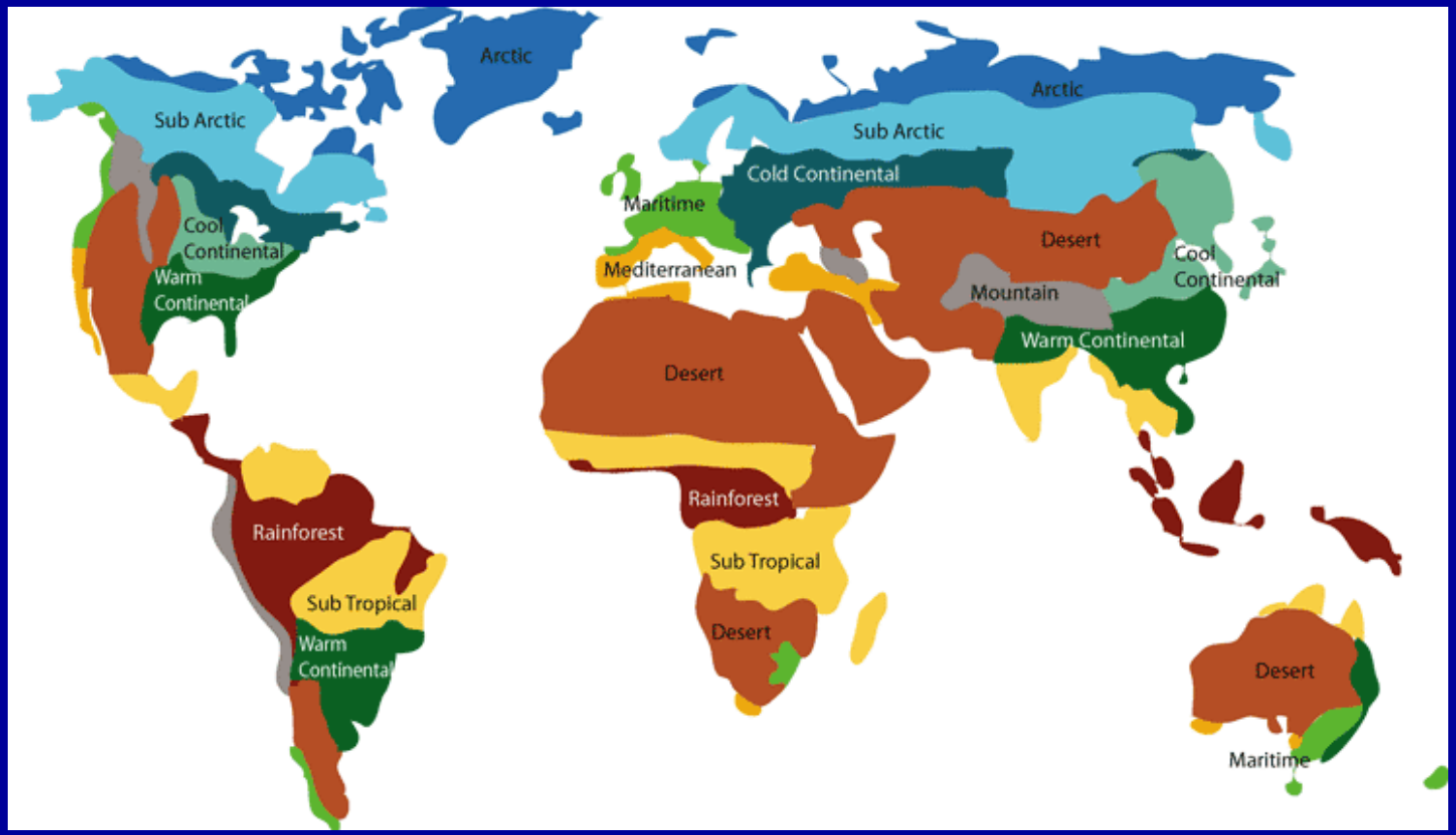
Grain Yields Around the World



Fertilizer Use



Constraints on World Ag Production



40% too dry

21% too wet

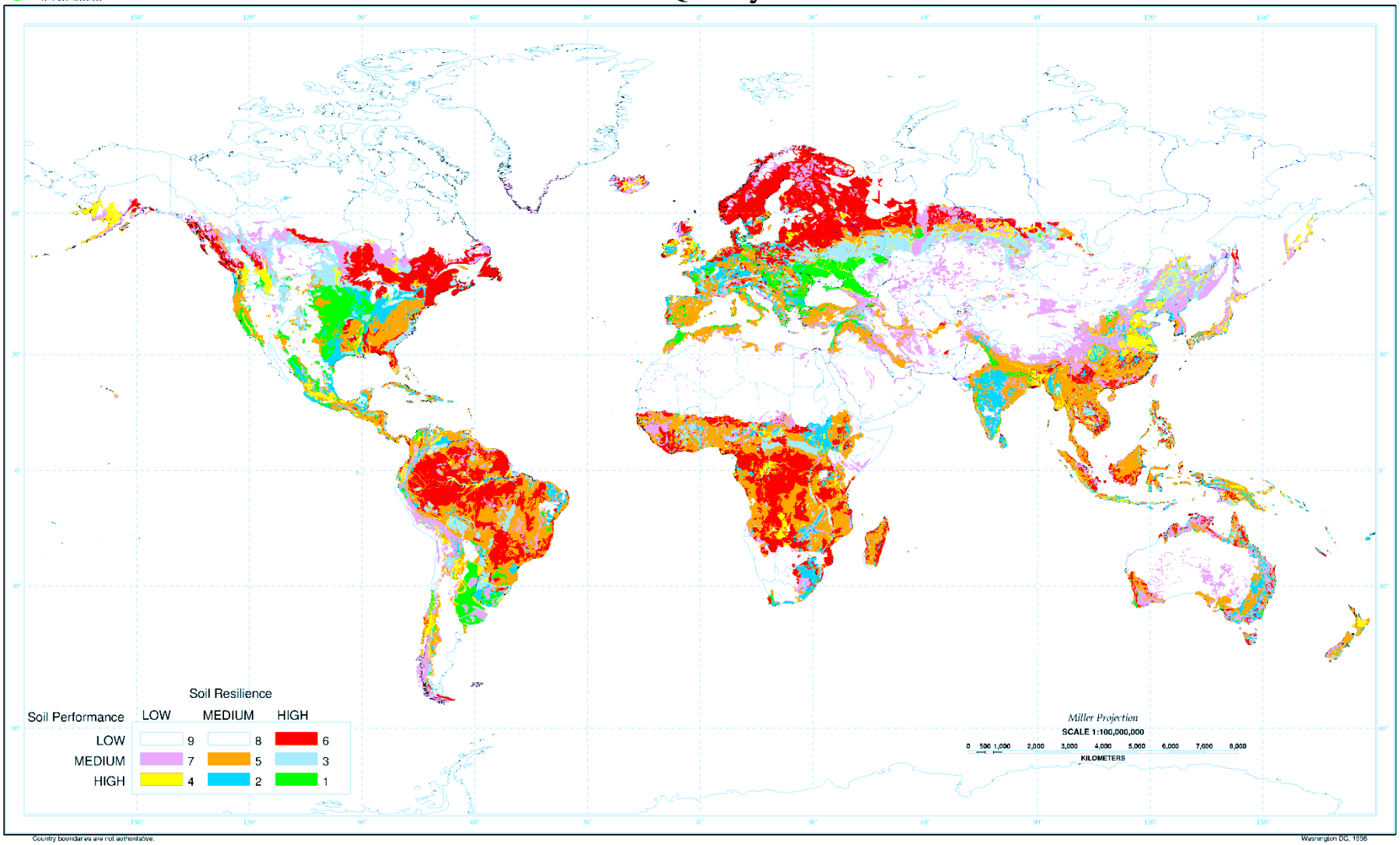
21% too cold

6% too rough terrain

2% unsuitable soils

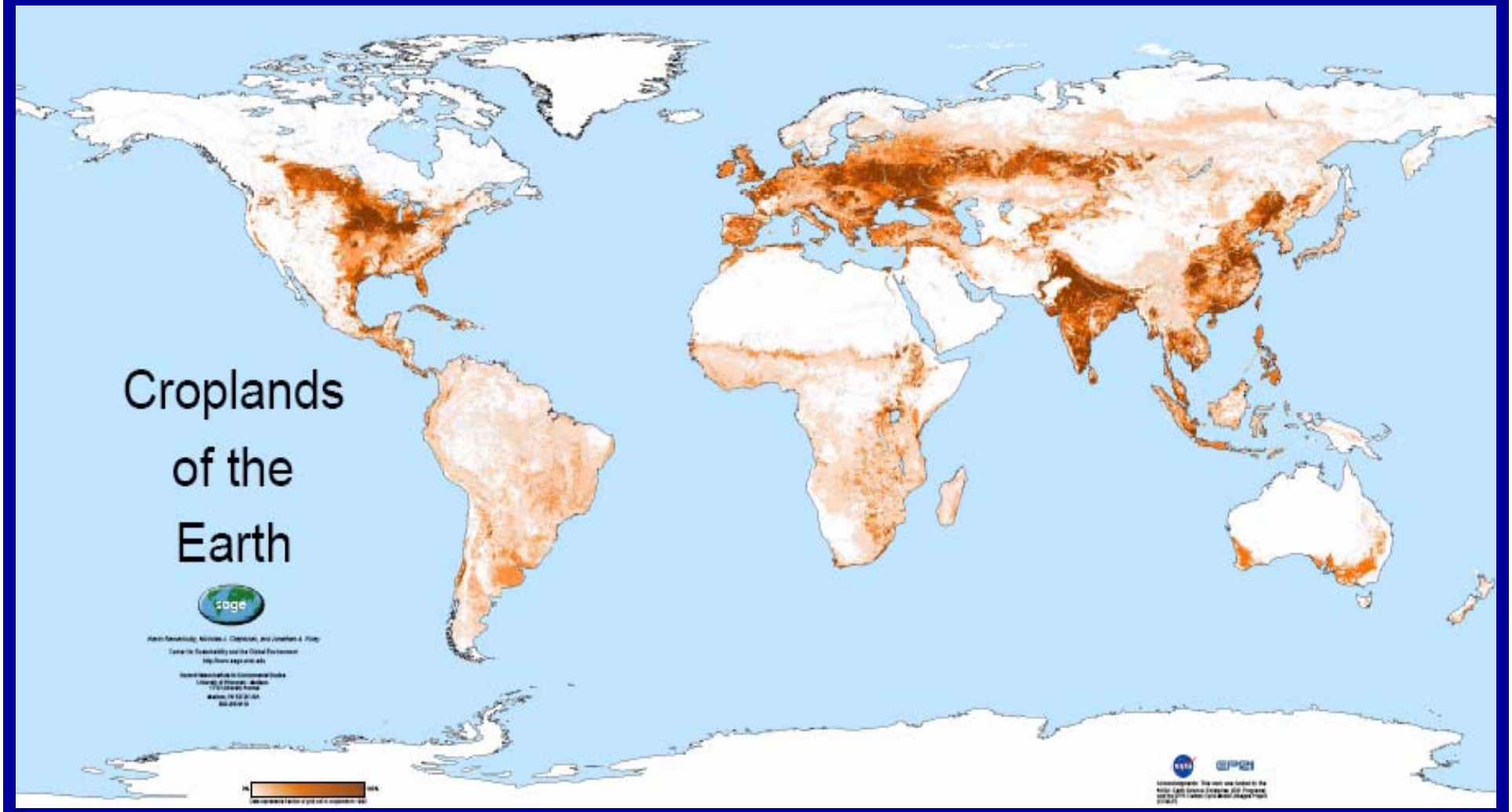
U.S. Dept. of Agriculture
Natural Resources Conservation Service
Soil Survey Division
World Soil Resources

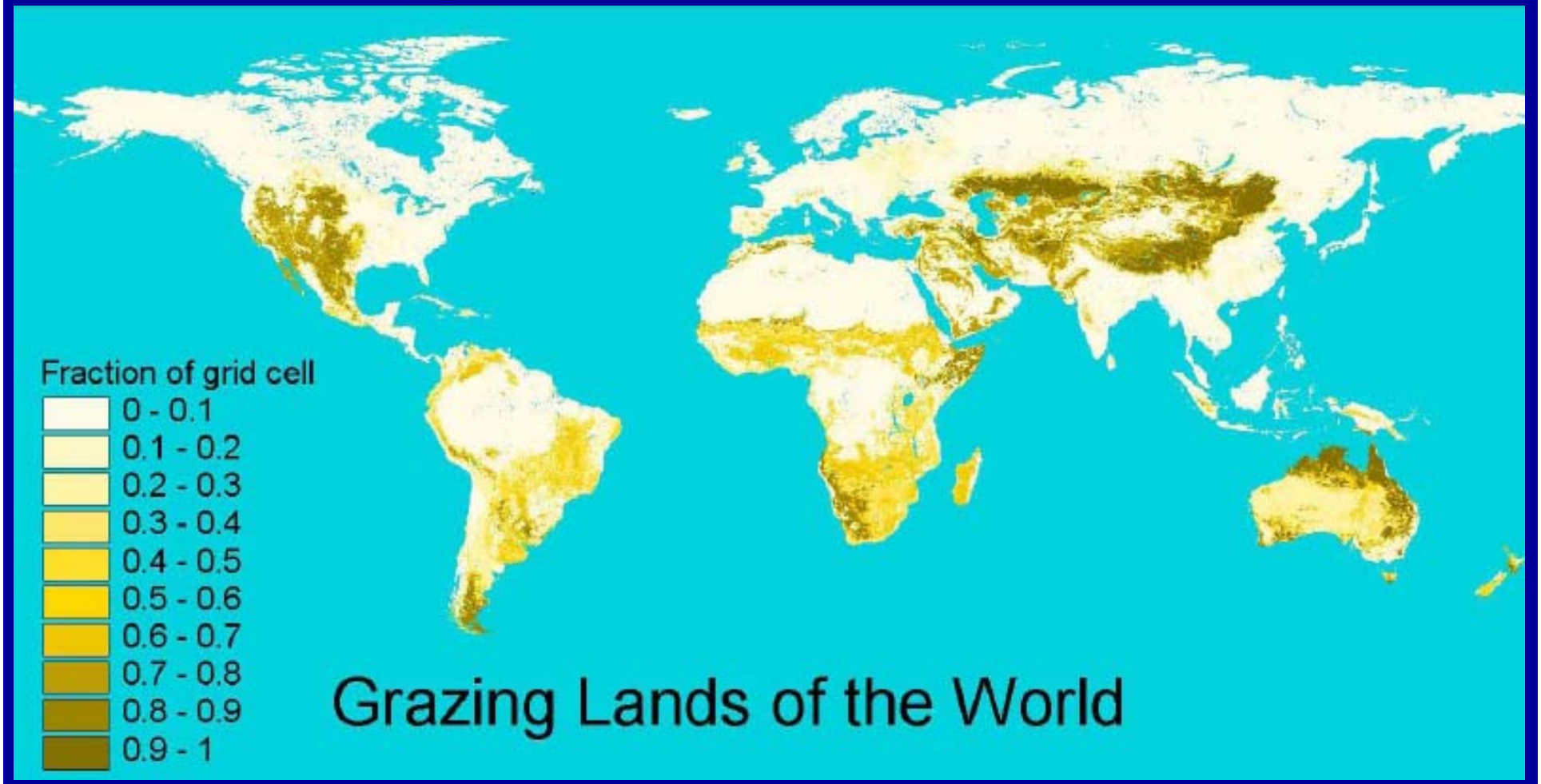
Inherent Land Quality Assessment



Country boundaries are not authoritative.

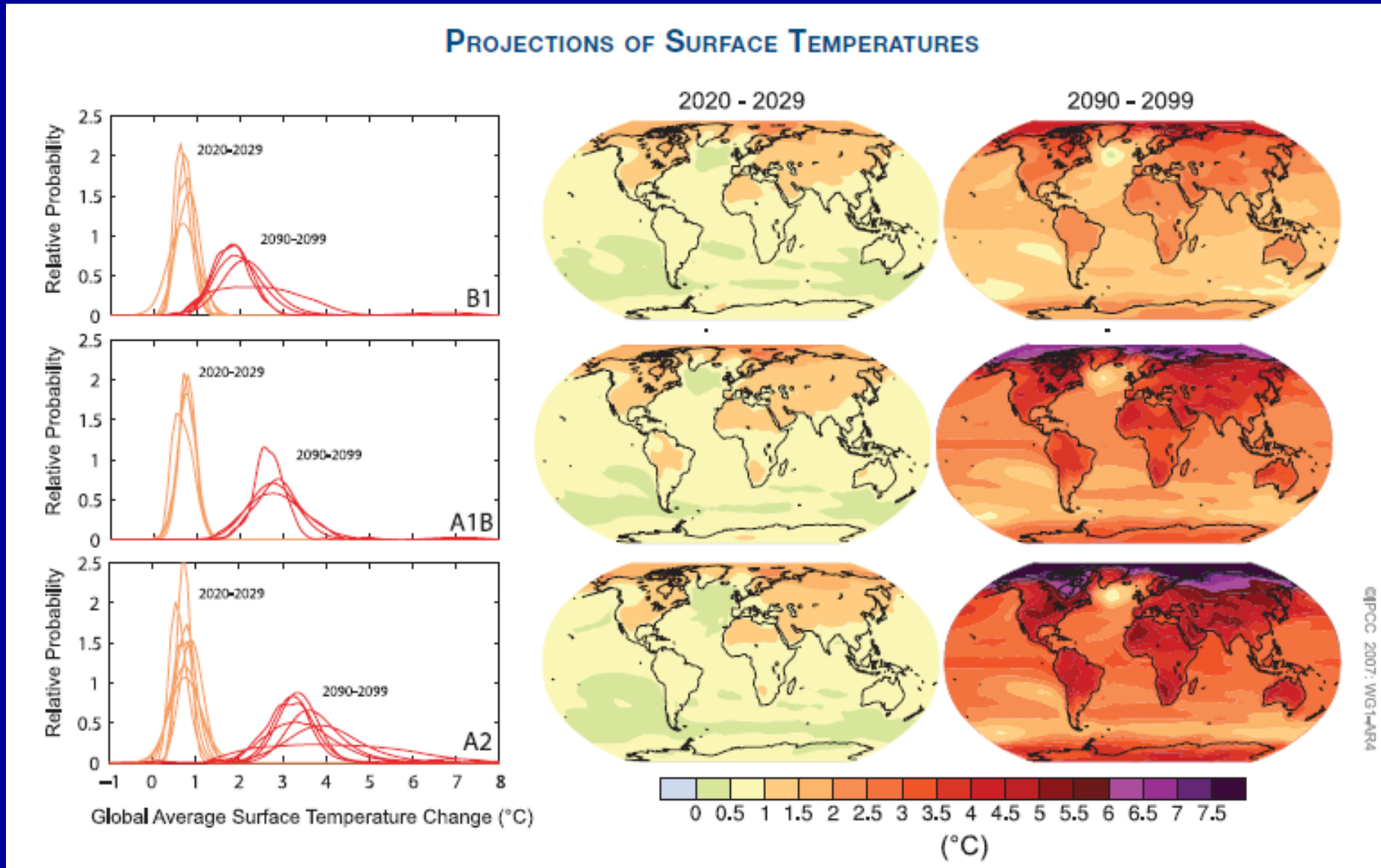
Washington DC, 1998


Croplands
of the
Earth
sage


Fraction of grid cell
0 - 0.1
0.1 - 0.2
0.2 - 0.3
0.3 - 0.4
0.4 - 0.5
0.5 - 0.6
0.6 - 0.7
0.7 - 0.8
0.8 - 0.9
0.9 - 1
Grazing Lands of the World

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.



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

Projected Patterns of Precipitation Changes

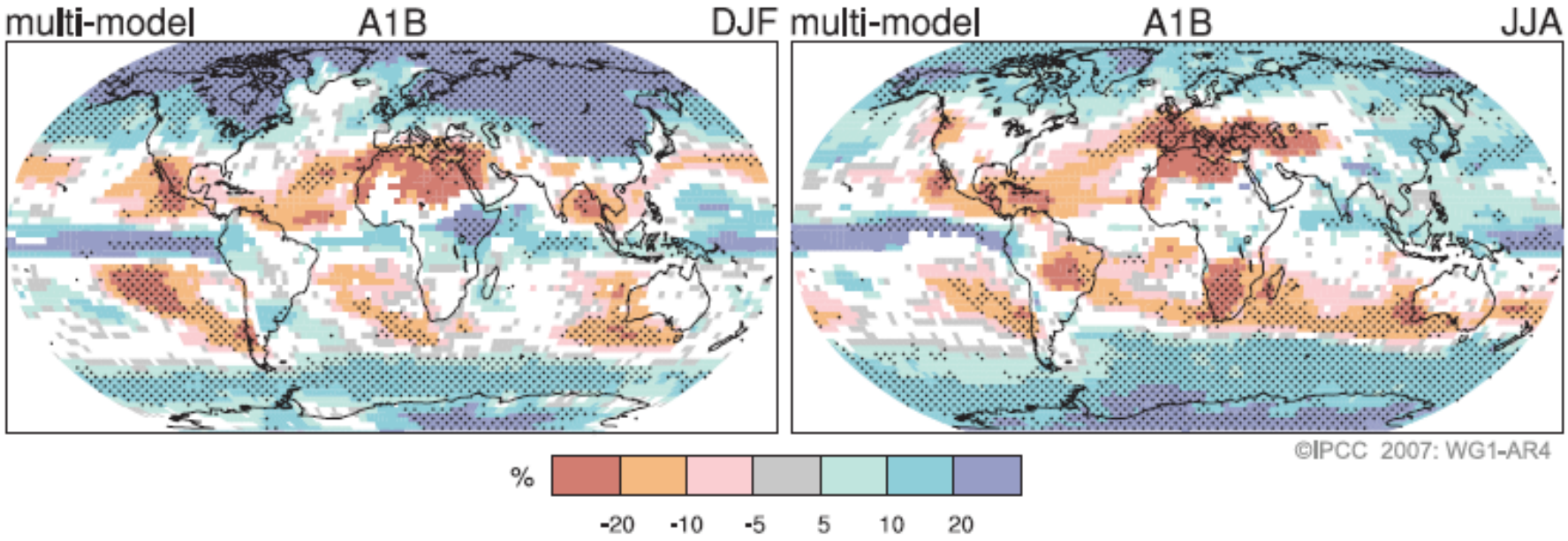


Figure SPM.7. *Relative changes in precipitation (in percent) for the period 2090–2099, relative to 1980–1999. Values are multi-model averages based on the SRES A1B scenario for December to February (left) and June to August (right). White areas are where less than 66% of the models agree in the sign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

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 Investments 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

World Agriculture in Disarray*

- Most high income countries subsidize their agriculture, distorting relative returns to various outputs and inducing larger total investment in agriculture relative to other sectors.
- Many LDCs' food policies turn 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 further distort what is produced where.

*Title of a famous book by D. Gale Johnson

OECD Producer Support Estimates

(Percent of Gross Receipts)

Country	1986-88	2004-06
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

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)

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 can increase land and water productivity faster than world demand grows.

Agriculture Has Been Off the Global Development Agenda

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

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Key Outcomes 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.