



Four Challenges or One? Population, Food, Energy, Climate

Patrick Cunningham

Chief Scientific Adviser to the Government

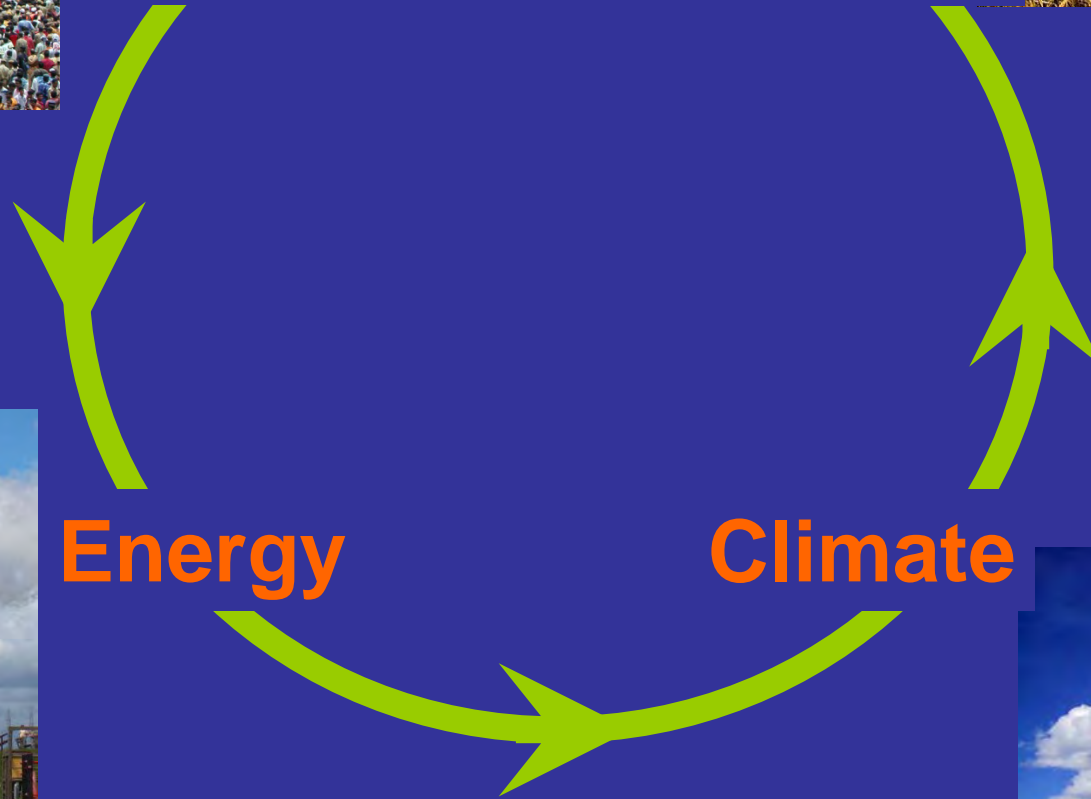
METIER, Brussels, 4-6 November, 2009



Population



Food



Energy

Climate



World Population Growth 1950-2050

Billion

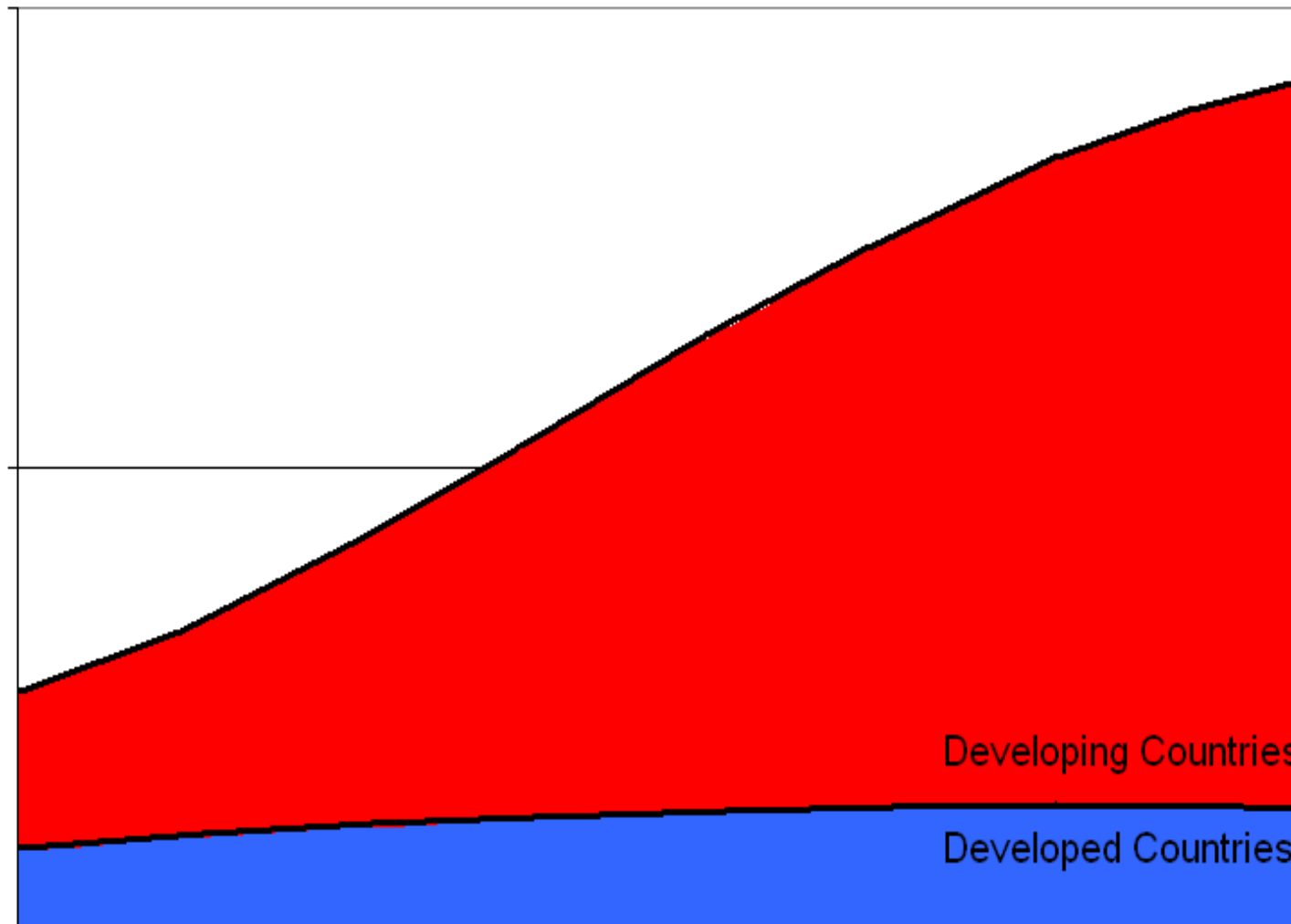
10

5

1950

2000

2050

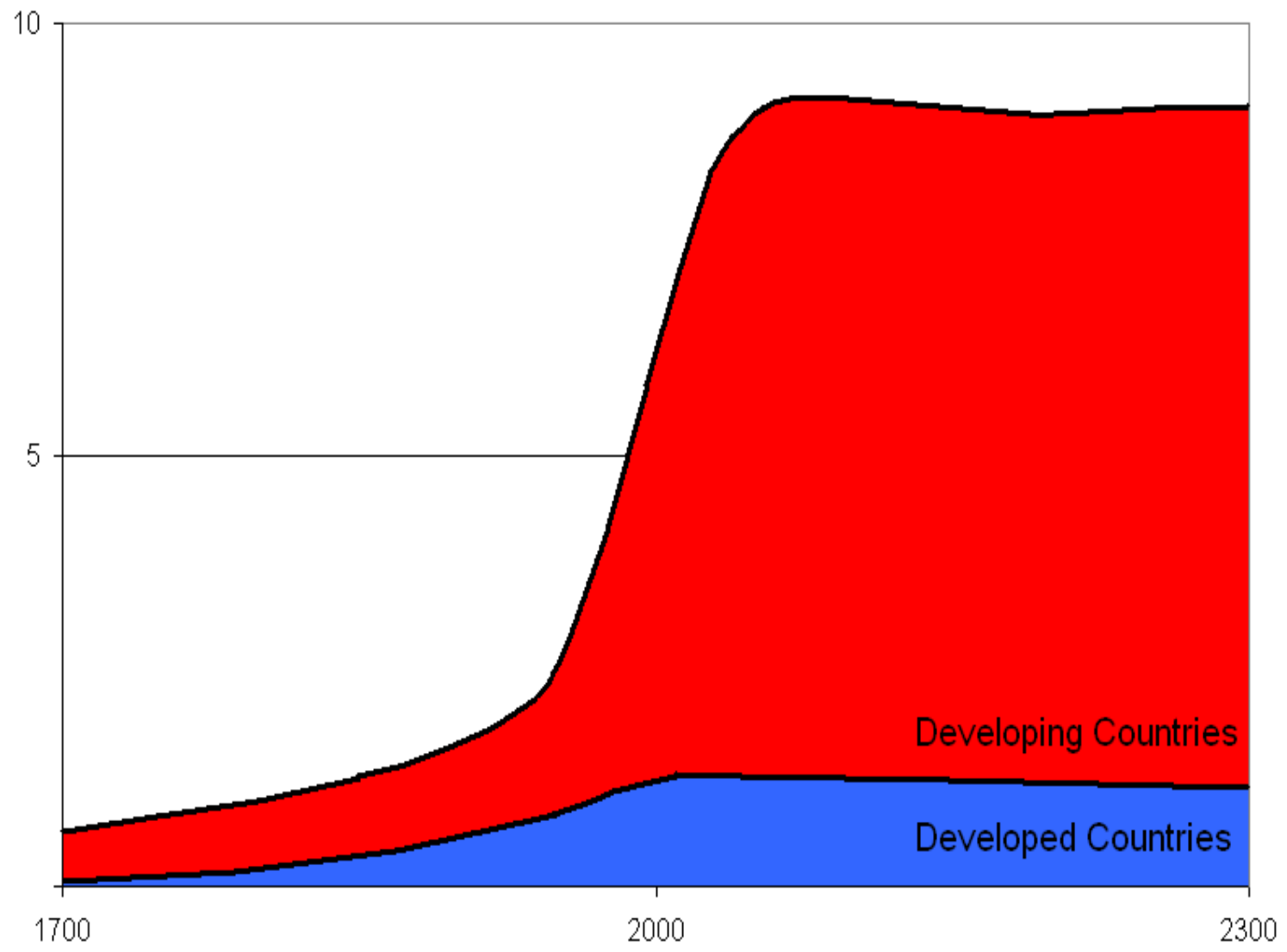


Developing Countries

Developed Countries

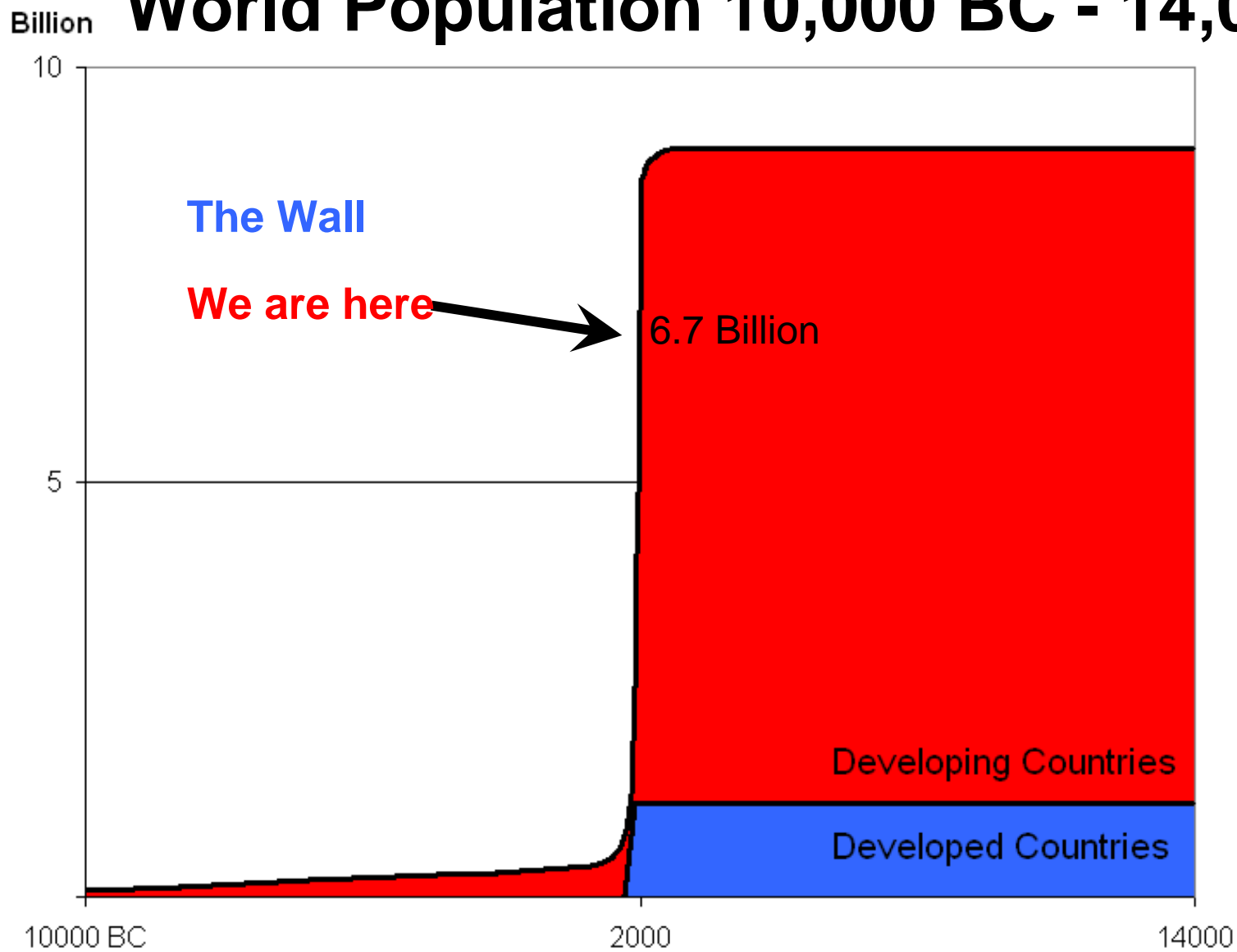
Source: *World Population Prospects, United Nations Secretariat, 2006*

Billion World Population Growth 1700-2300



Source: World Population Prospects, United Nations Secretariat, 2006

World Population 10,000 BC - 14,000 AD



Source: *World Population Prospects, United Nations Secretariat, 2006*

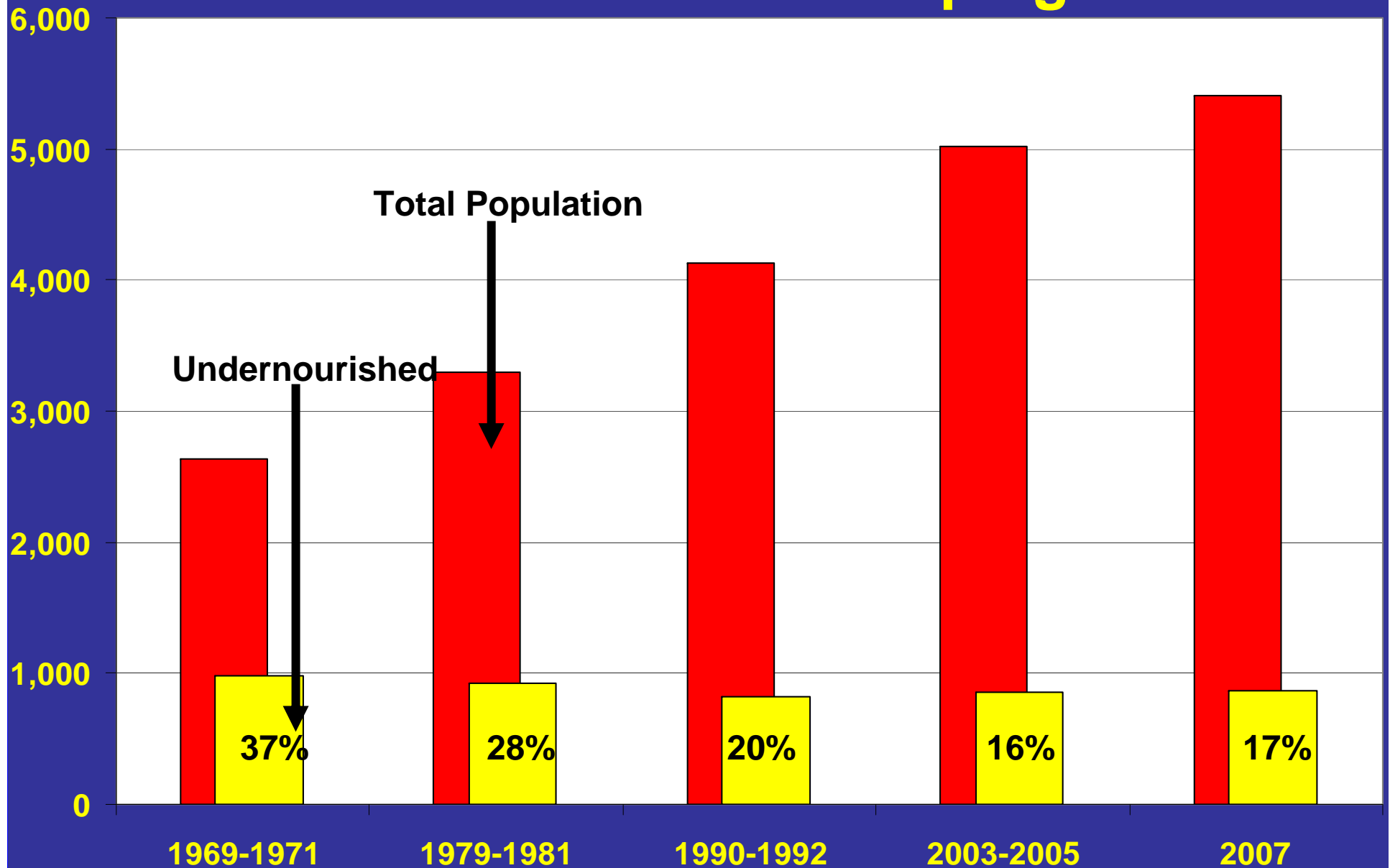


**Food expenditure :
\$1.23 / week**

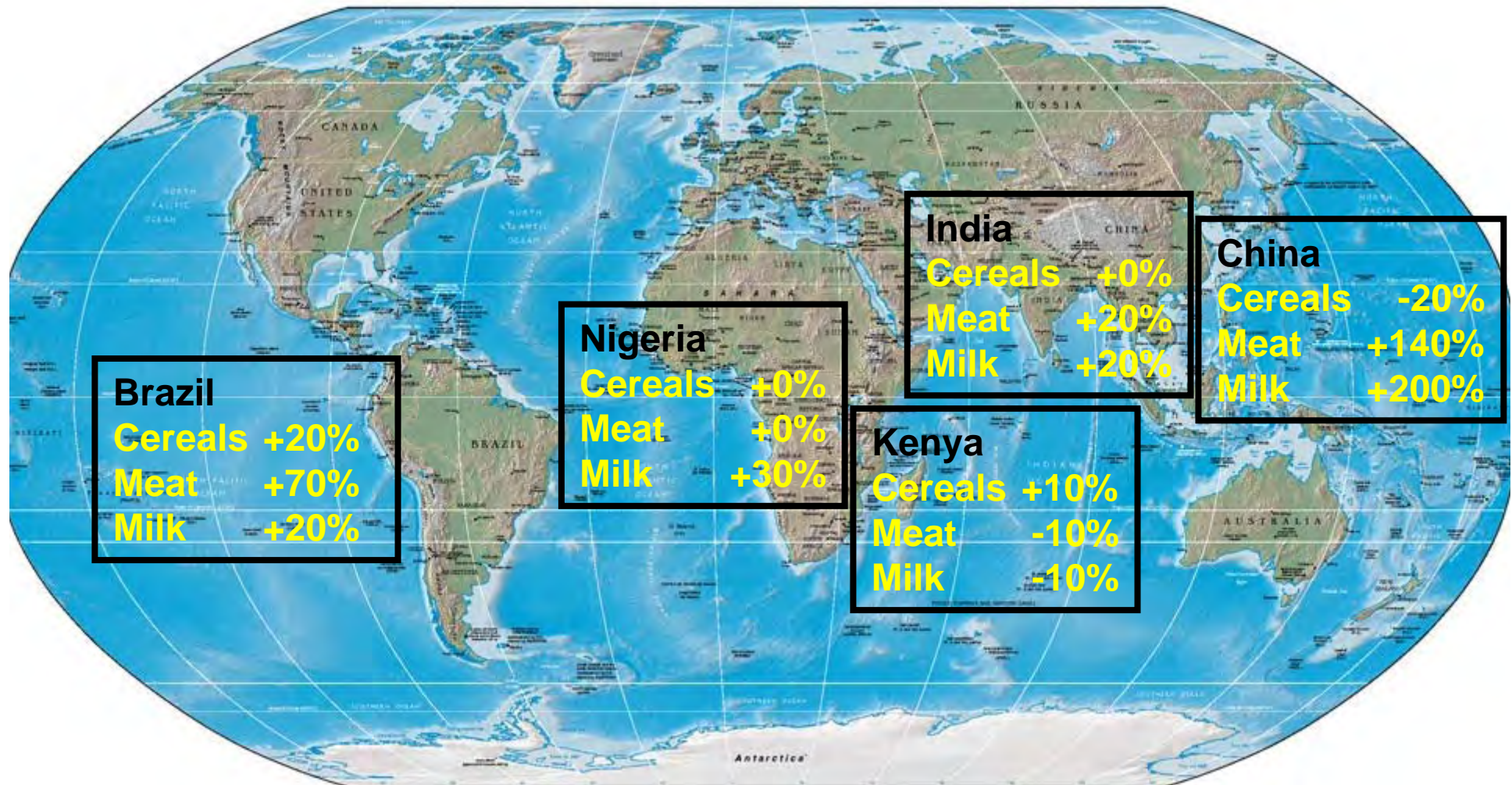


**Food expenditure:
\$500.07 / week**

Under-nutrition in the Developing World

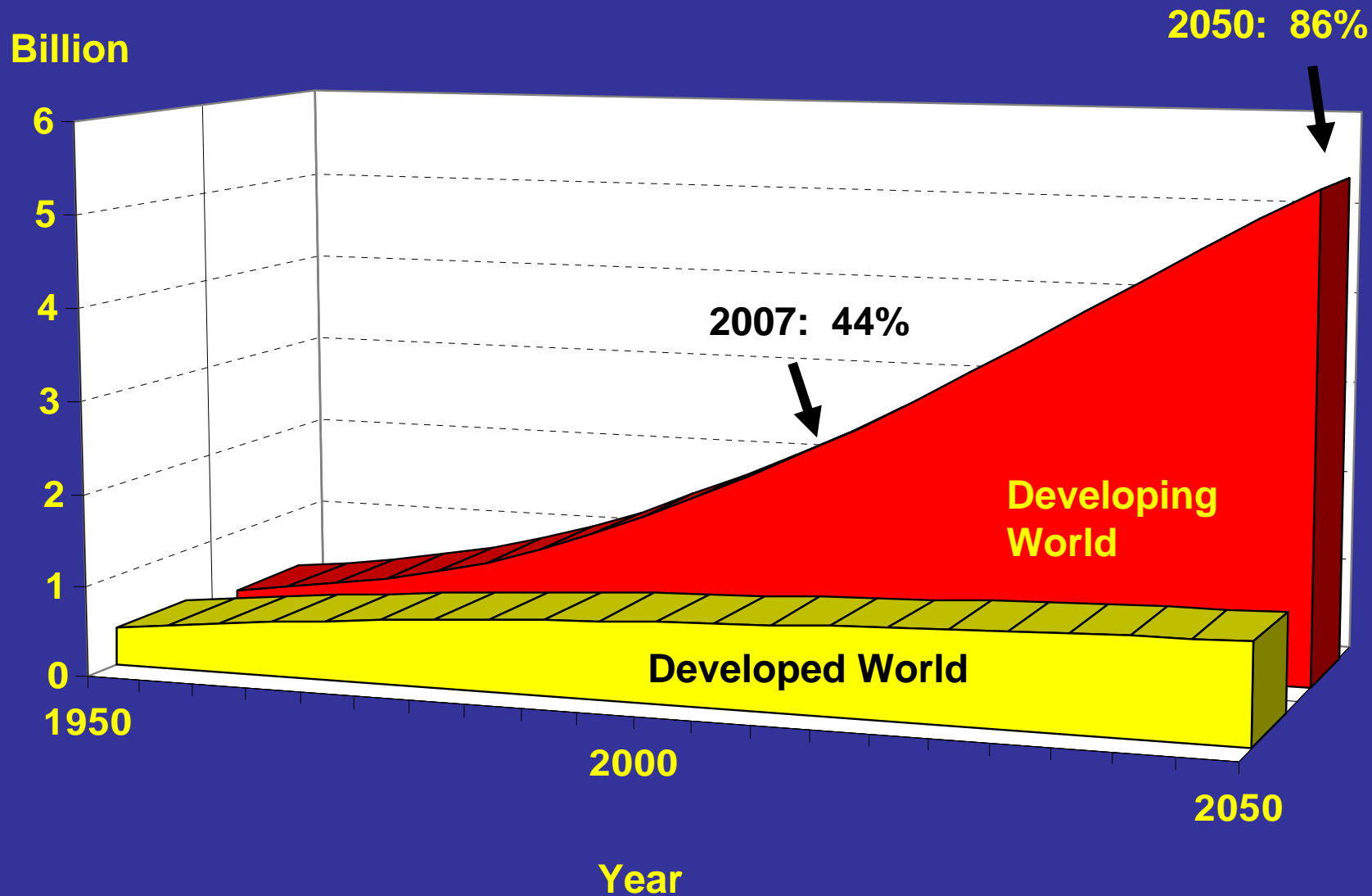


Changing Diets 1990-2005 (per cent change)

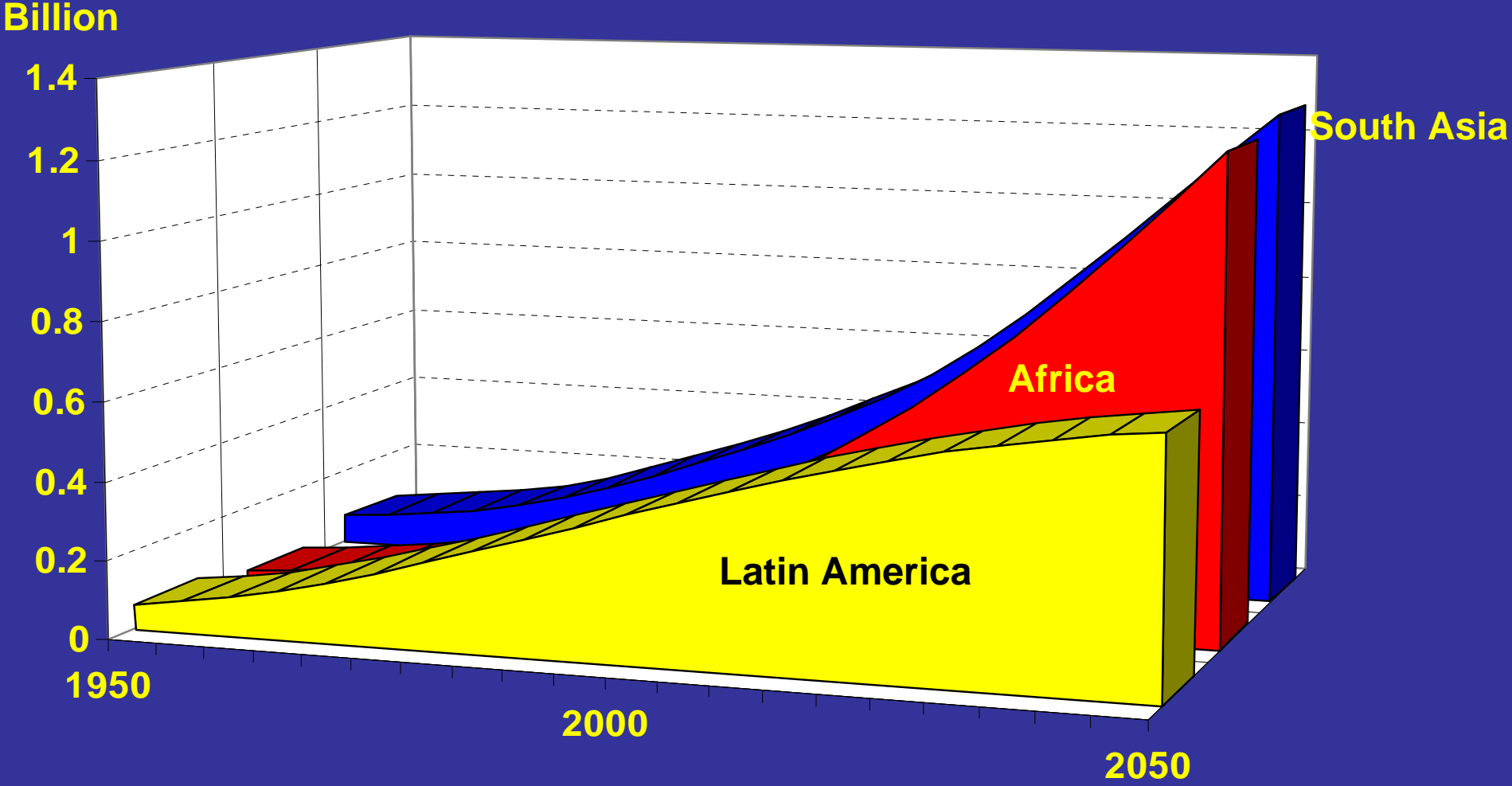


Source: von Braun, IFPRI, 2007

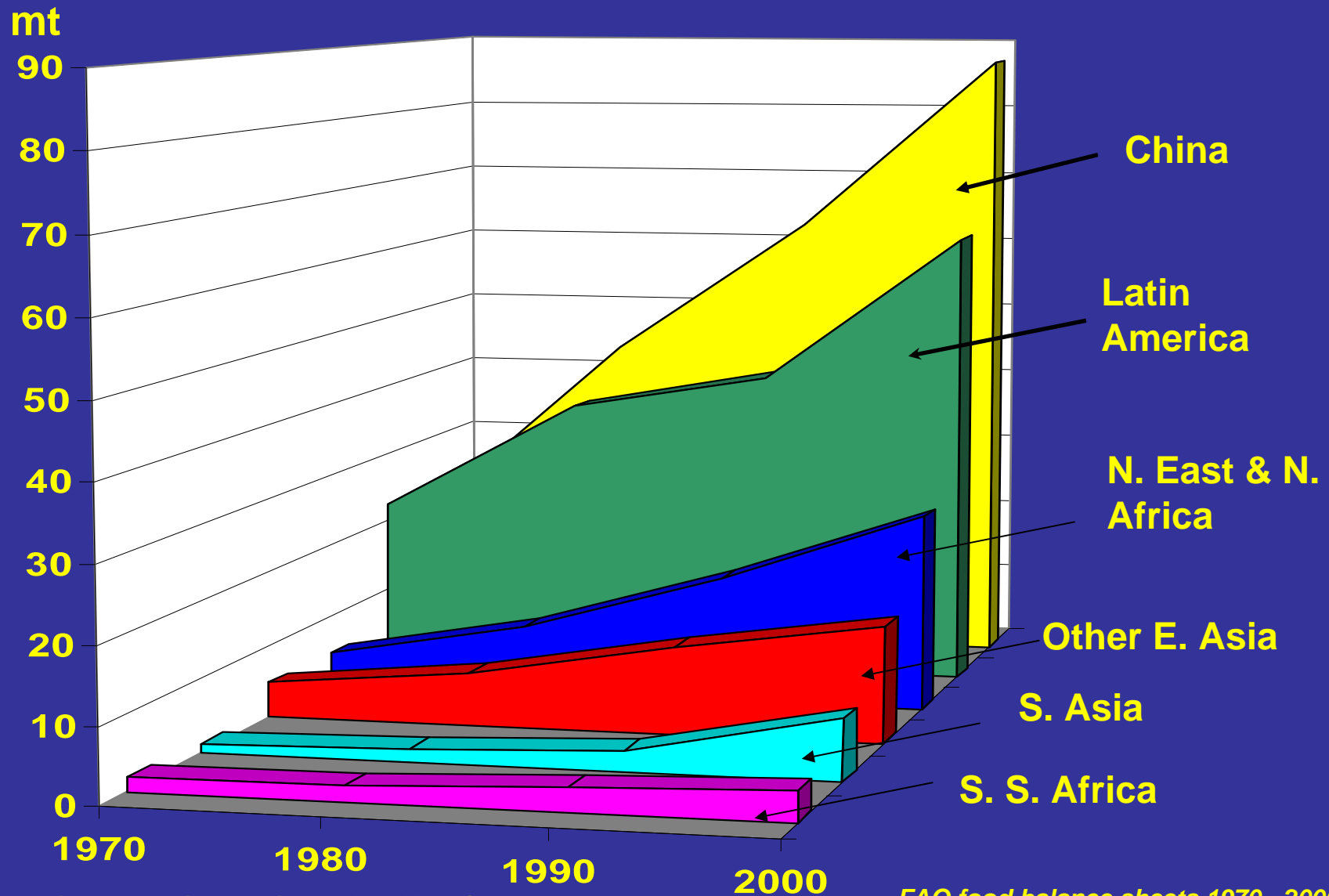
Urban Growth



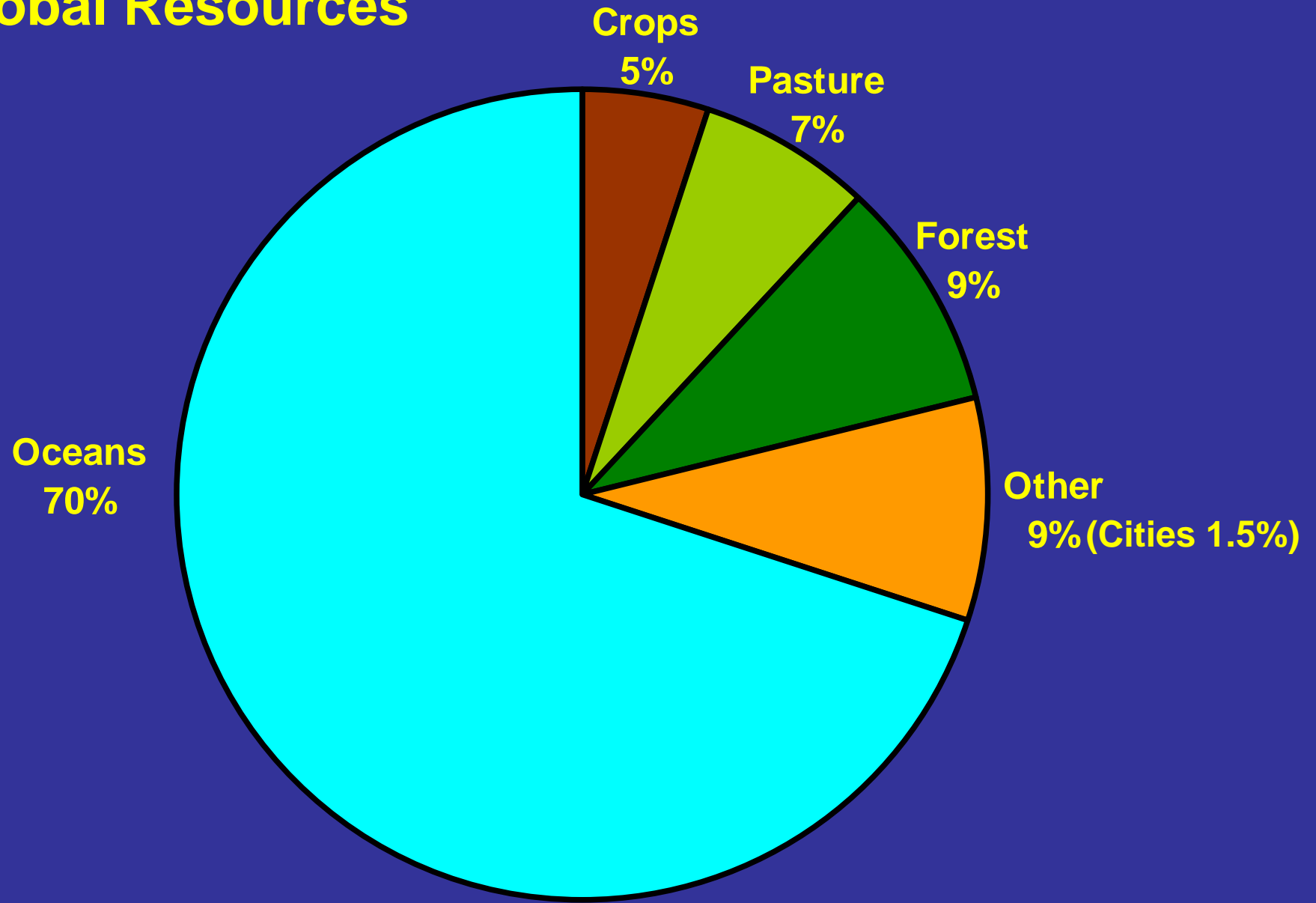
Urban Growth (2)



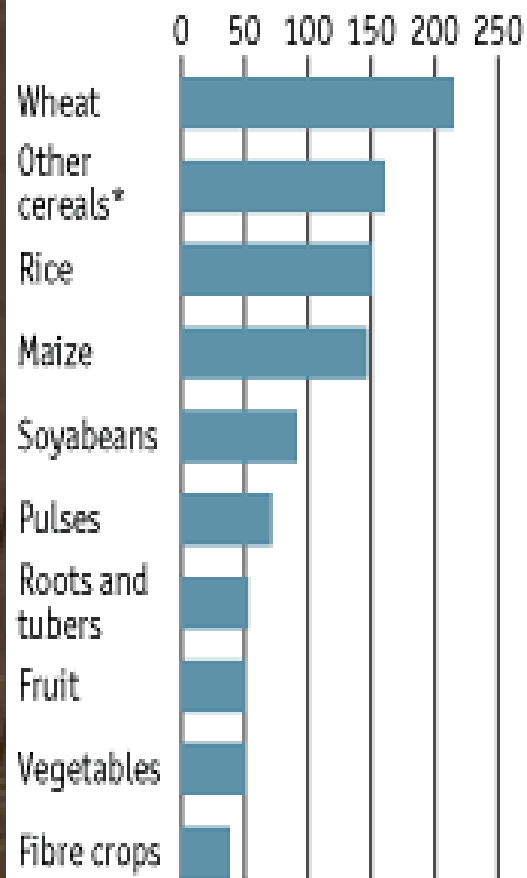
Cereal Use in Animal Feed in Developing Countries



Global Resources



World crops, 2004, m hectares



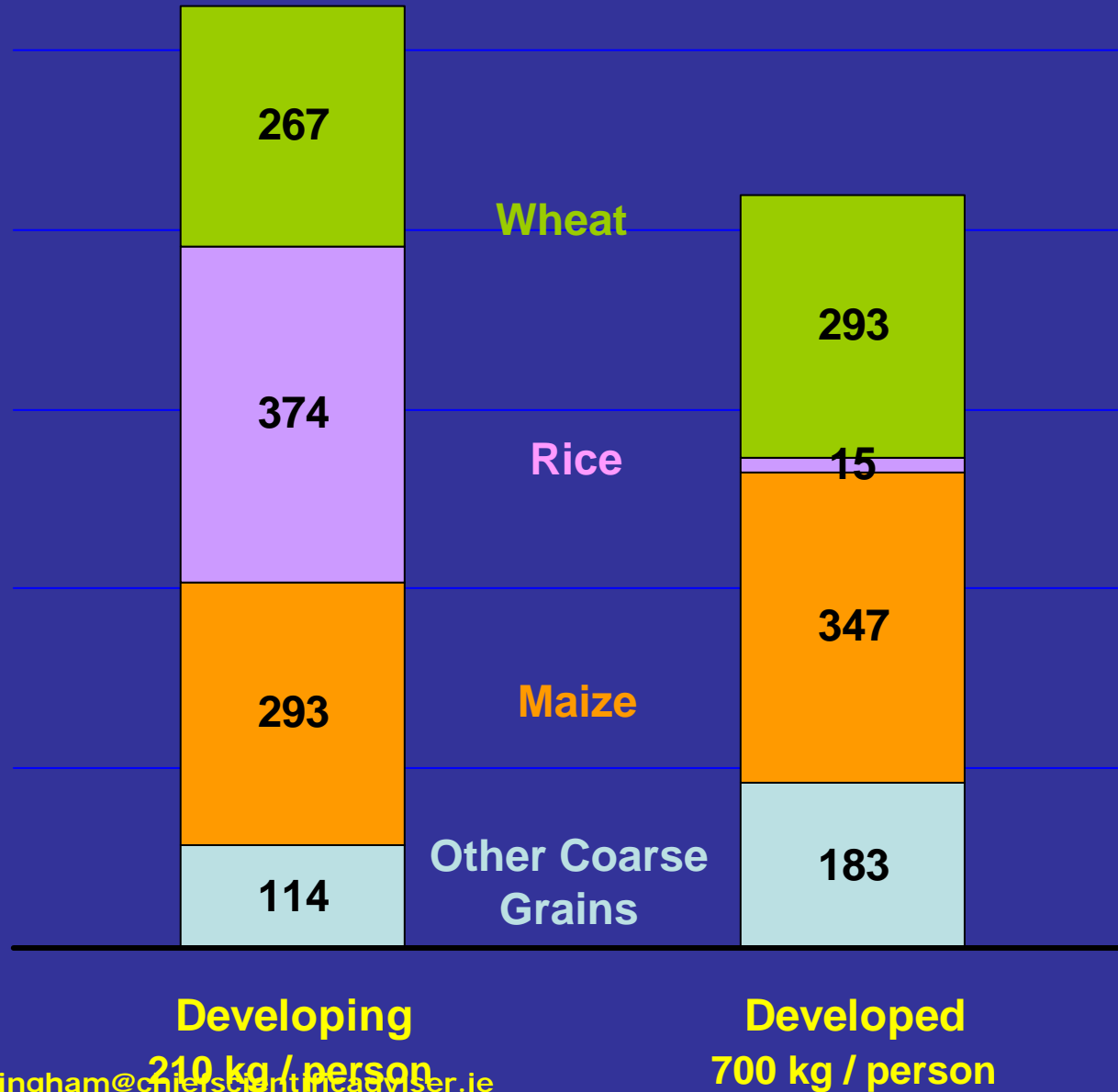
* Barley, rye, millet, etc

Source: Food and Agriculture Organisation



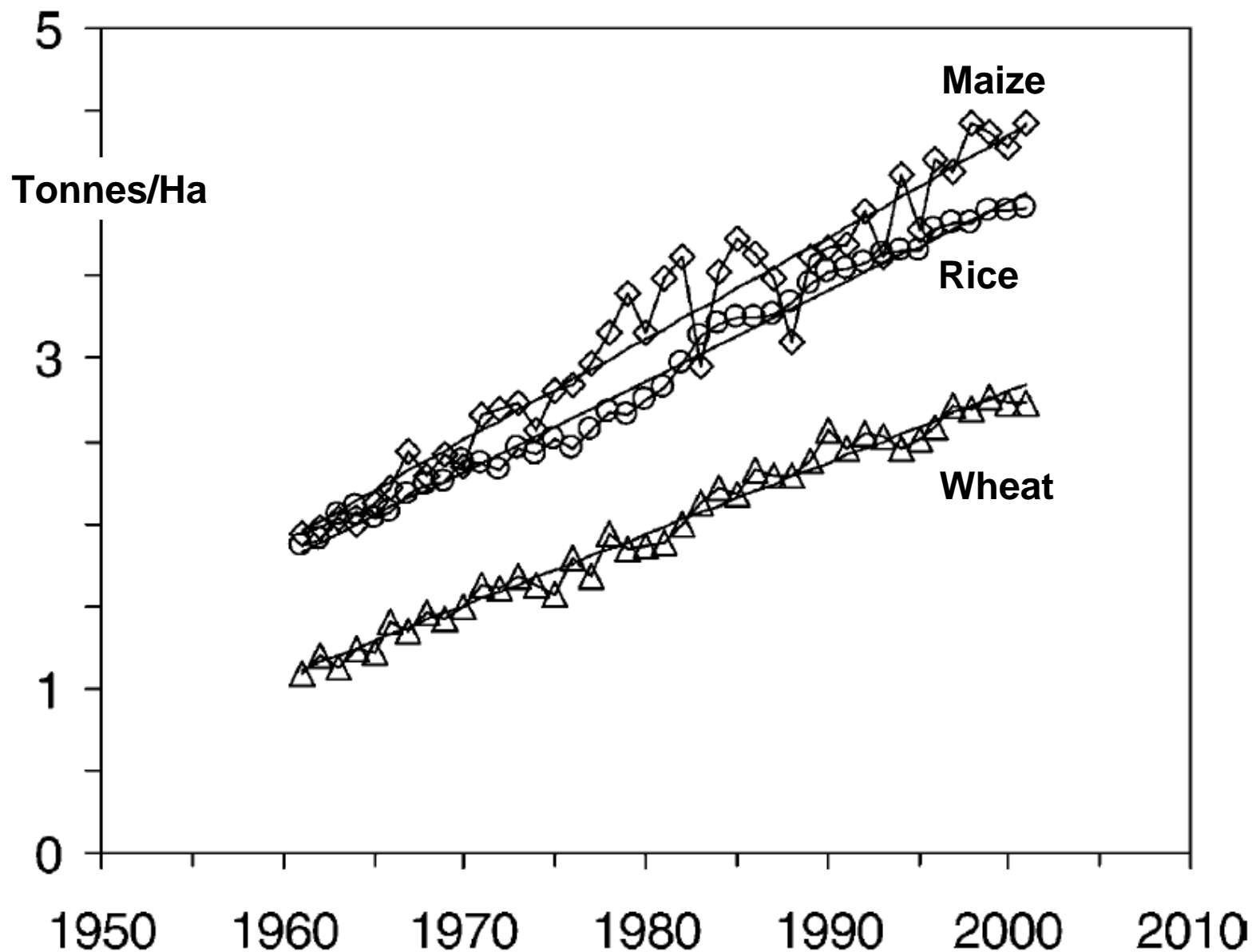
Global Cereal Production, 2003

(1,886 million tonnes)



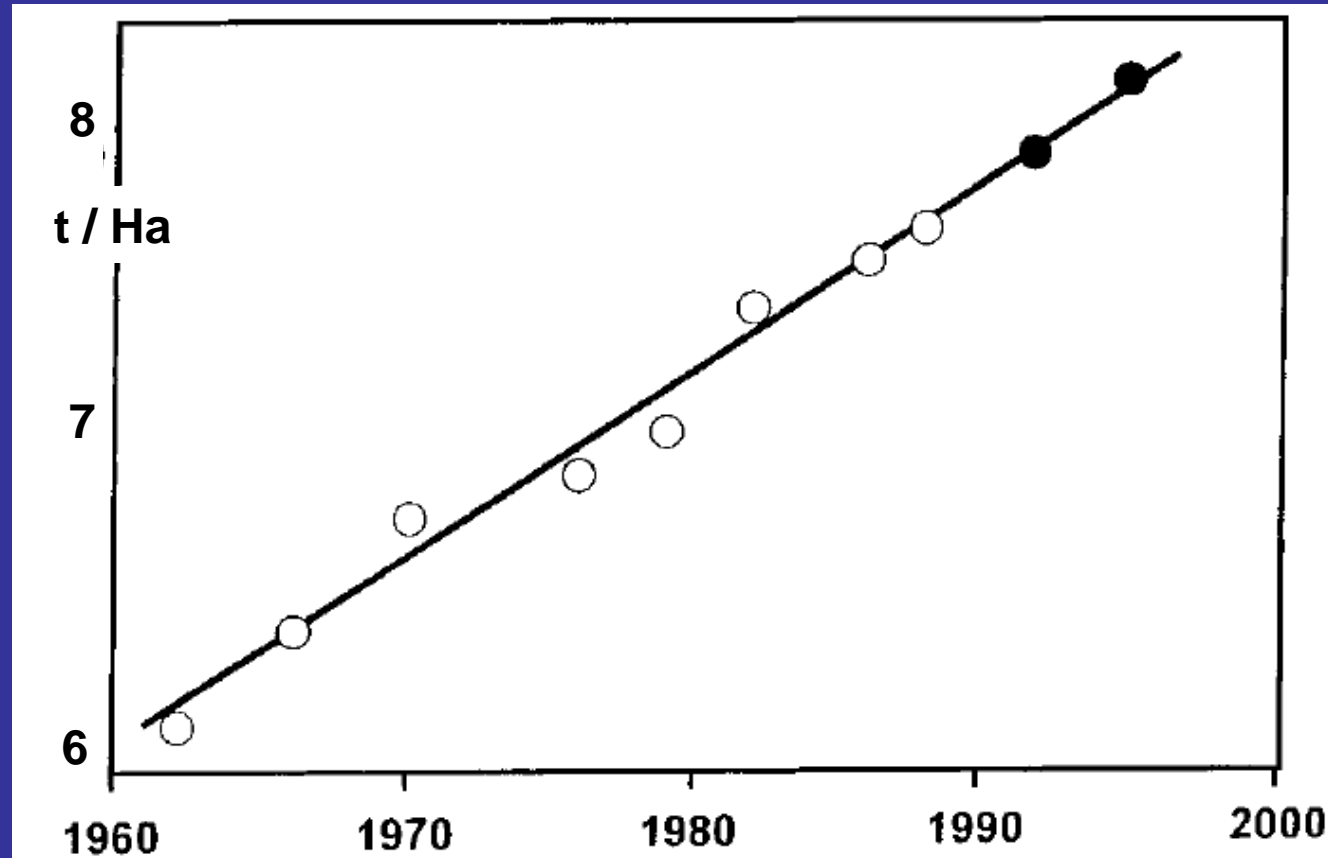
Source: FAO Stat

World Cereal Yields



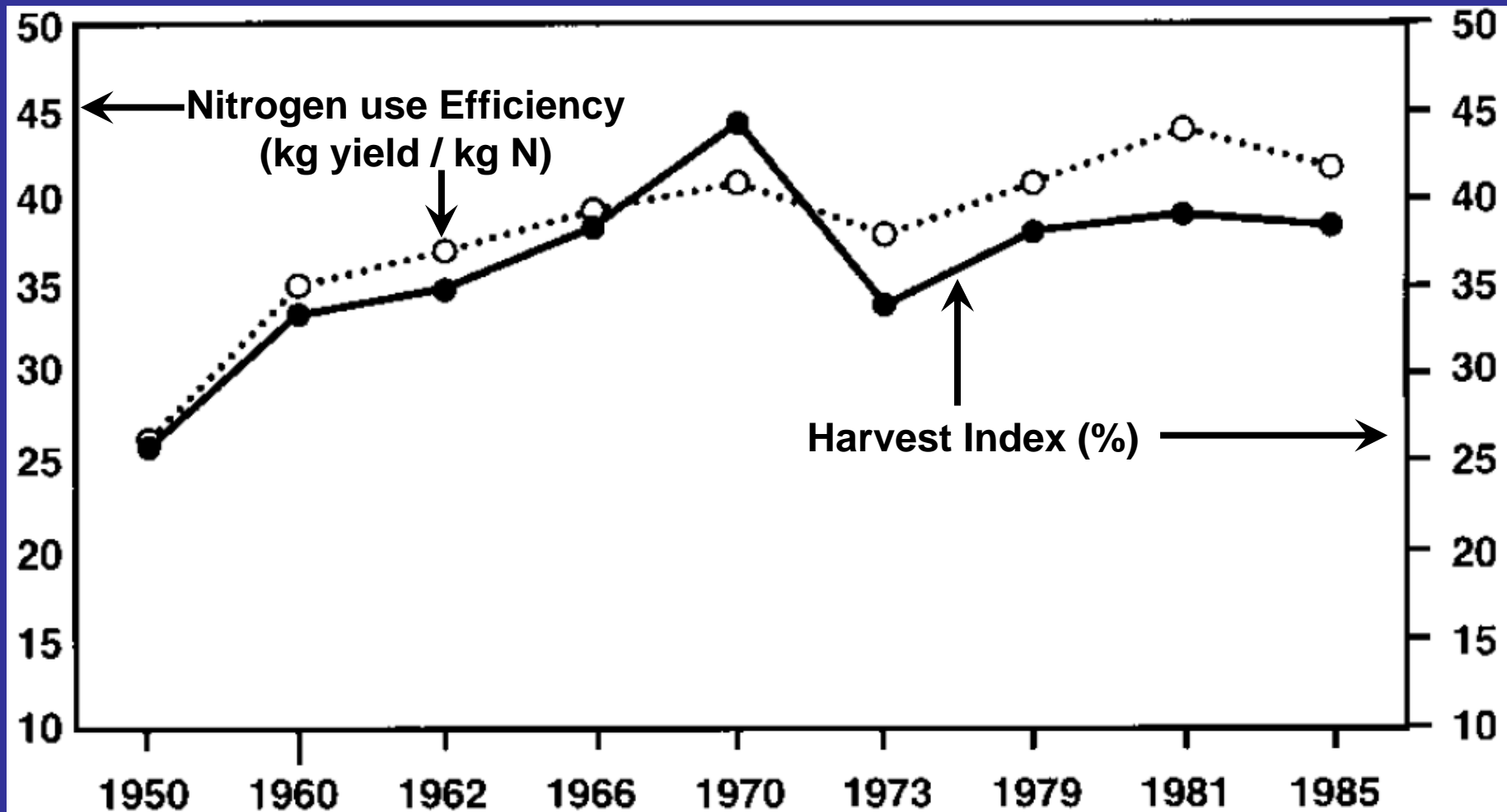
Source: Trends in maize, rice and wheat yields, Hafner, 2003

Irrigated Wheat Yield



Source: Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT)

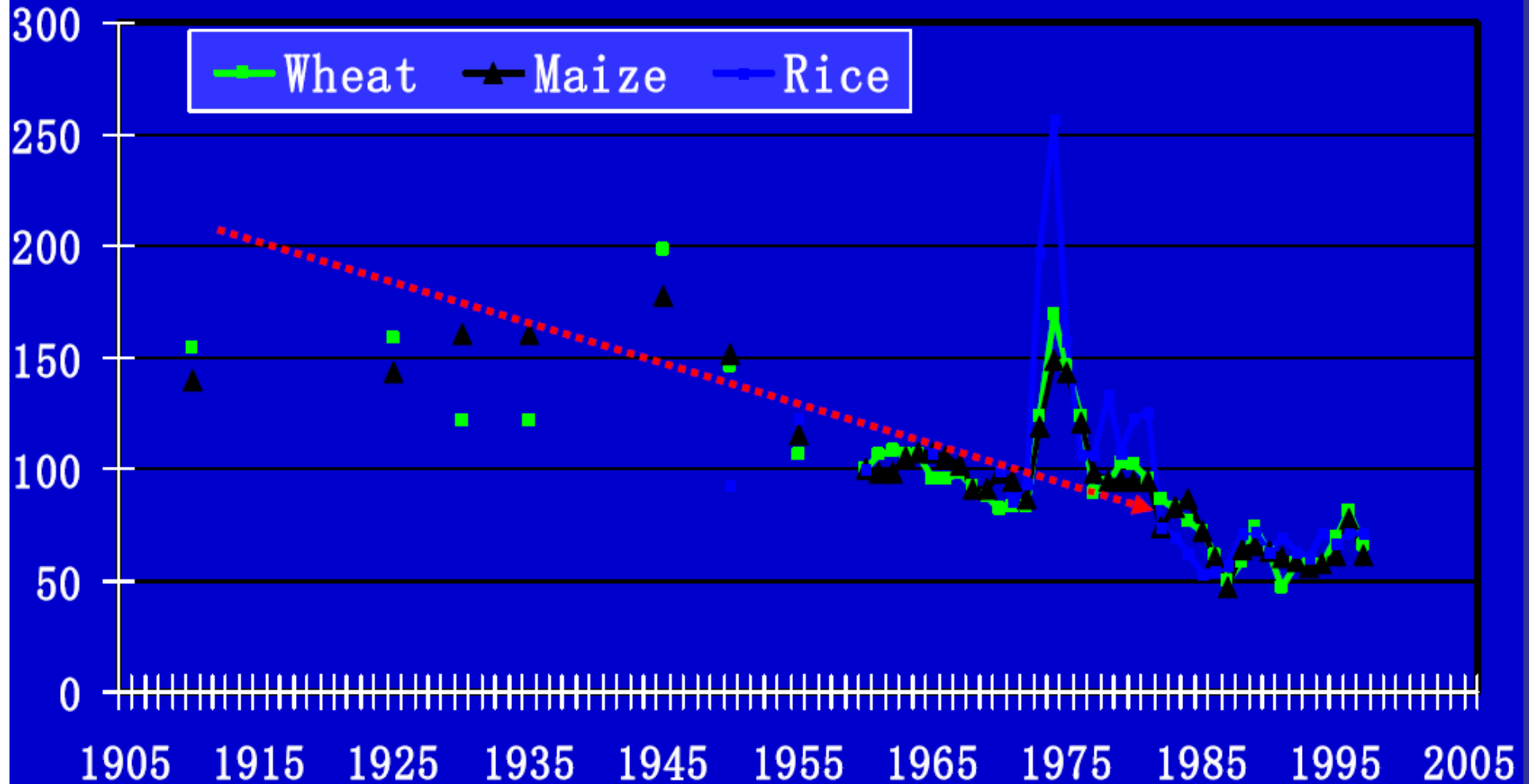
Nitrogen use Efficiency



Source: *Physiological and Genetic Changes of Irrigated Wheat*, Reynolds et al, 1999

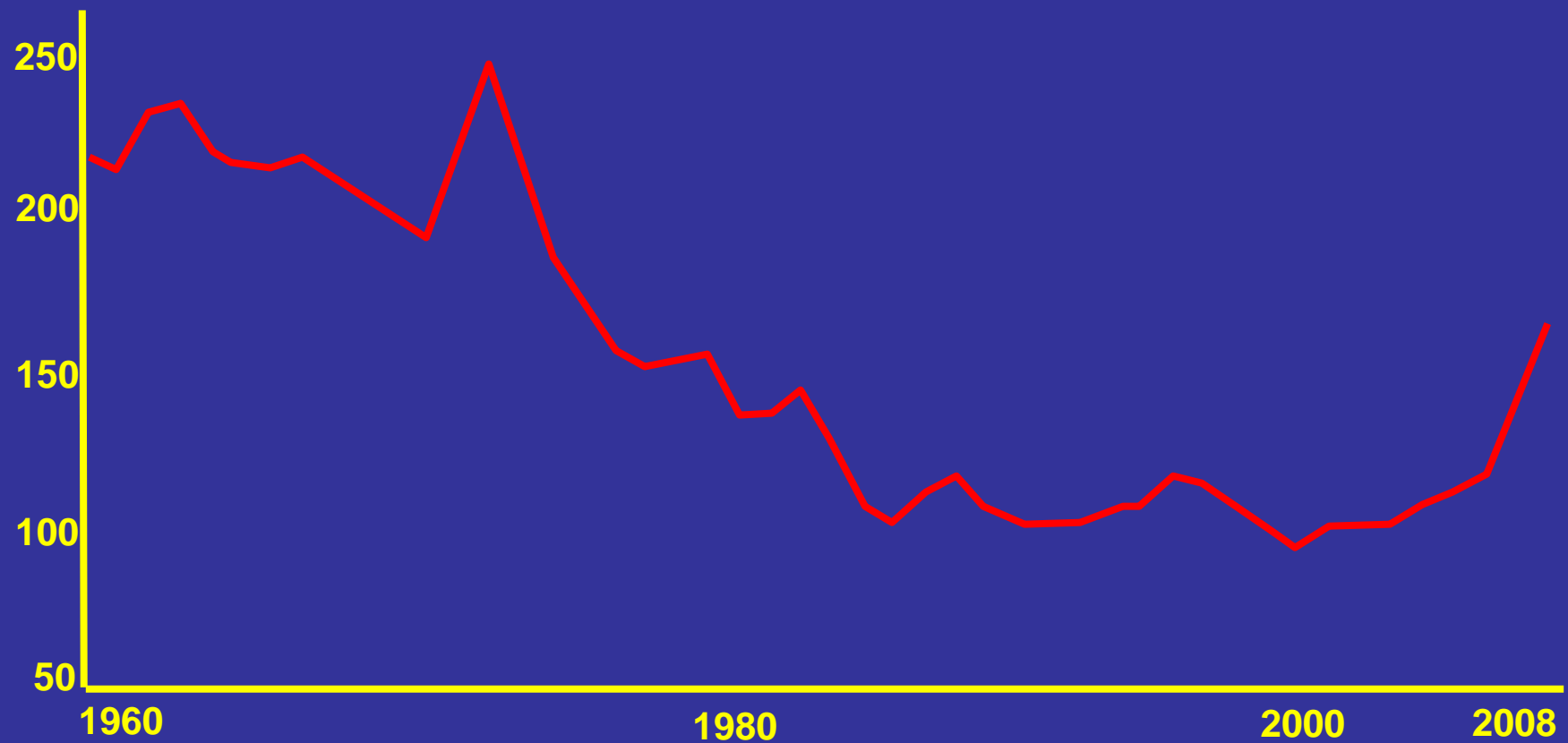
Cereal Price Index, 1905-2000

(All prices = 100 in 1960)



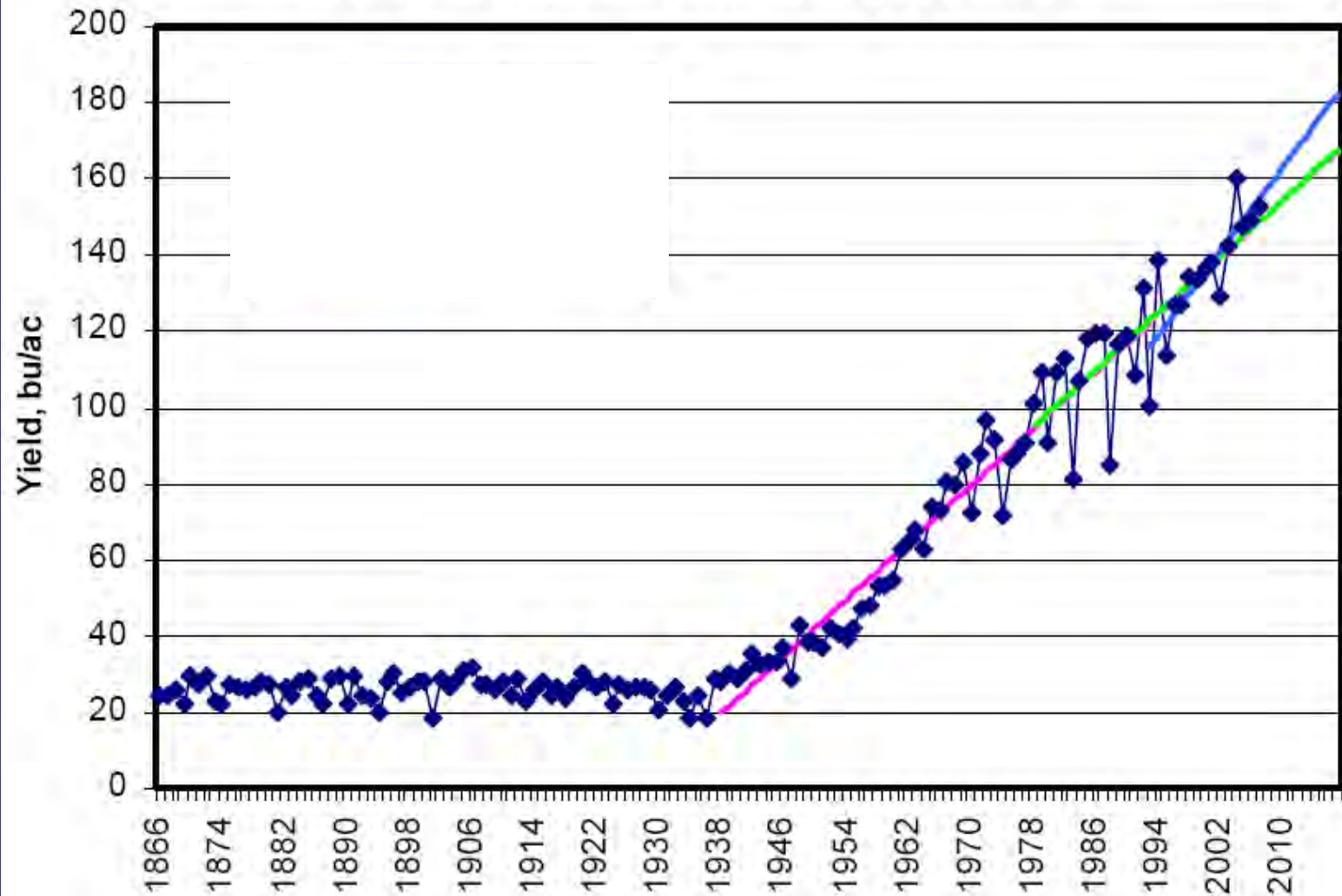
Source: von Braun, IFPRI, February 2008

Annual Food Price Index



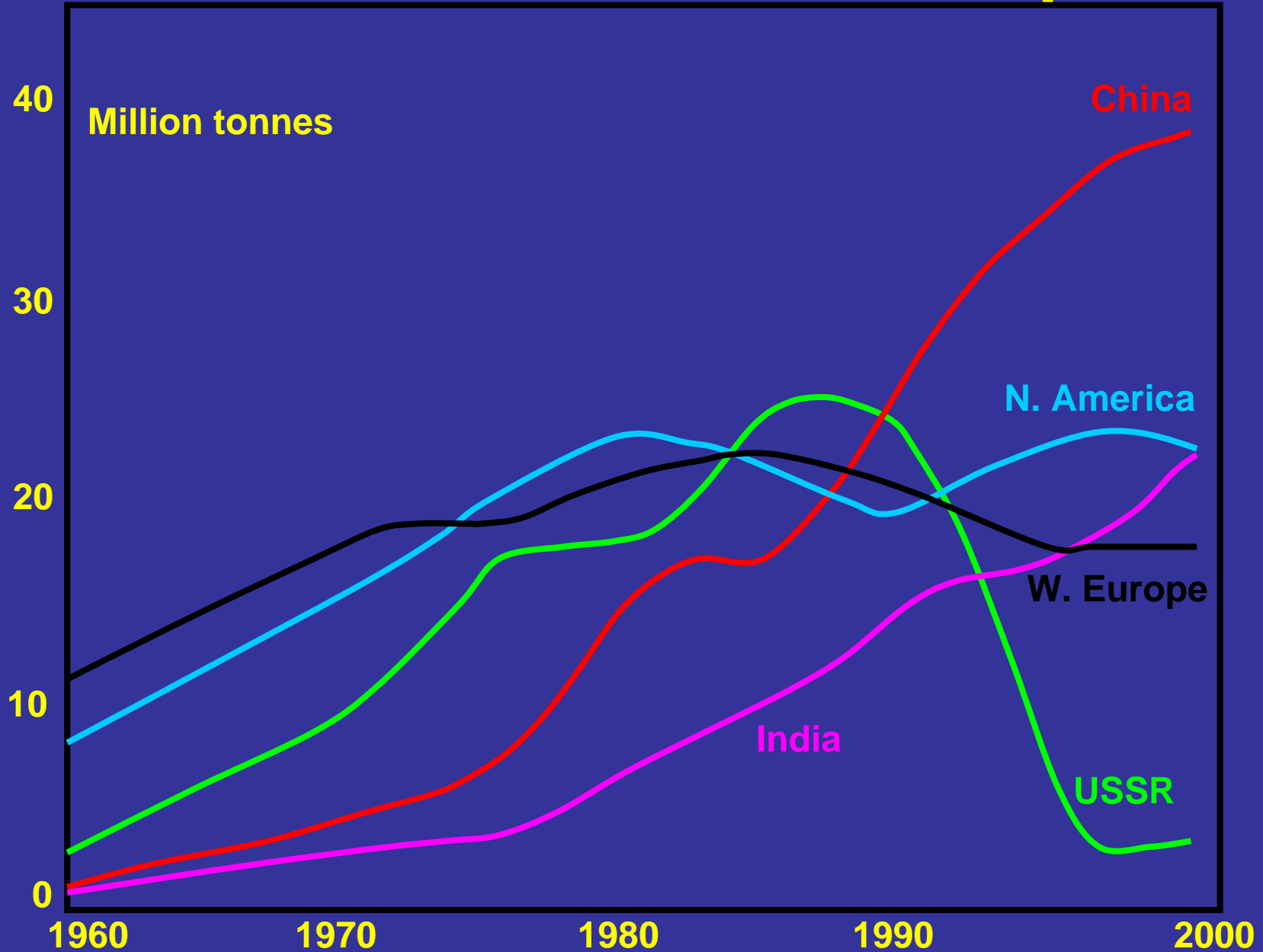
Source: FAO 2008

U.S. Corn Yield -- Actual and Predicted



Source: *Ethanol Industry – Impact on Corn and DGS Production*, Dhuyvetter et al.

Trends in Fertilizer Consumption



1 Litre Diesel

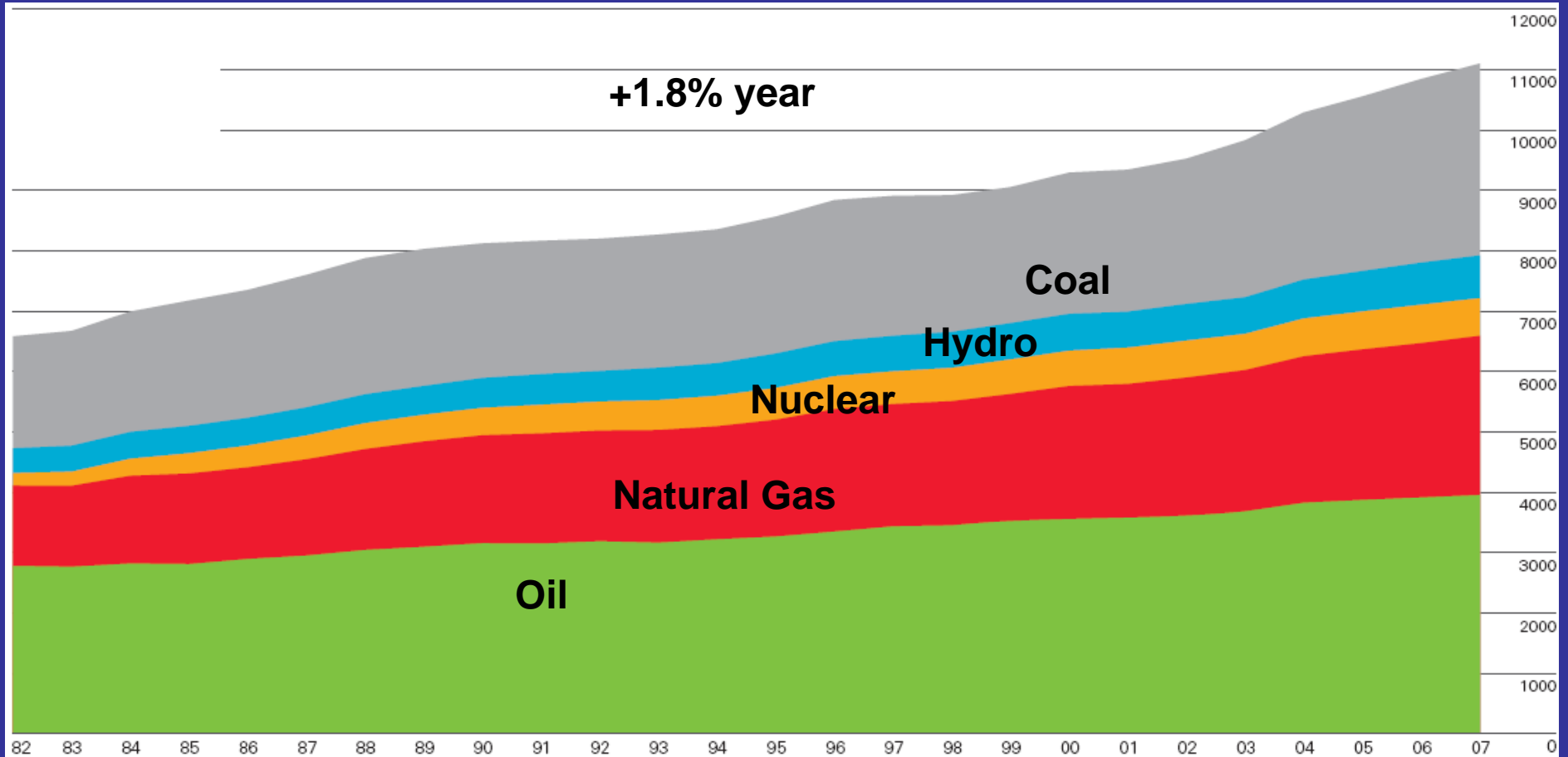
7 Kg Grain

1 Kg Chicken

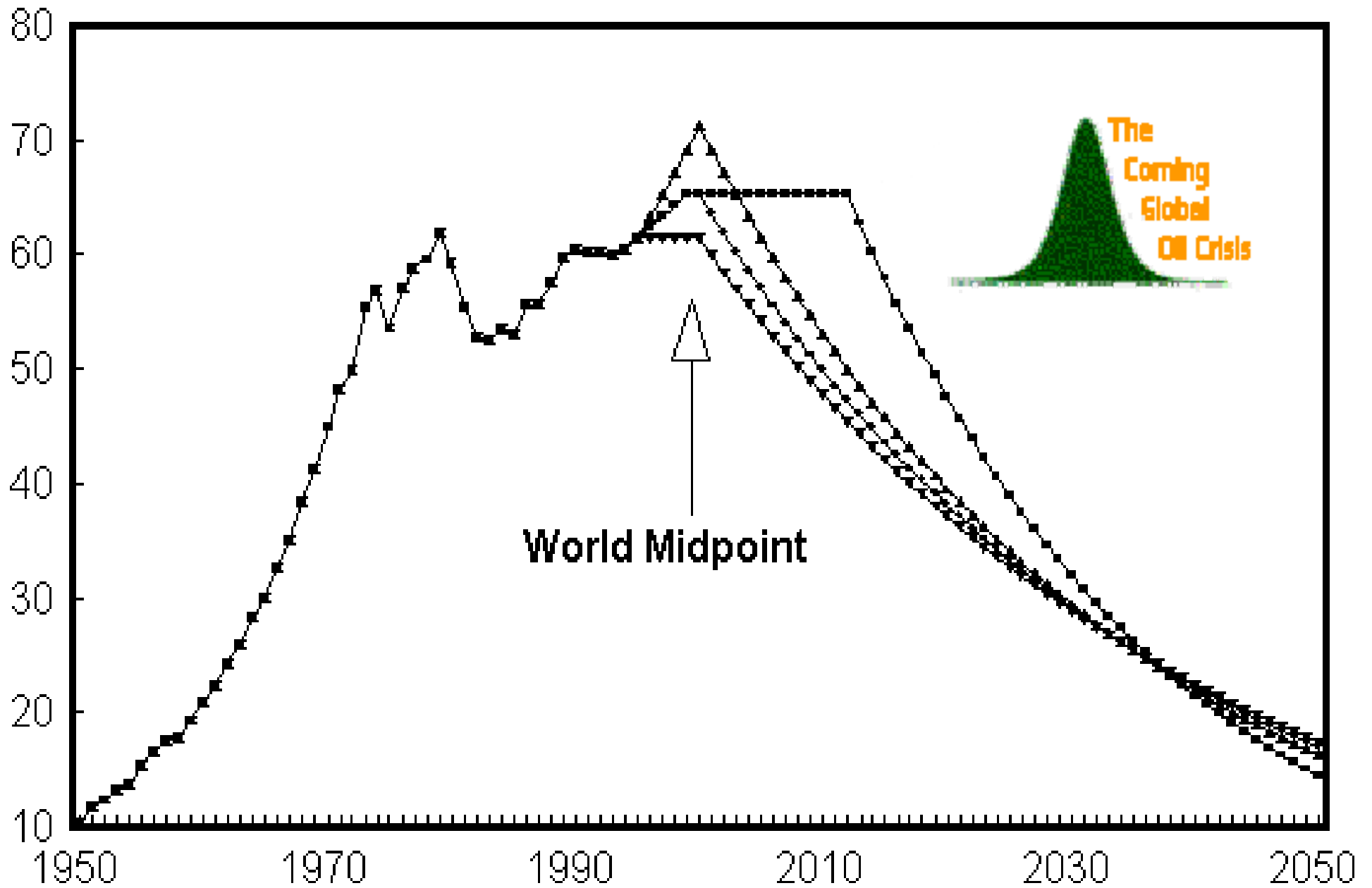
1 Kg Pigmeat

10 Litres Milk

Global Energy Consumption (Mtoe) 1982 - 2007

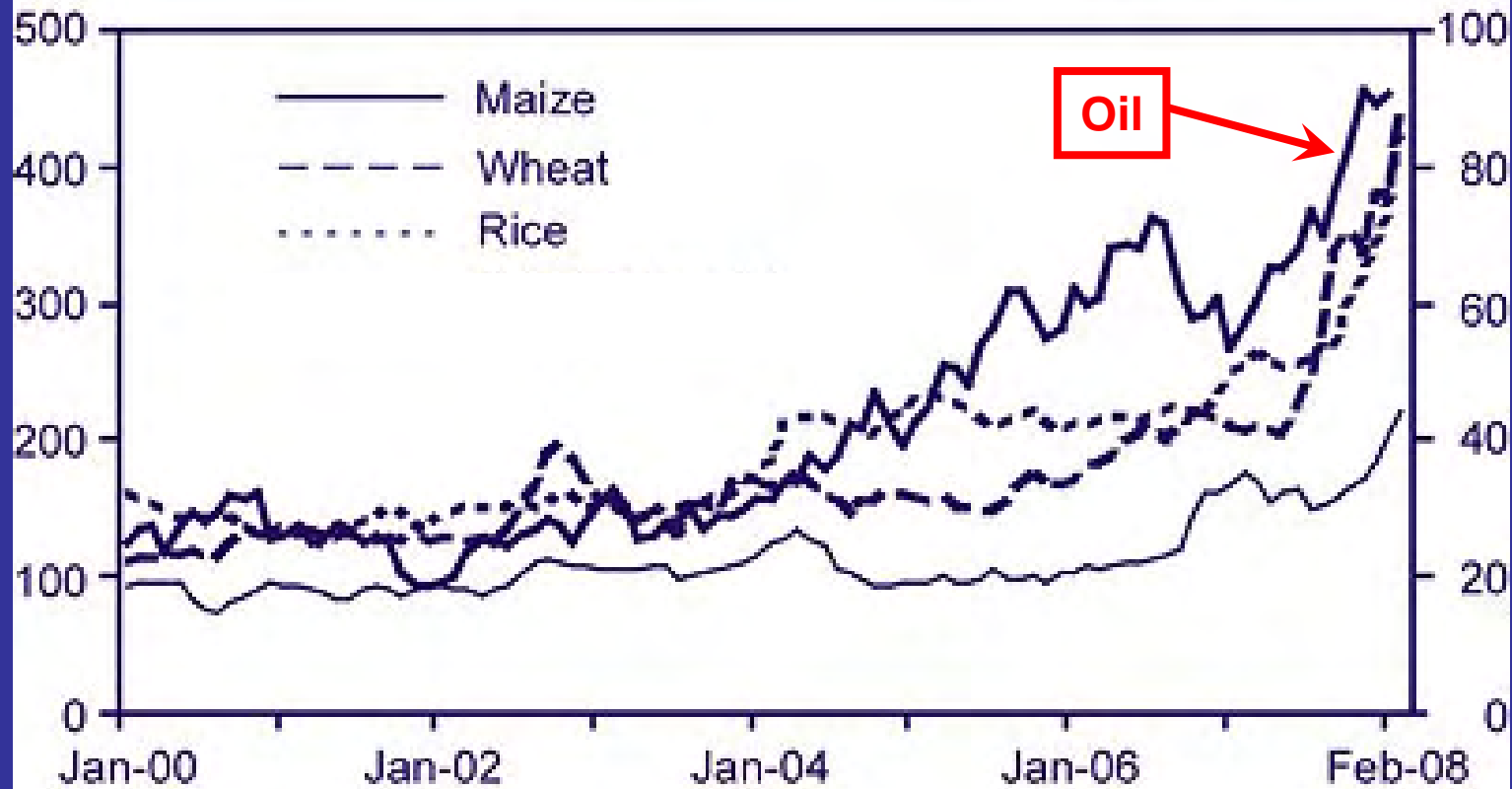


Source: BP Statistical Review of World Energy, June 2008

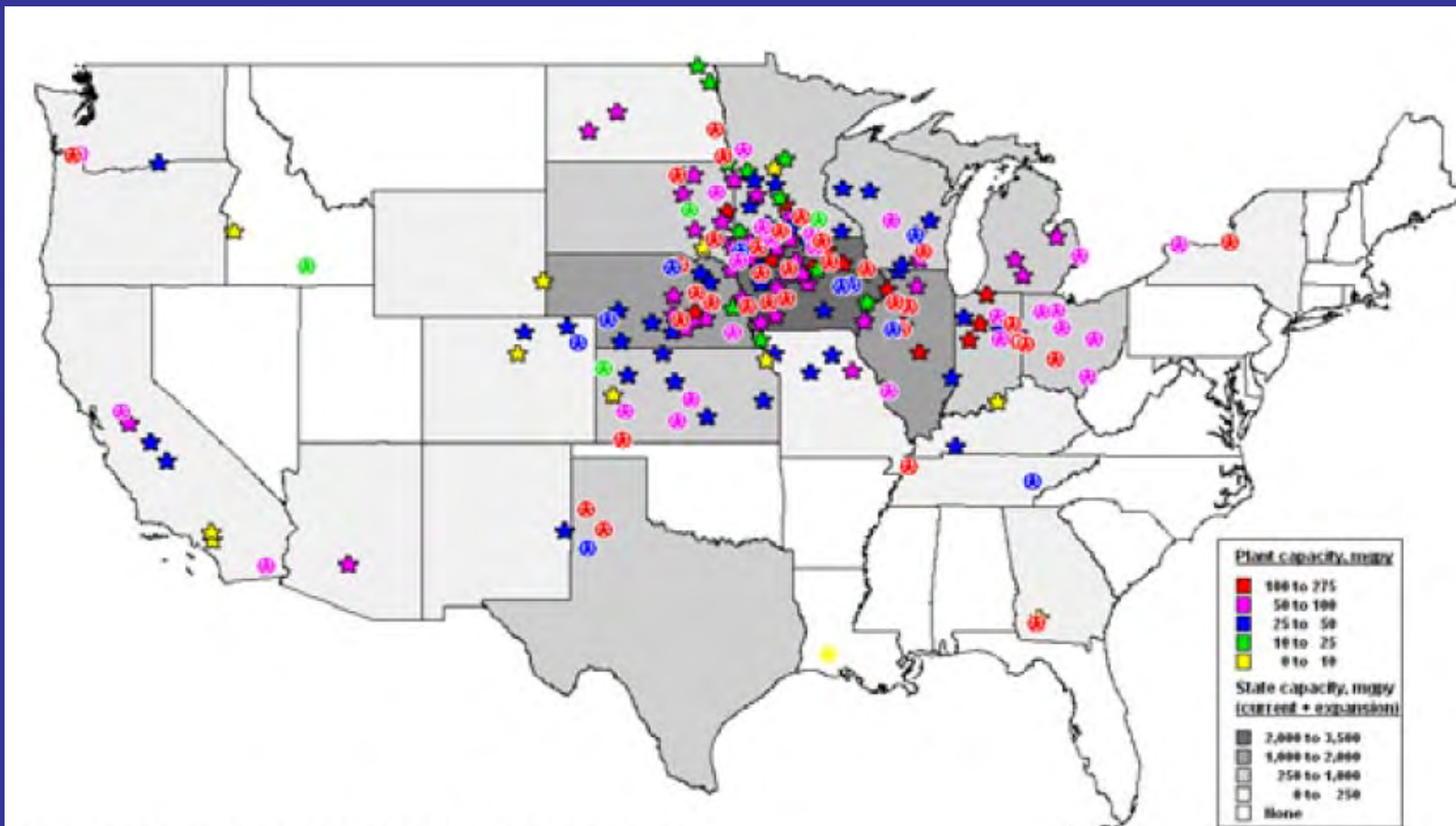


Campbell World Oil Production Plot

World Commodity Prices, January 2000–February 2008 (US\$/metric ton)



Sources: FAO international commodity prices database 2008, and IMF world economic outlook database 2007.

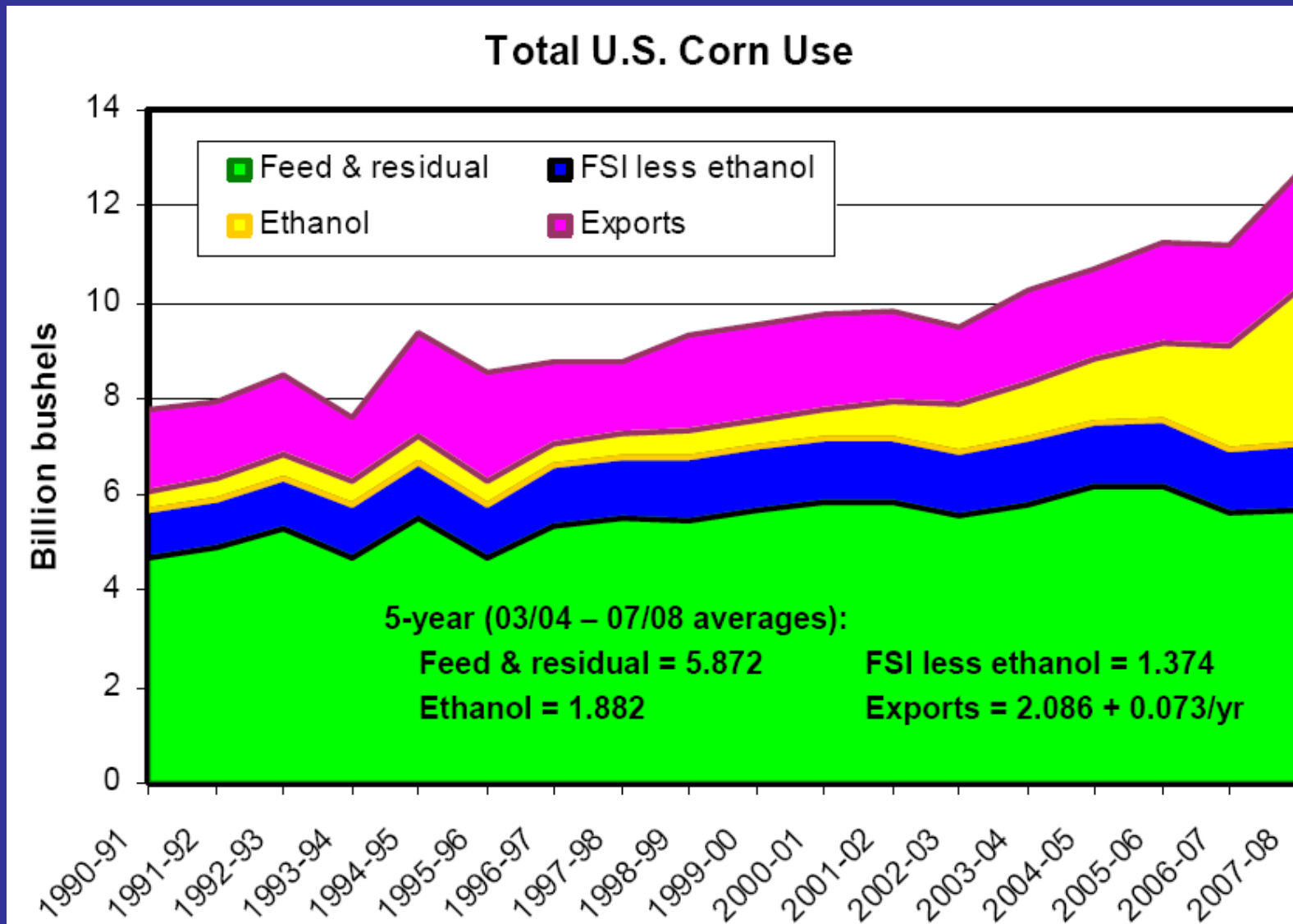


12/01/07 – 201 plants capacity of 13.45 bgy

Current ethanol plant capacity: 134 plants, 7.23 billion gallons/year

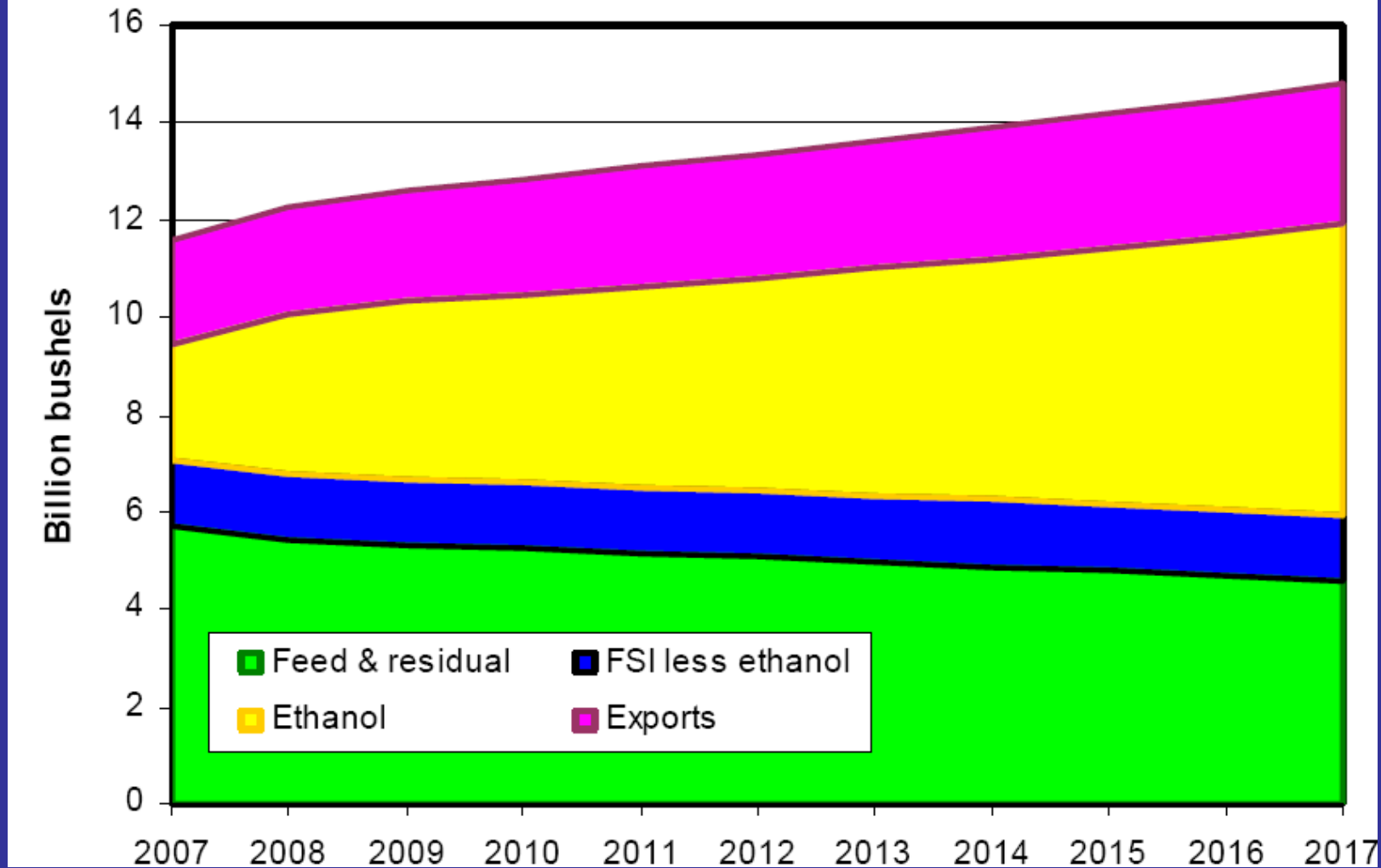
Expansion and new construction plant capacity, 77 plants, 6.22 billion gallons/year

Source: Ethanol Industry – Impact on Corn and DGS Production, Dhuyvetter et al.



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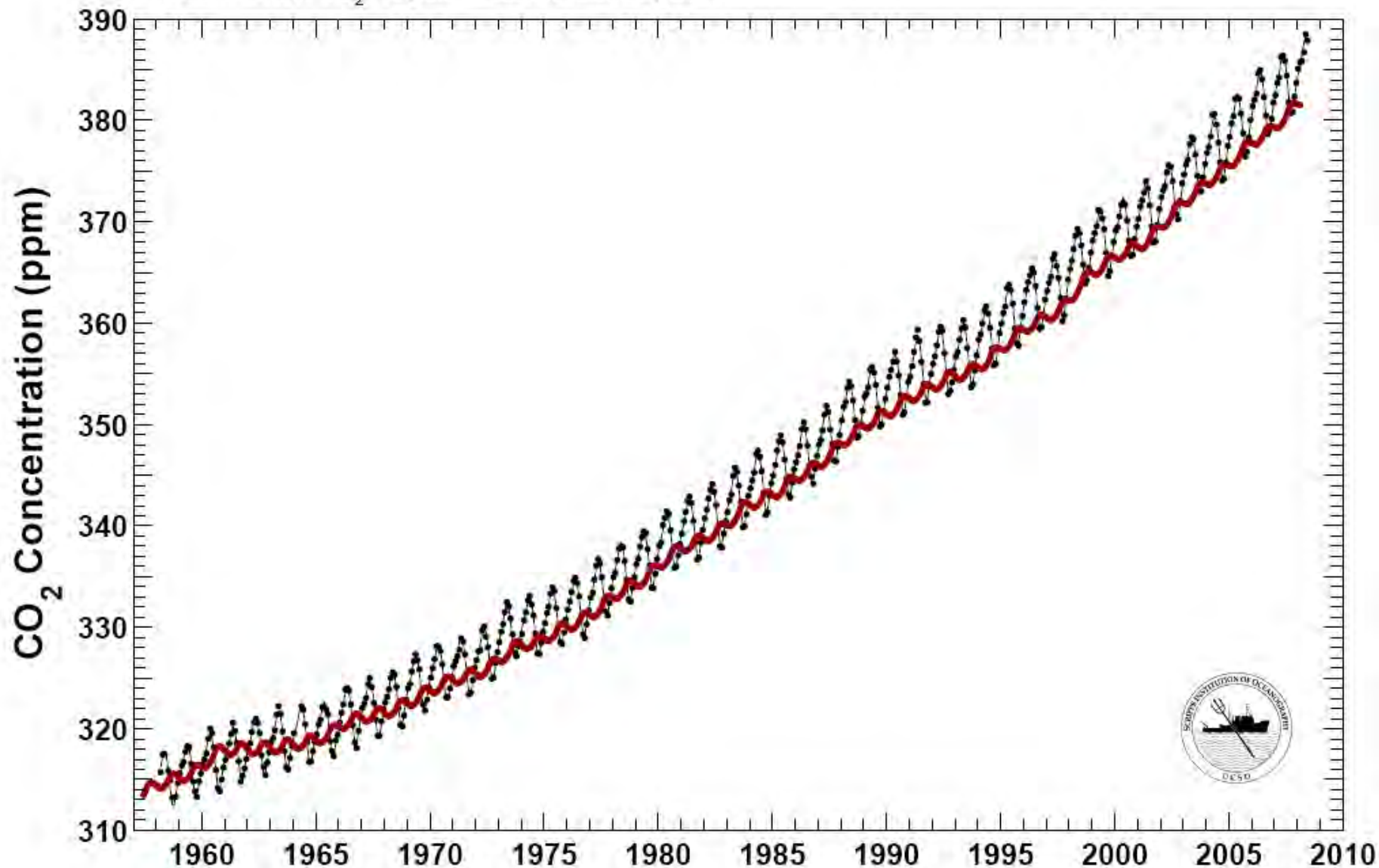
Projected Total U.S. Corn Use

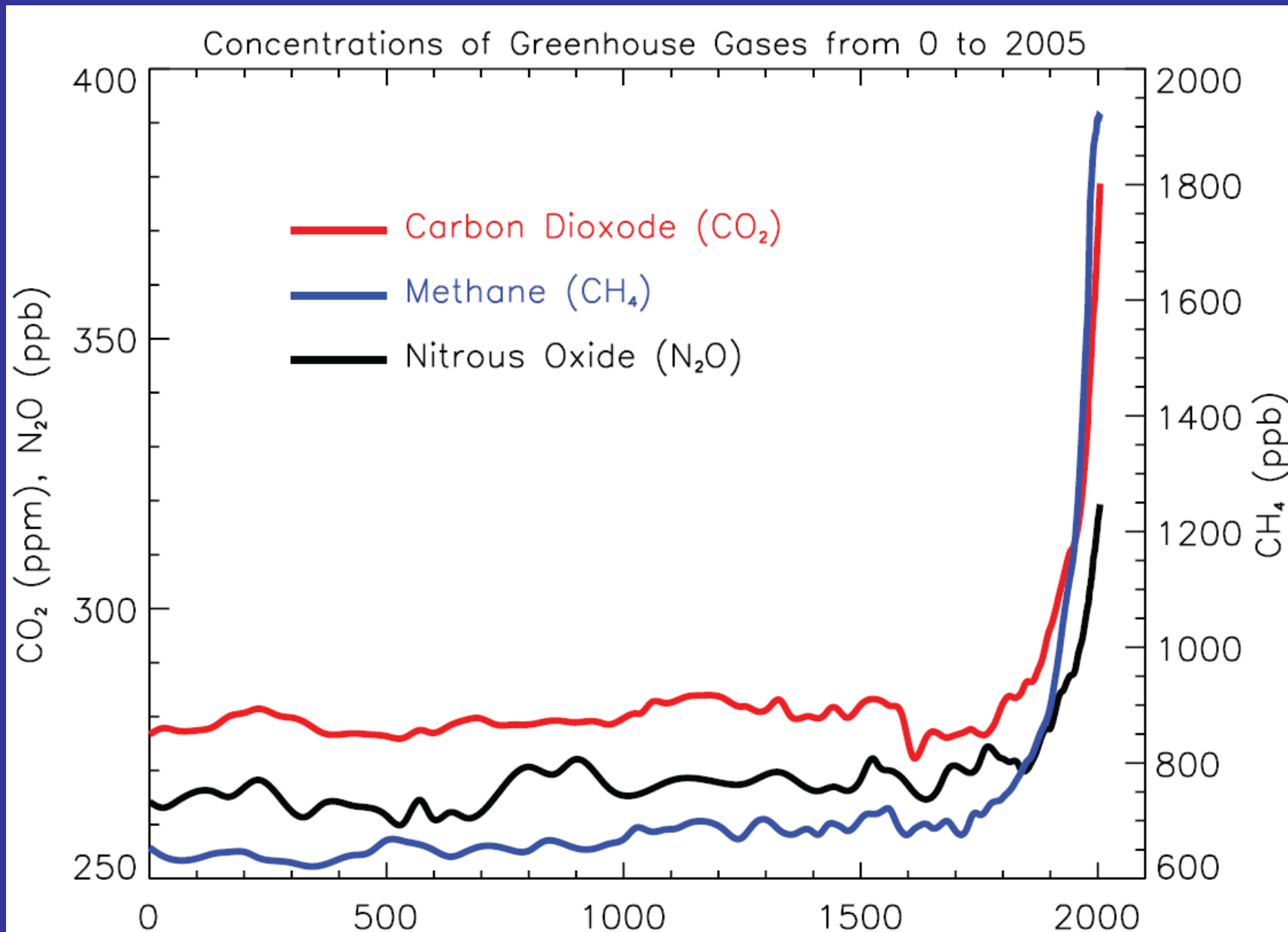


Source: Ethanol Industry – Impact on Corn and DGS Production, Dhuyvetter et al.

Mauna Loa Observatory, Hawaii and South Pole, Antarctica Monthly Average Carbon Dioxide Concentration

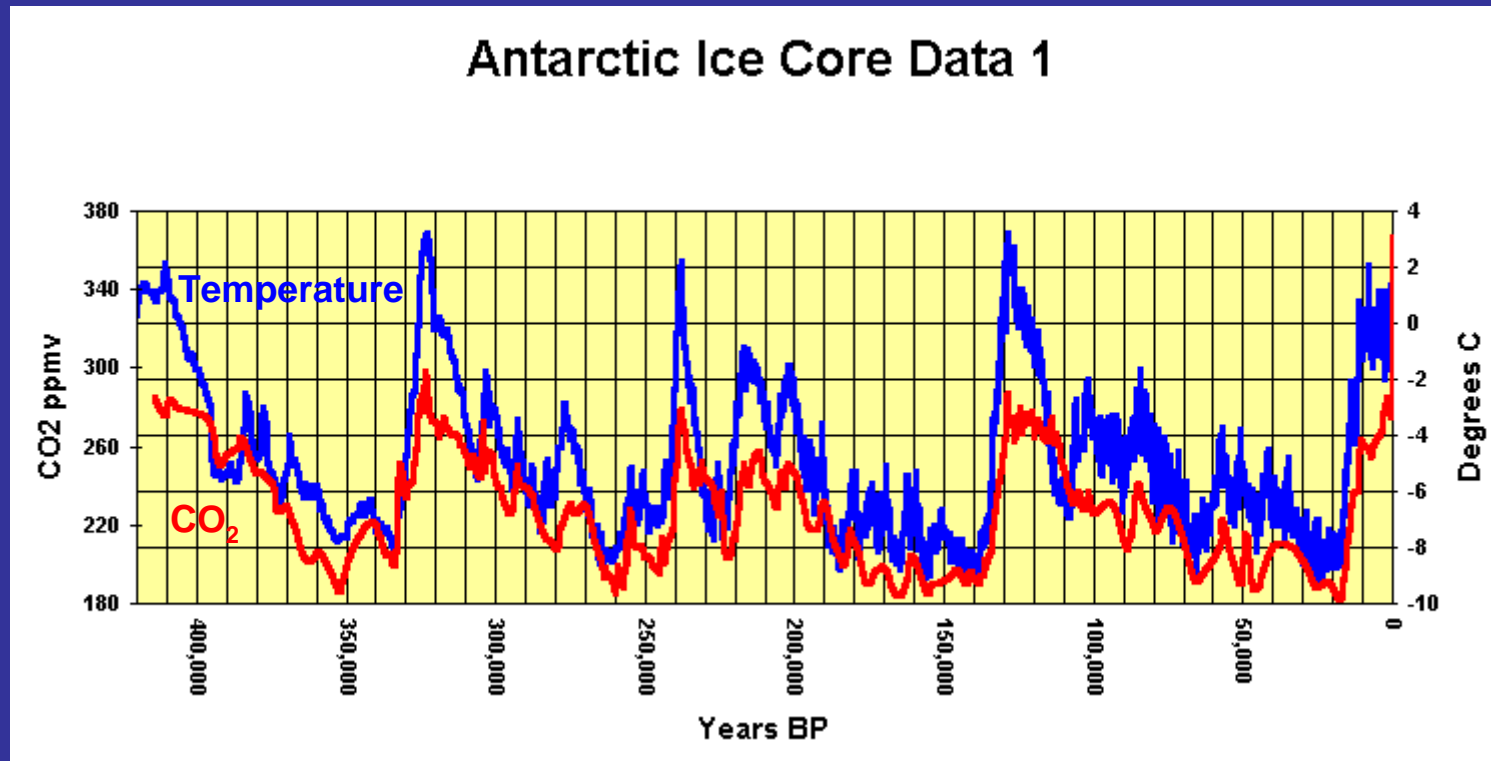
Data from Scripps CO₂ Program Last updated July 2008





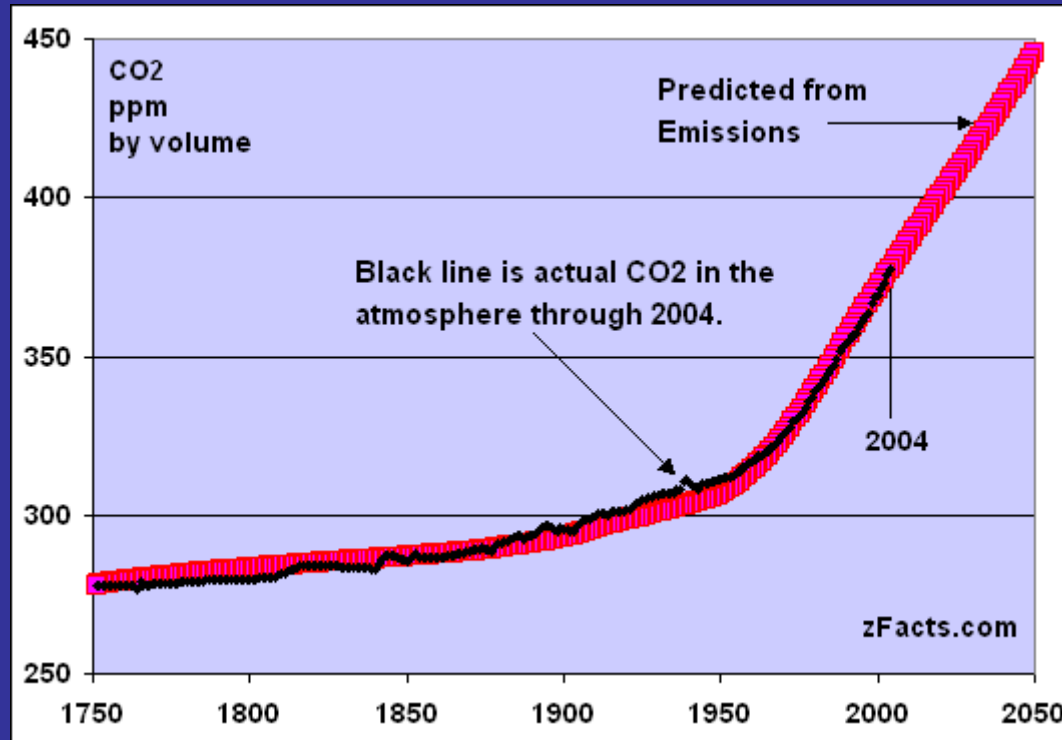
Source: IPCC, 2007.

Long-term CO₂ + Temperature

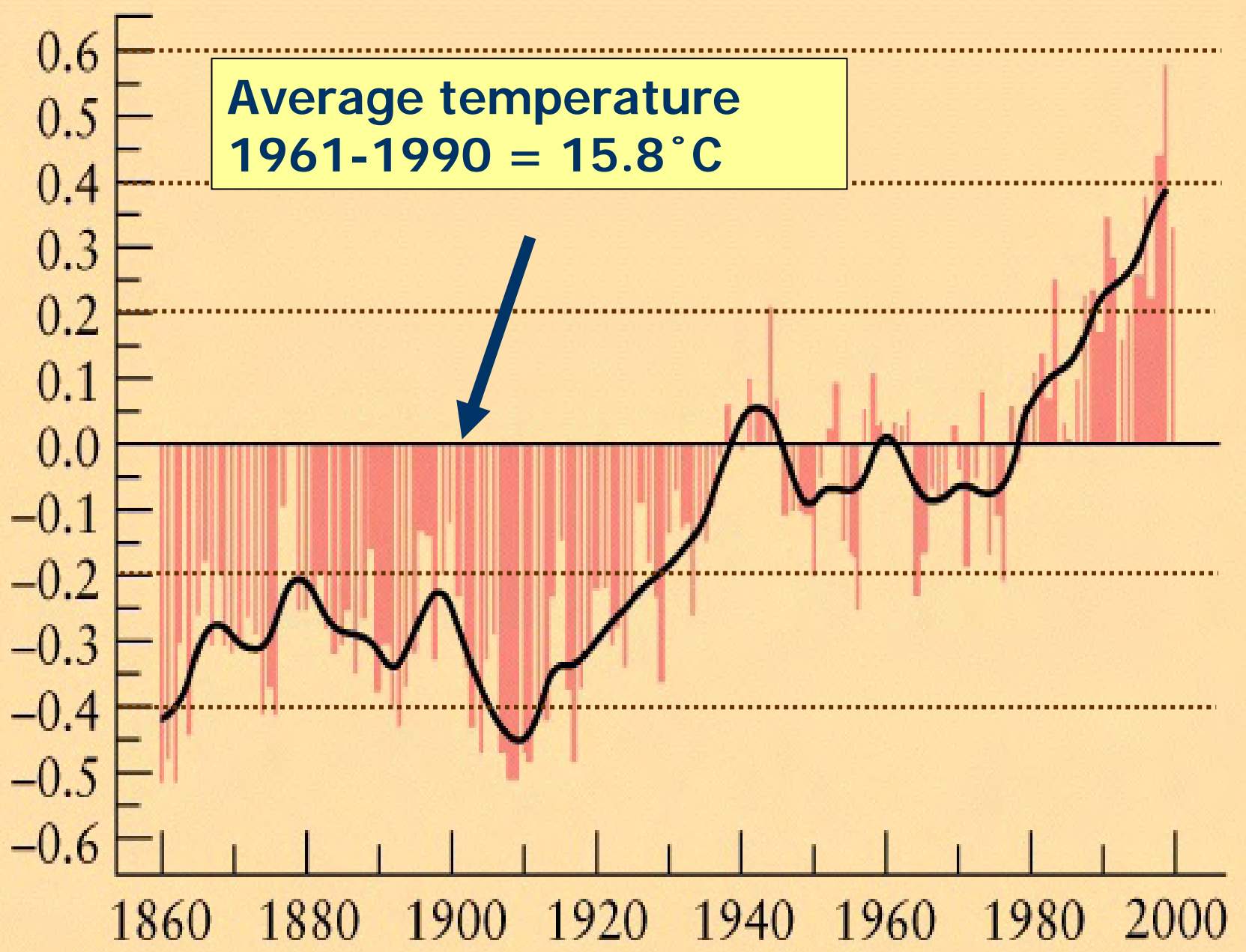


Source: Davies & Company

CO₂ 1750 - 2050



°C



Expected Impact of Climate Change on Cereal Production by 2080

| | | <i>Range</i> | | |
|-----------------|----------------------|--------------|----|--------|
| <i>Positive</i> | Developed Countries | +2.7% | to | +9.0% |
| | Latin America | +5.2% | to | +12.5% |
| <i>Negative</i> | Developing Countries | -3.3% | to | -7.2% |
| | South Asia (India) | -18.2% | to | -22.1% |
| <i>World</i> | | -0.6% | to | -0.9% |

Source: von Braun, IFPRI, 2007

Conclusion



Population
+60% by 2050



Food
+100% by 2050

+

Energy
+100% by 2050



Climate
+2° by 2050



Dublin: European City of Science 2012

