

# How to feed the world in 2050?



**Josef Schmidhuber, FAO**

**Food and Agriculture Organization of the United Nations (FAO)**

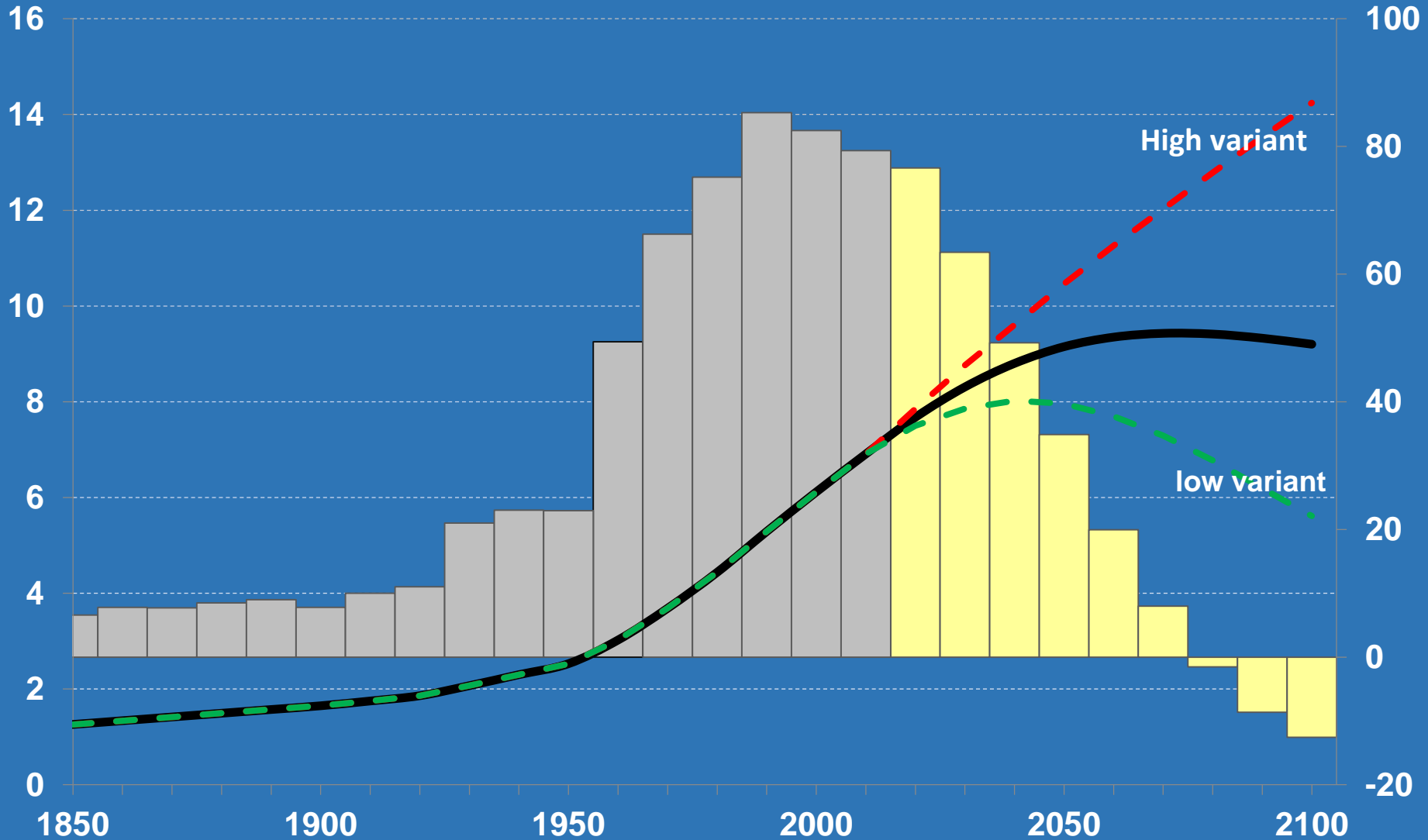
**Drivers of change**

**POPULATION and  
INCOME**

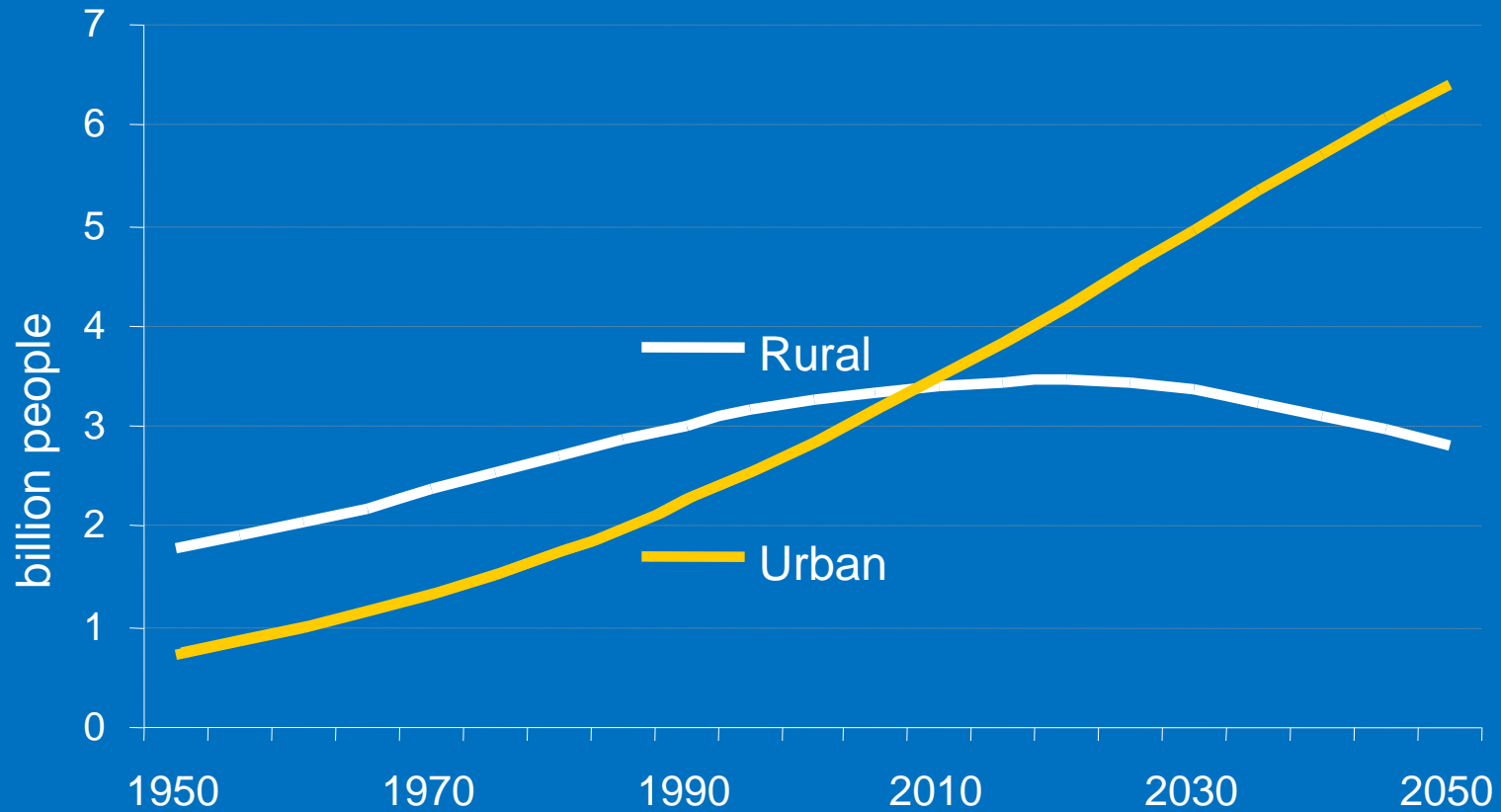
# Population growth to continue

Total population  
(billions)

Annual increments  
(millions)



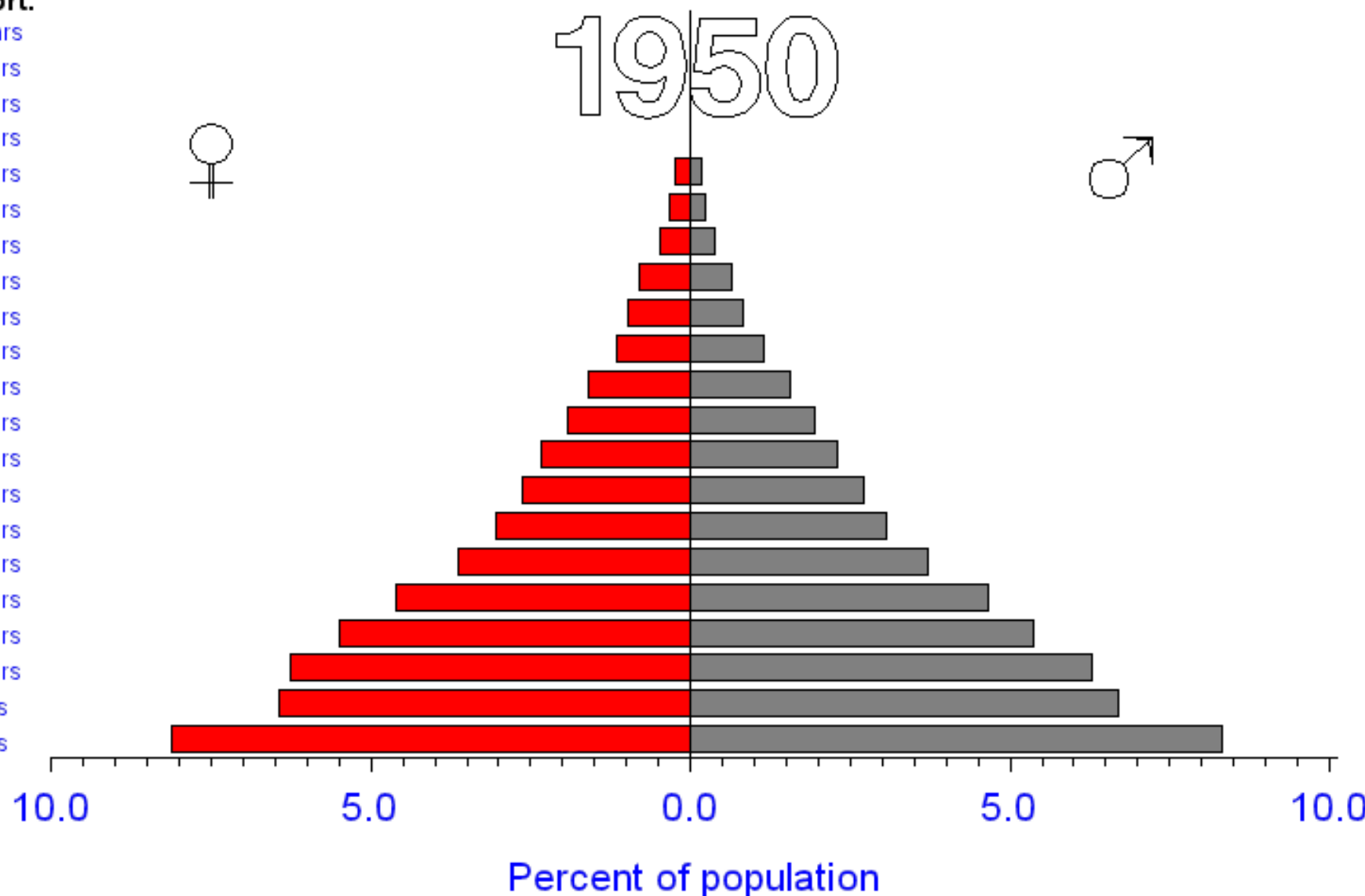
# Urbanization to accelerate



# Thailand: Population structure 1950 to 2050

## Age cohort:

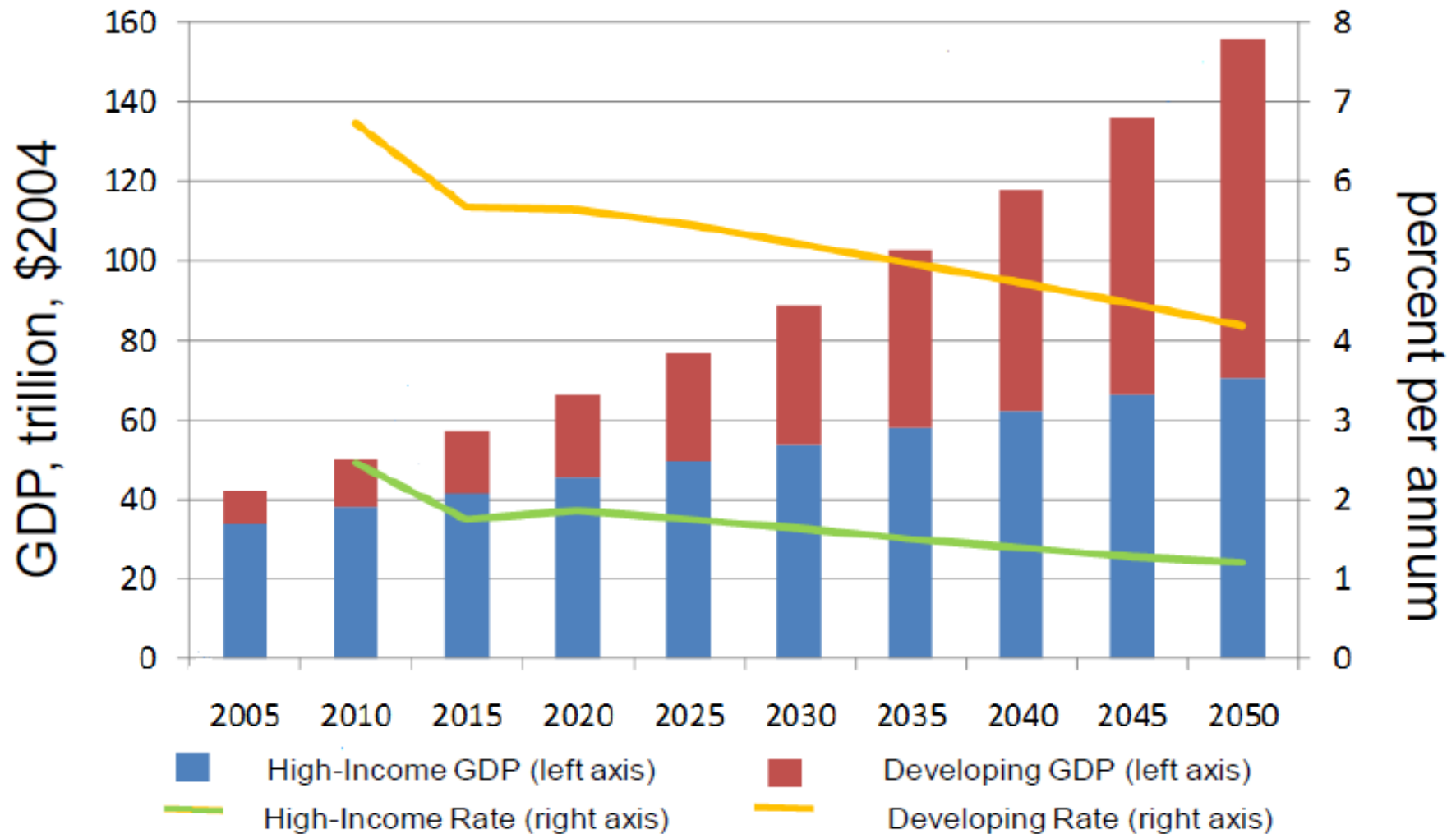
100 + years  
95-99 years  
90-94 years  
85-89 years  
80-84 years  
75-79 years  
70-74 years  
65-69 years  
60-64 years  
55-59 years  
50-54 years  
45-49 years  
40-44 years  
35-39 years  
30-34 years  
25-29 years  
20-24 years  
15-19 years  
10-14 years  
5-9 years  
0-4 years



Data: UN 2012 (<http://www.un.org/esa/population/unpop.htm>)

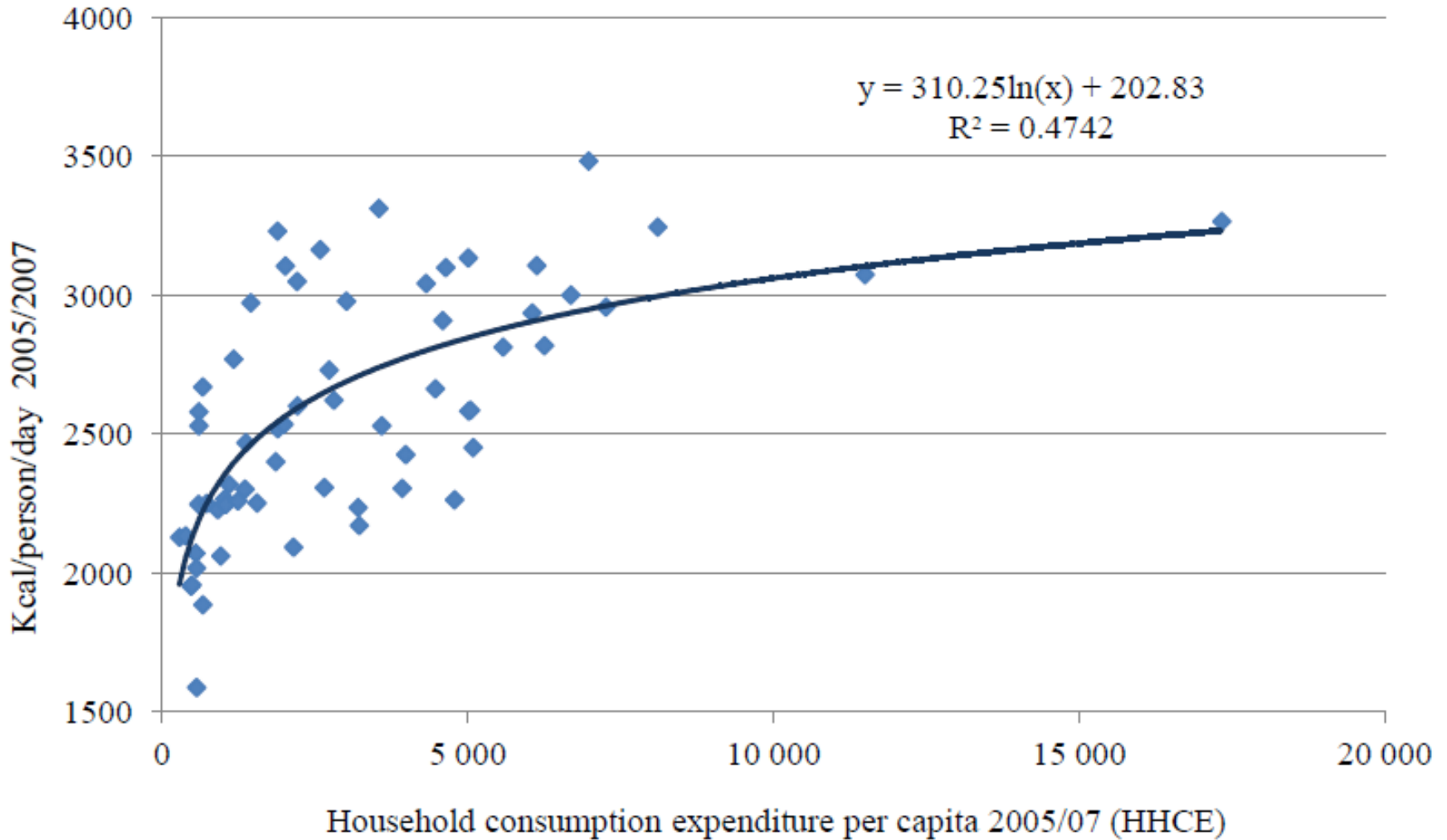
FAO (2013)

# GDP Growth to continue



Source: World Bank

# Consumption(kcal/pc) and GDP p.c. (62 Developing Countries)

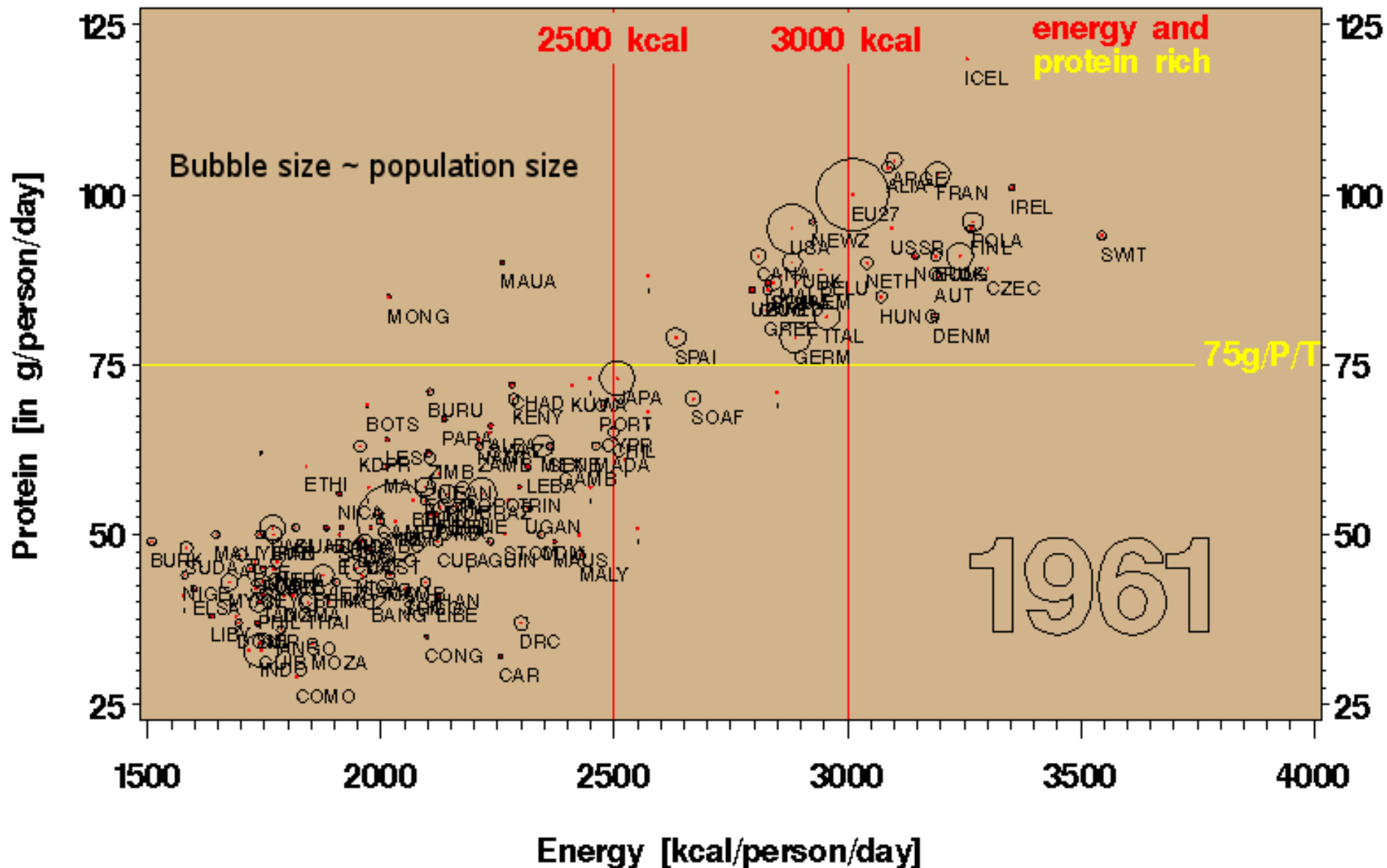




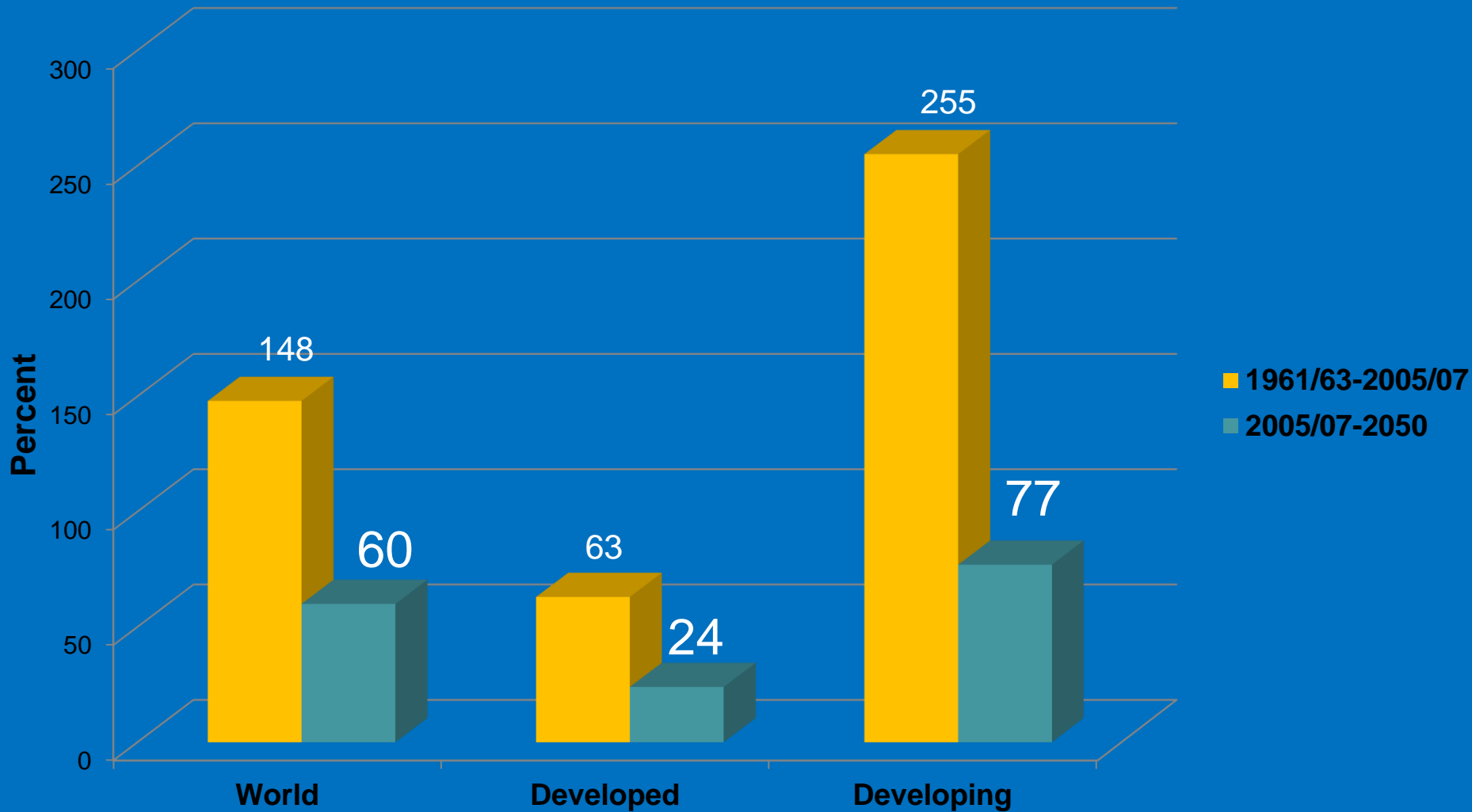
**Impacts on**  
**FOOD**  
**AVAILABILITY**  
**& PRODUCTION**



# Energy and Protein Content of the Diet, Total Availability (1961-2080)



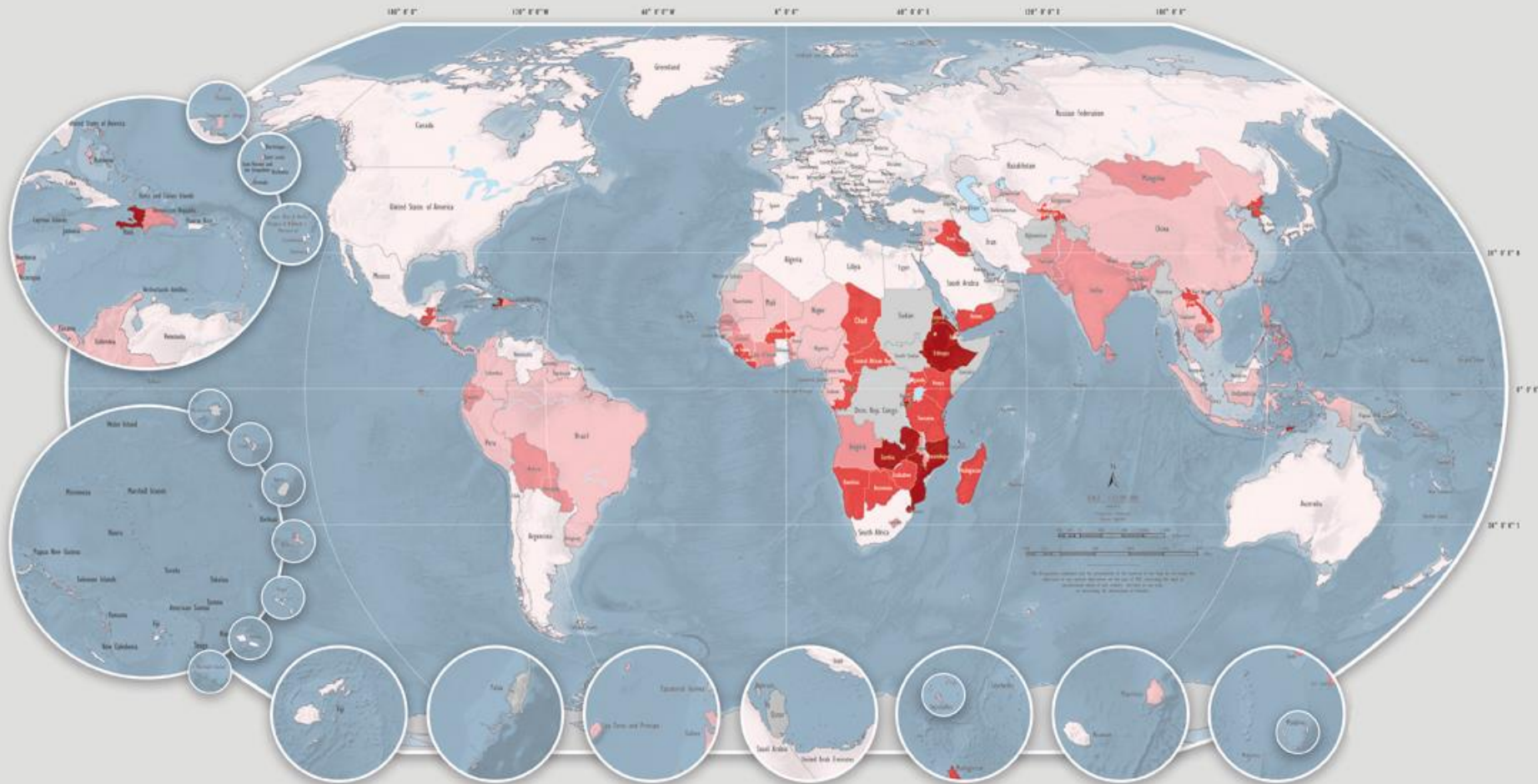
# Past and projected increase in food production



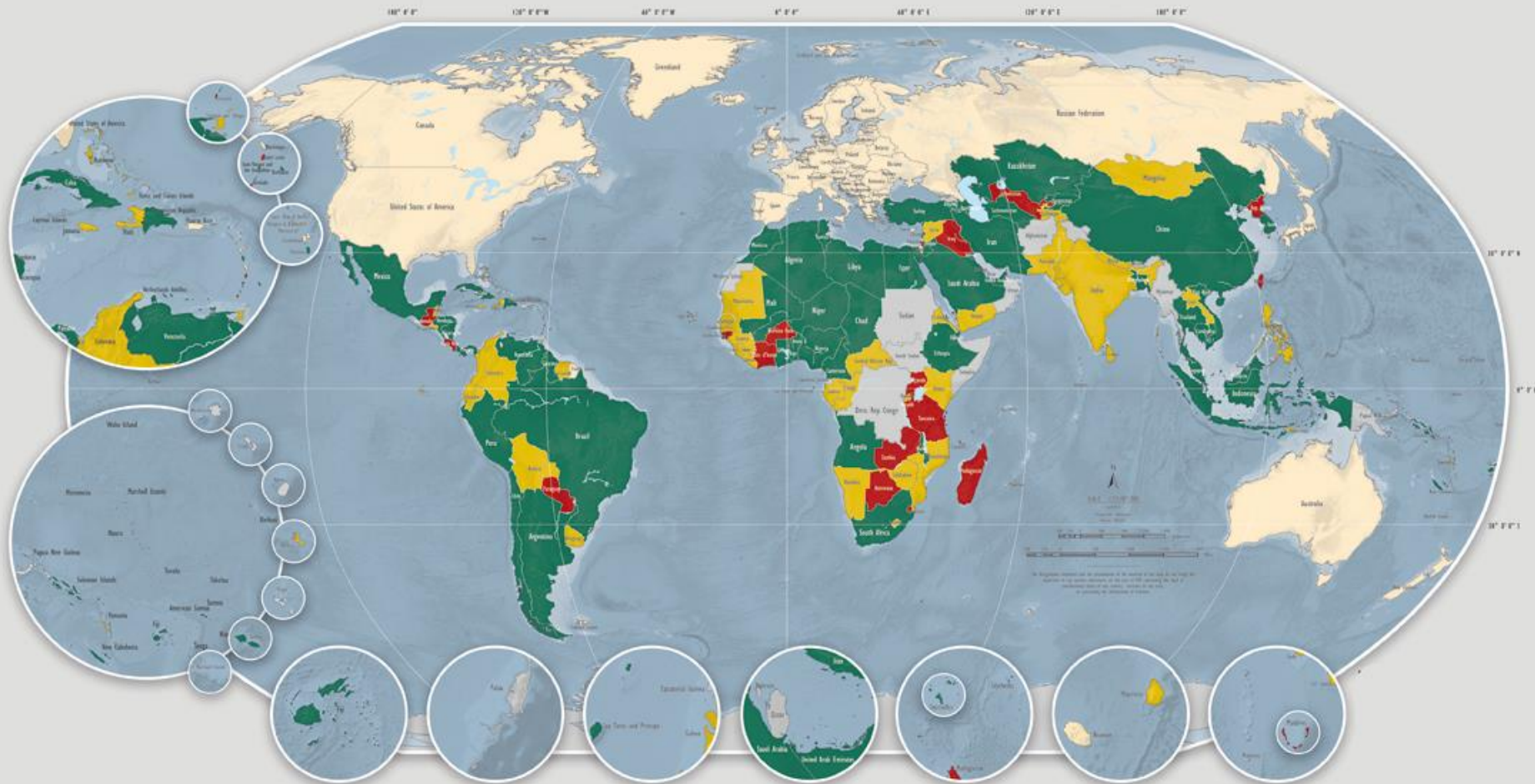
Impacts of change

**HUNGER &  
MALNUTRITION**

# Proportion of undernourished

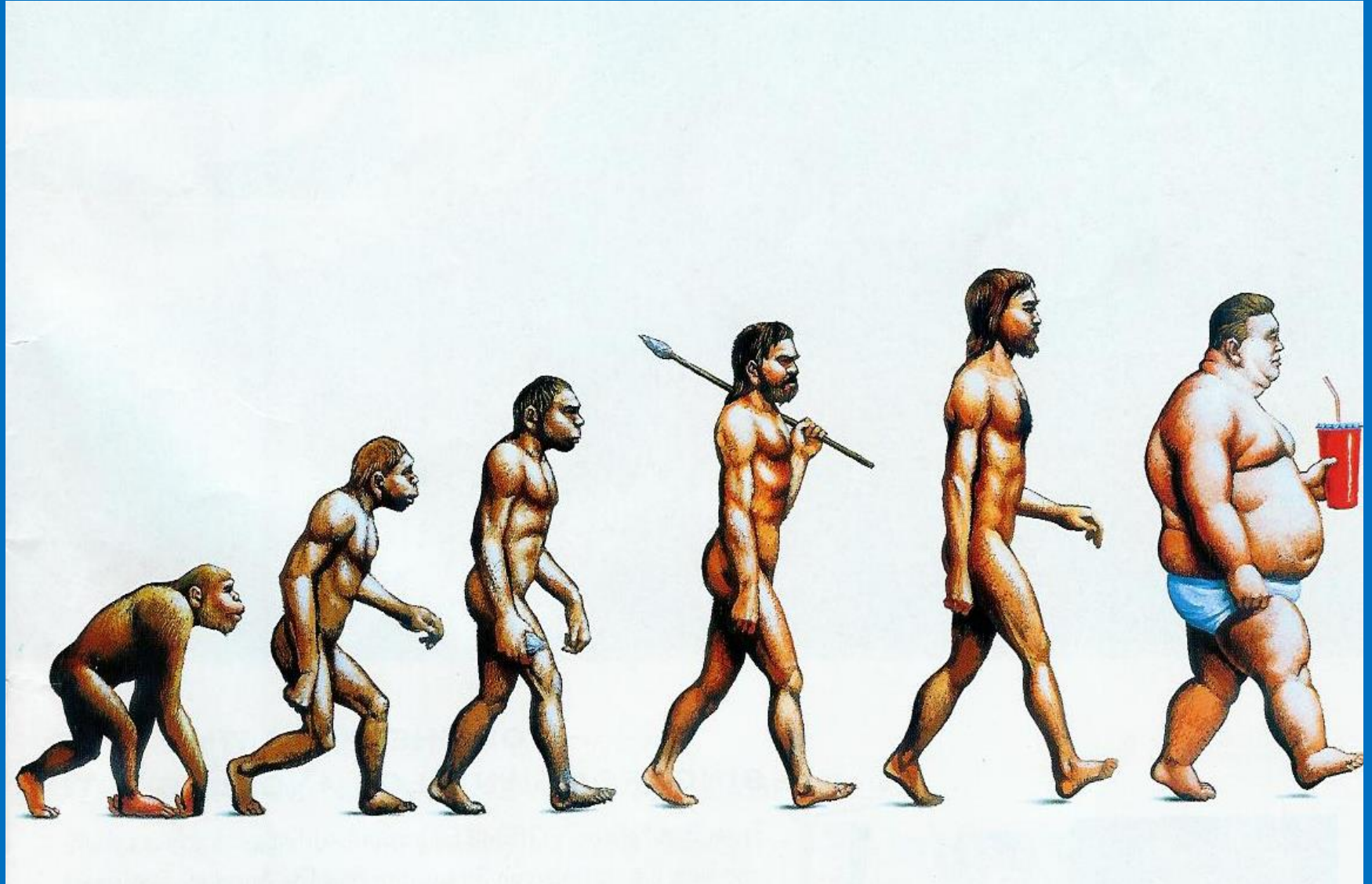


# Progress towards MDG1





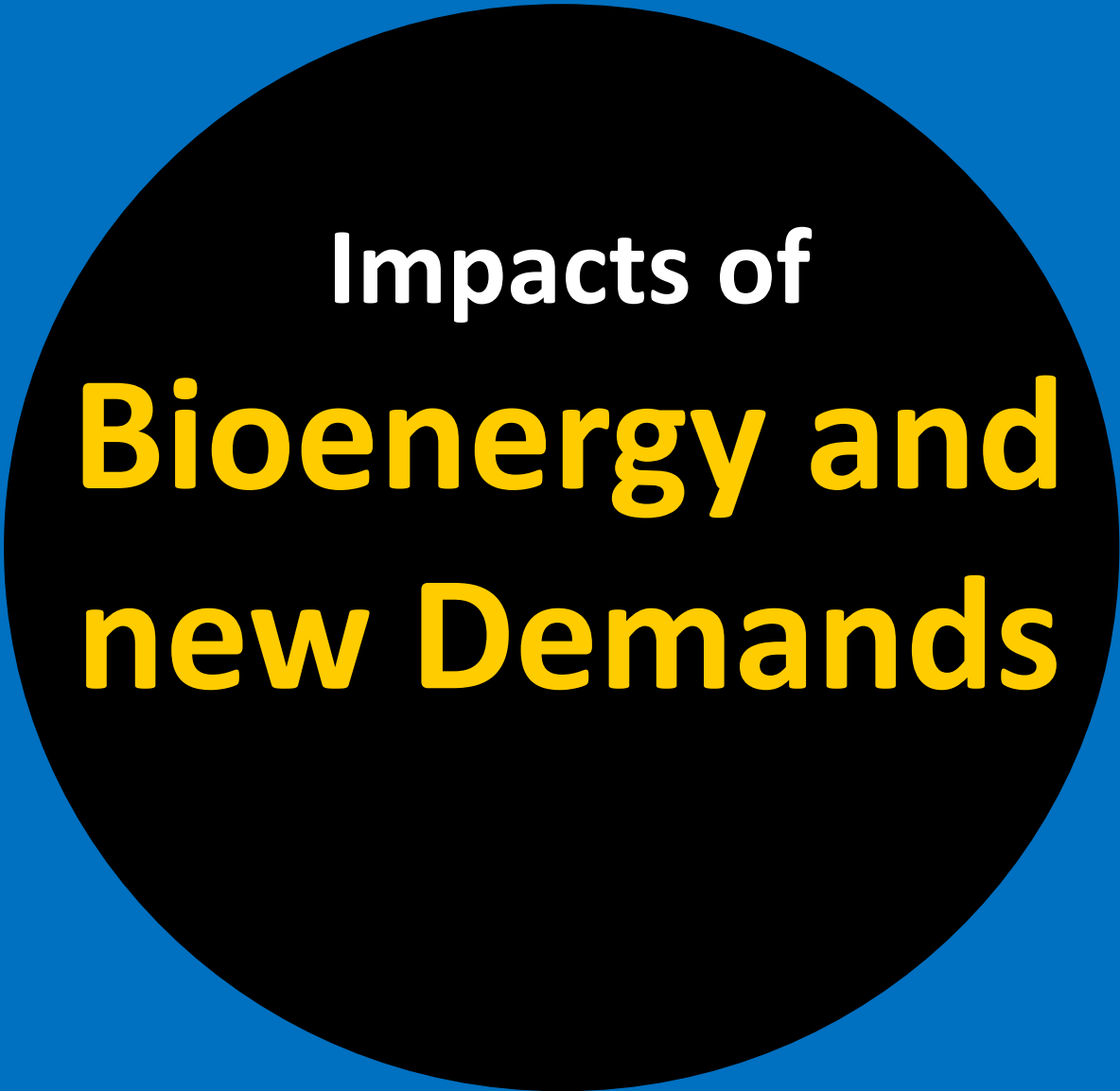
# The shape of things to come?



The Economist, December 2003

# AT2050/80: **provisional** nutritional outcomes (global averages/aggregates)

	undernourished		% of population with kcal/person/day		obese	
	%	million	>2700	>3000	%	million
2005/07	13	844	57	28	9	570
2050	4	330	91	52	15	1400
2080	2	150	98	66	21	2000



**Impacts of  
Bioenergy and  
new Demands**



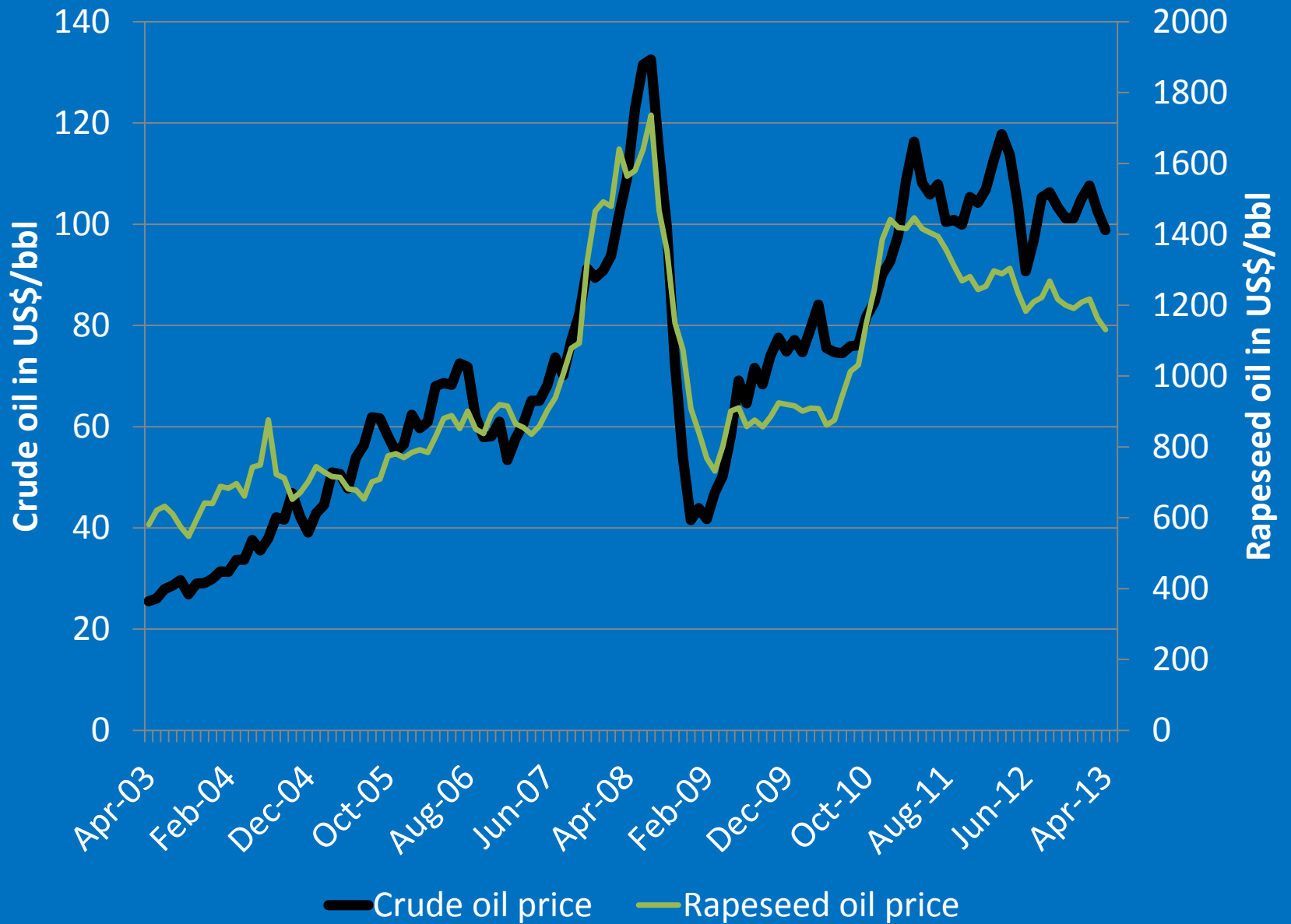
# How big is the energy market?

1. Energy market (TPES): nearly 500 EJ
2. Biomass: 50 EJ (80% in developing countries)
3. Biofuels: 3.3 EJ, on ca. 33 million ha
4. Transport energy needs: ca. 95 EJ
5. Crop area to cover transport energy needs:  
>1000 million ha, i.e. 2/3 of global crop area.

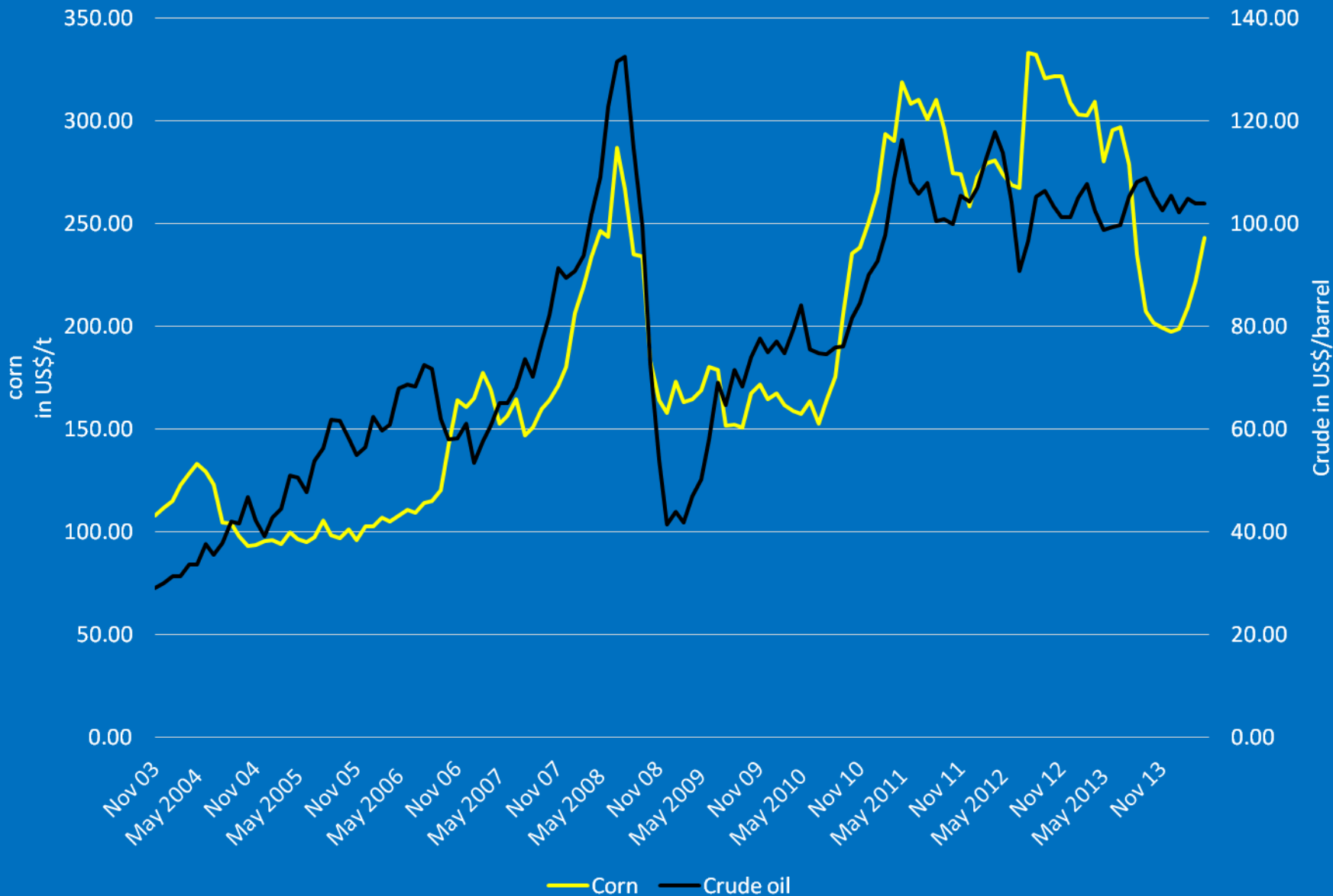
=>Energy market is large, creates perfectly elastic demand for agricultural produce at break-even points (parity prices).

=>Bio-energy subsidies have a price supporting impact, not price depressing as the traditional coupled agricultural subsidies.

# Rapeseed oil prices follow crude oil prices



# Corn and Crude oil prices



Impacts of change

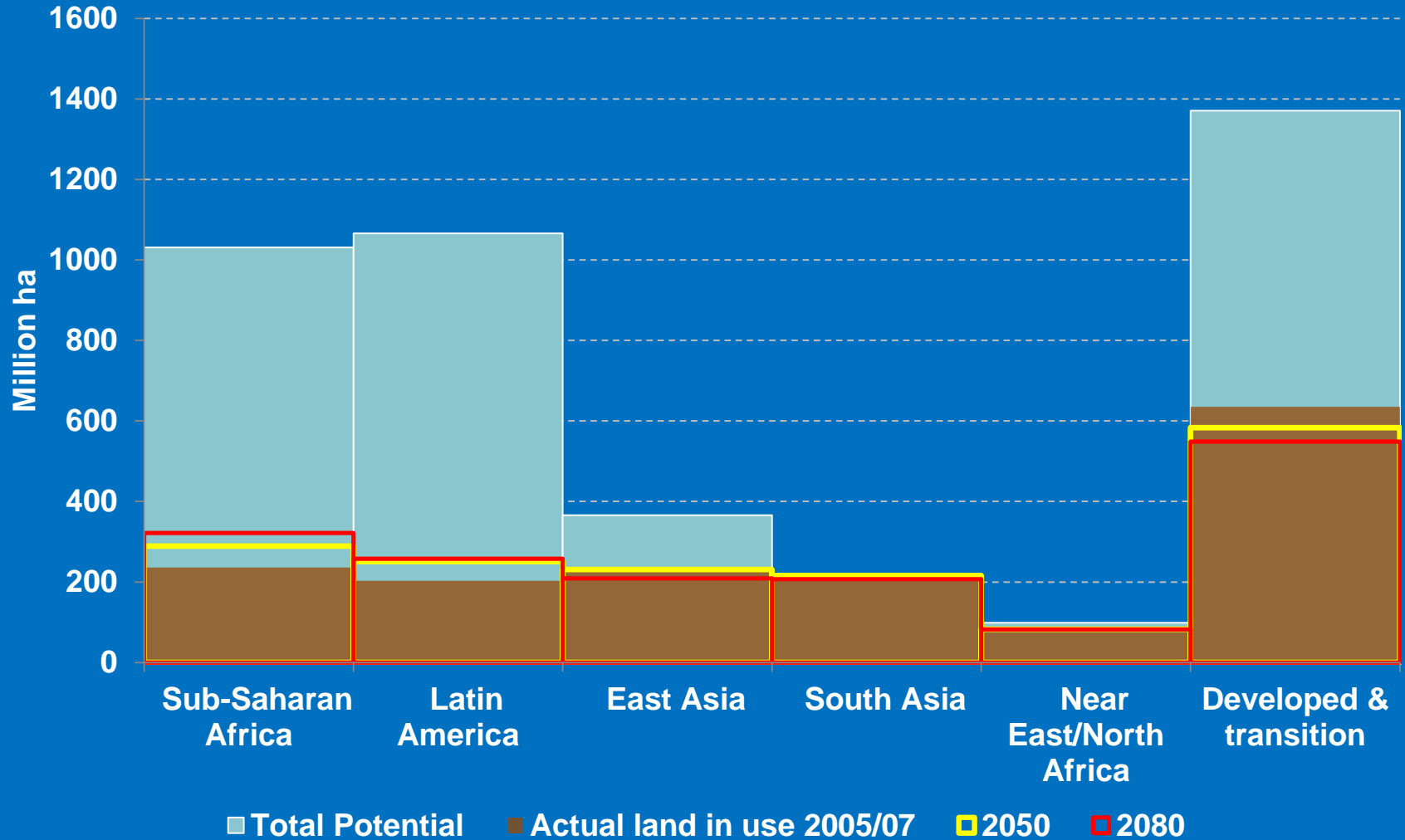
**RESOURCES &  
ENVIRONMENT**



A wide-angle photograph of a vast agricultural field during harvest. The foreground and middle ground are filled with golden-yellow wheat. In the center, a combine harvester is working, kicking up a small amount of dust. To the left, a red truck is parked. The horizon is flat, with a few distant trees and structures under a clear, bright blue sky.

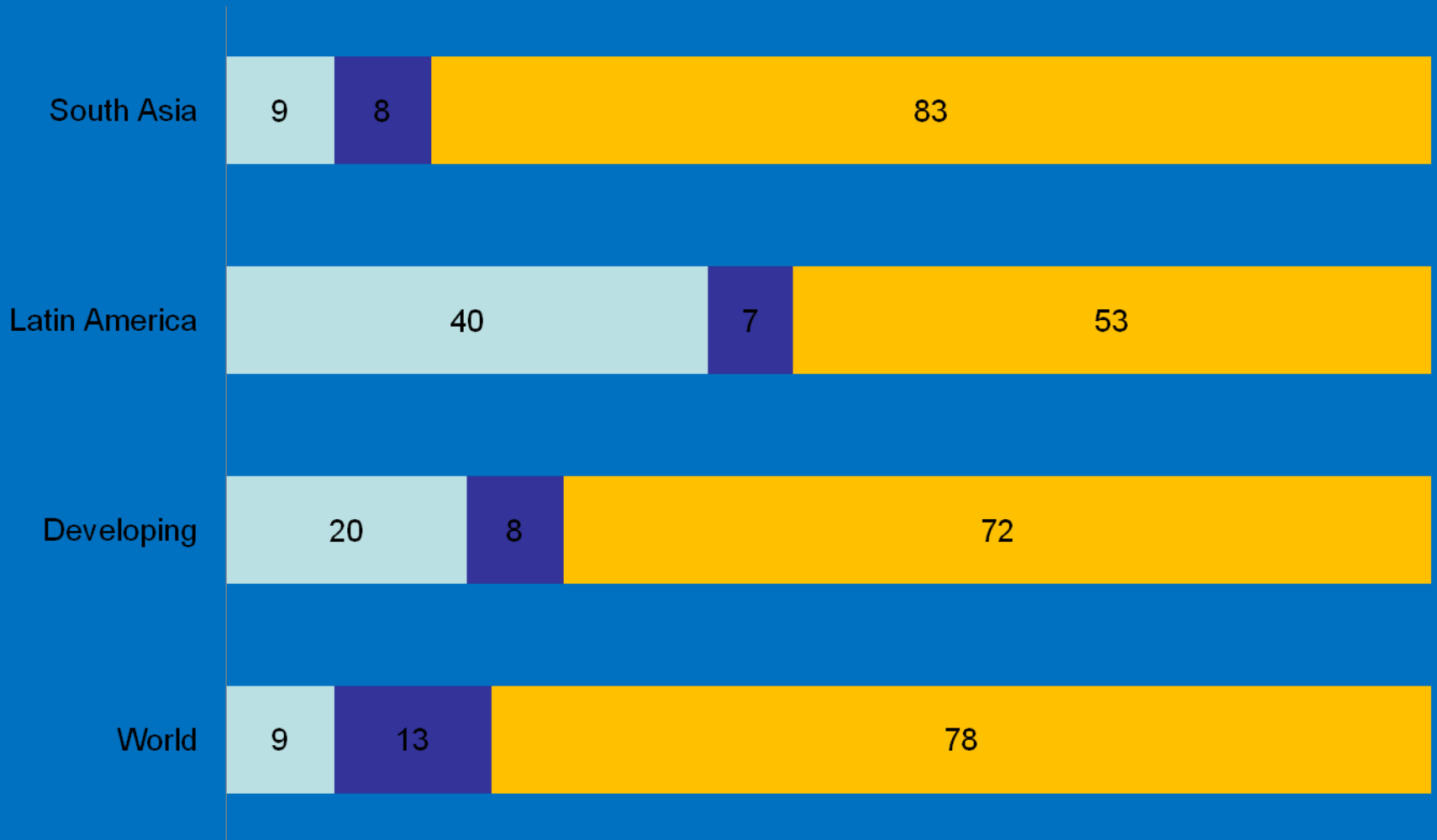
**Are there enough cropland  
and enough yield potential?**

# Cropland potential and actual use 2005/07, 2050 and 2080



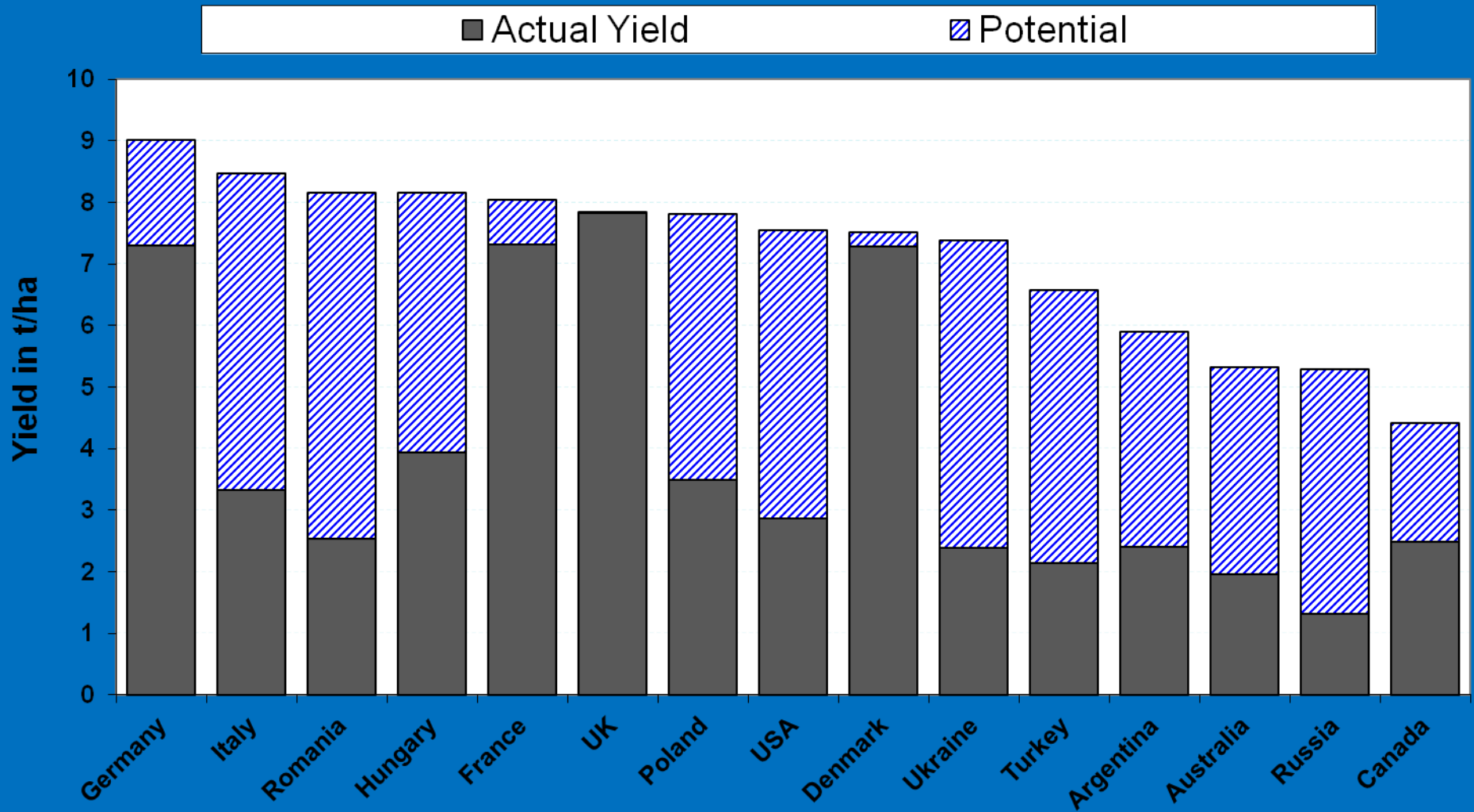
# Sources of growth (%): 2005/07-2050

■ Cropland ■ Cropping intensity ■ Yields





## Actual (1996/00) and potential wheat yields for intensive production systems



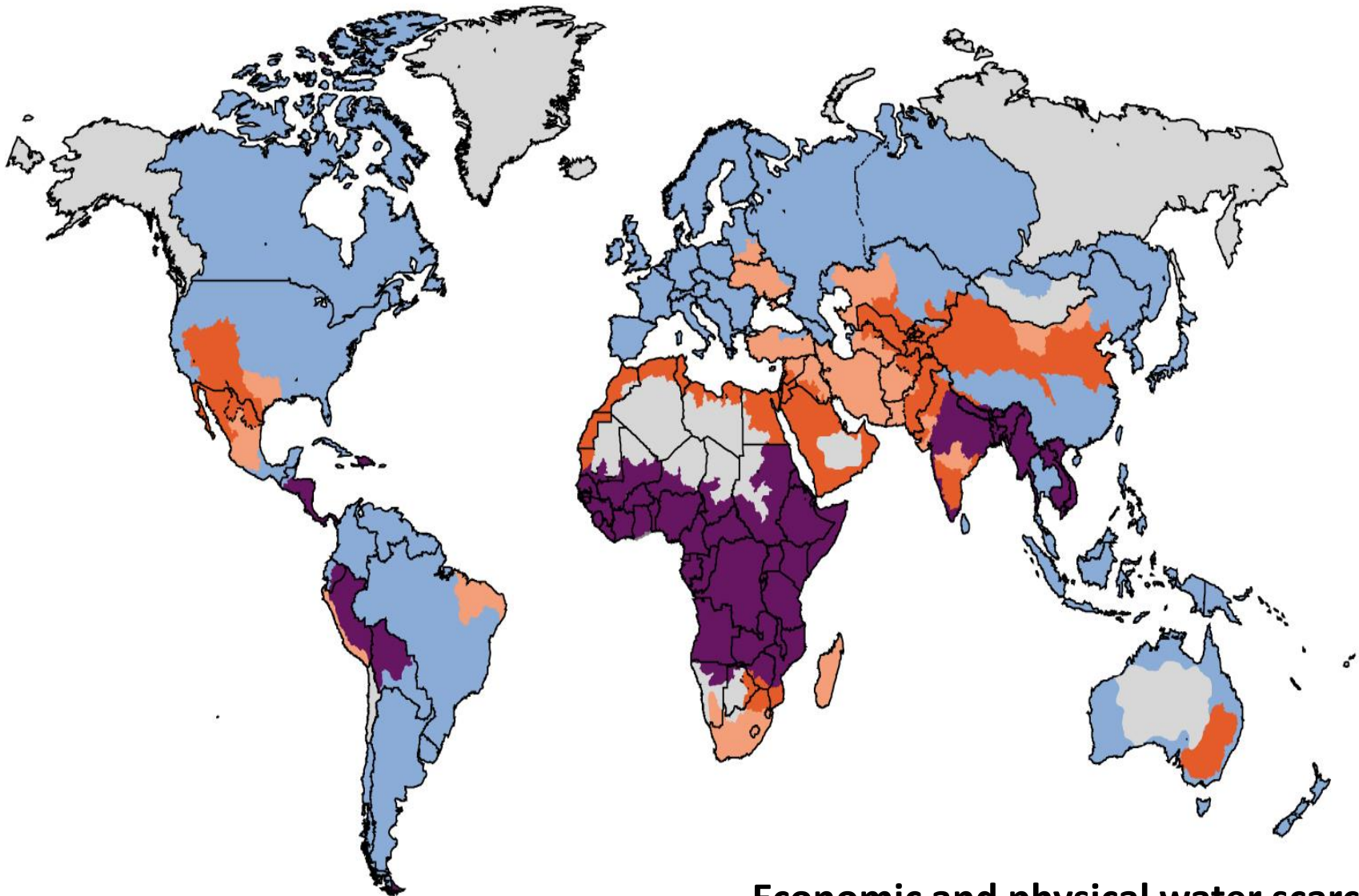
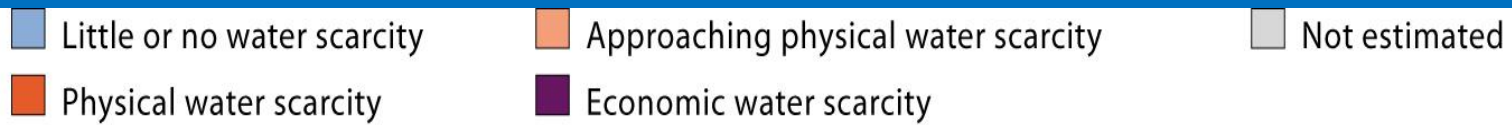


Impacts of change

**RESOURCES &  
ENVIRONMENT**

**Is there enough water?**





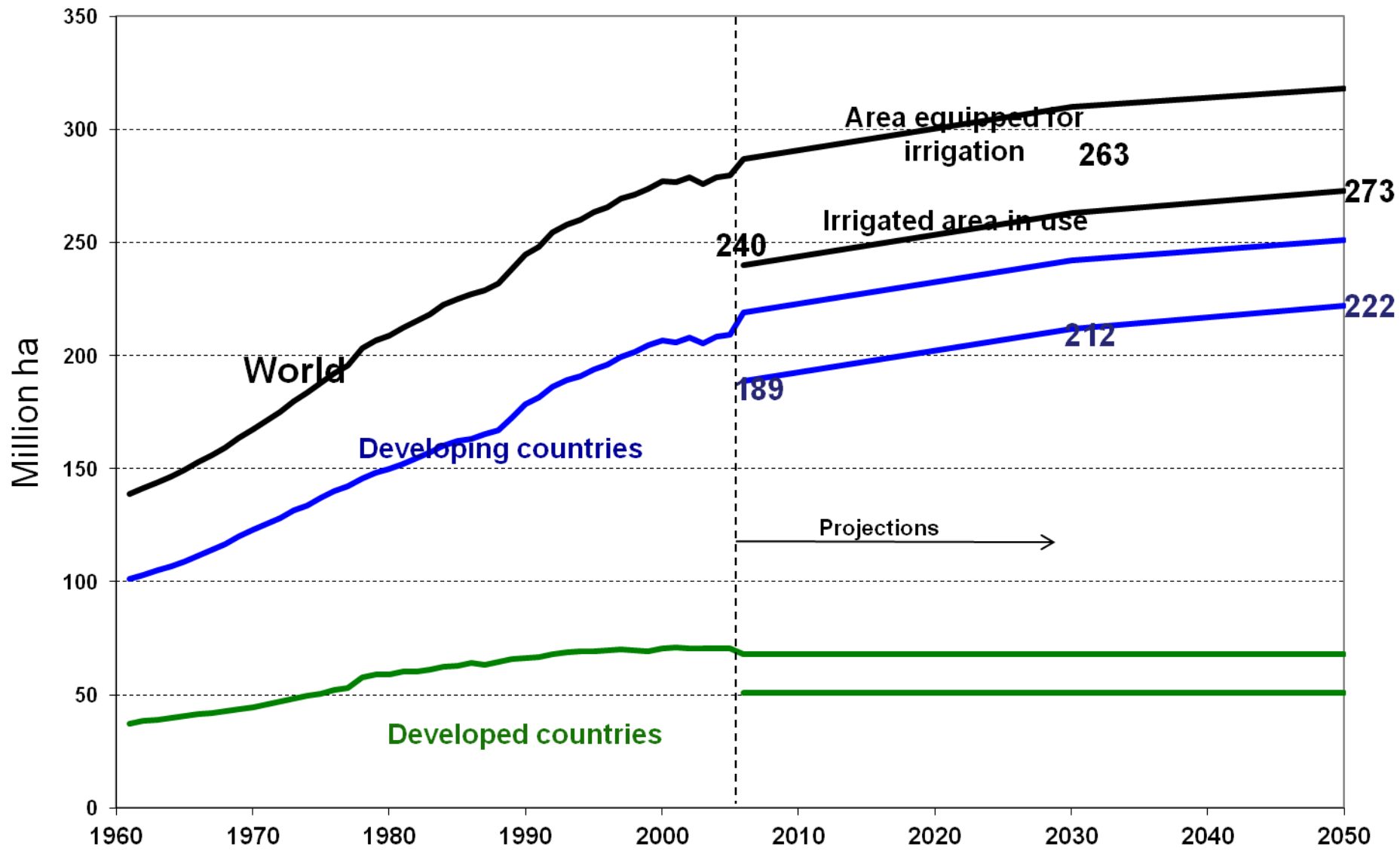
**Economic and physical water scarcity**

# Irrigated land expansion and water use

## Area equipped for irrigation

	1961/63	2005/07	2050	1961-05	2005-50
	million ha			% p.a.	
<b>World</b>	141	287	318	1.71	0.24
<b>Developed countries</b>	38	68	68	1.57	0.00
<b>Developing countries</b>	103	219	251	1.76	0.31
<b>excl. China and India</b>	47	97	117	1.91	0.42
<b>sub-Saharan Africa</b>	3	6	8	2.07	0.67
<b>Latin America</b>	8	18	24	2.05	0.72
<b>Near East/North Africa</b>	15	29	36	1.86	0.47
<b>South Asia</b>	37	81	86	1.98	0.14
<b>East Asia</b>	40	85	97	1.42	0.30

# Area equipped for irrigation and irrigated area in use

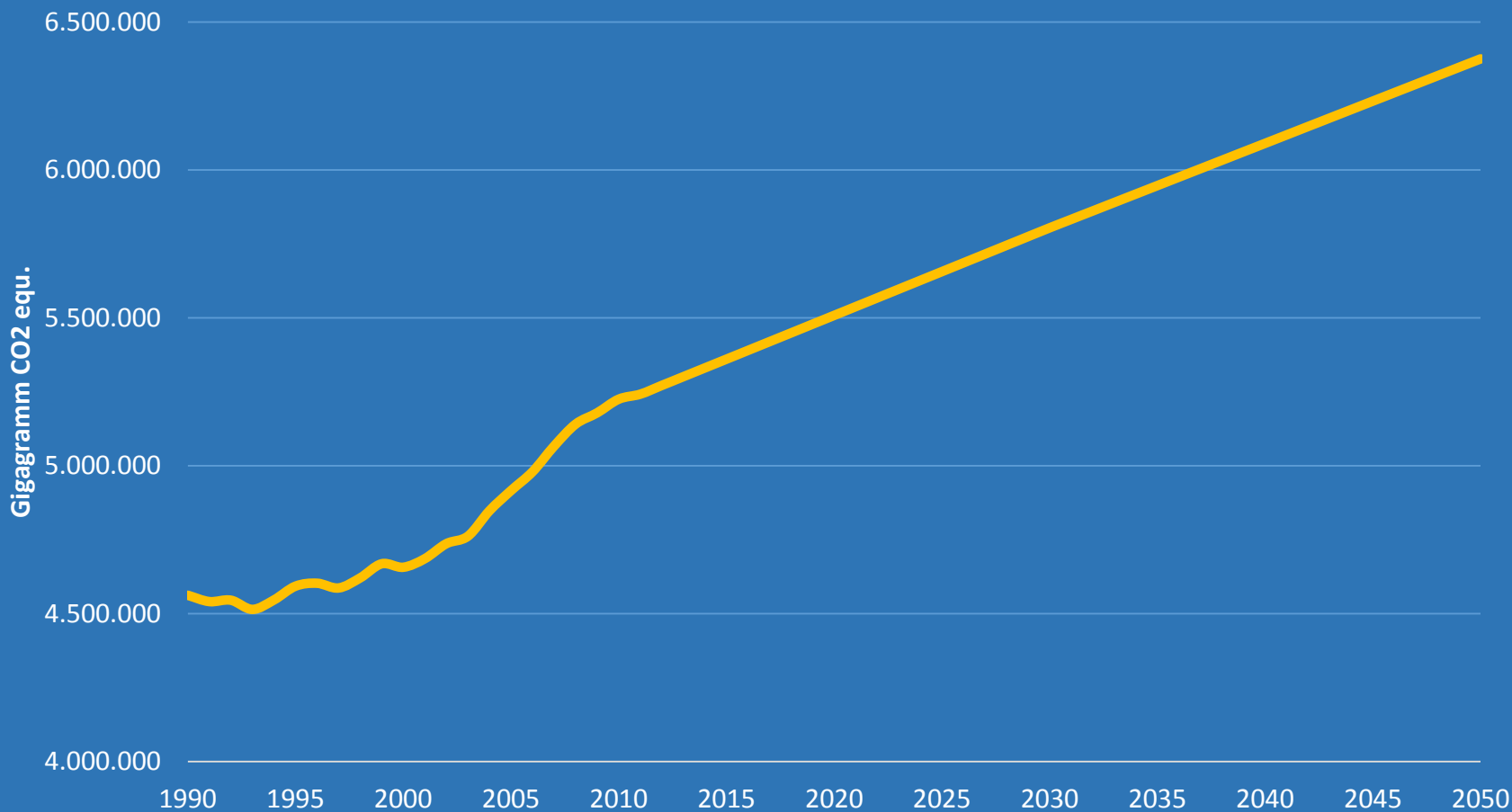




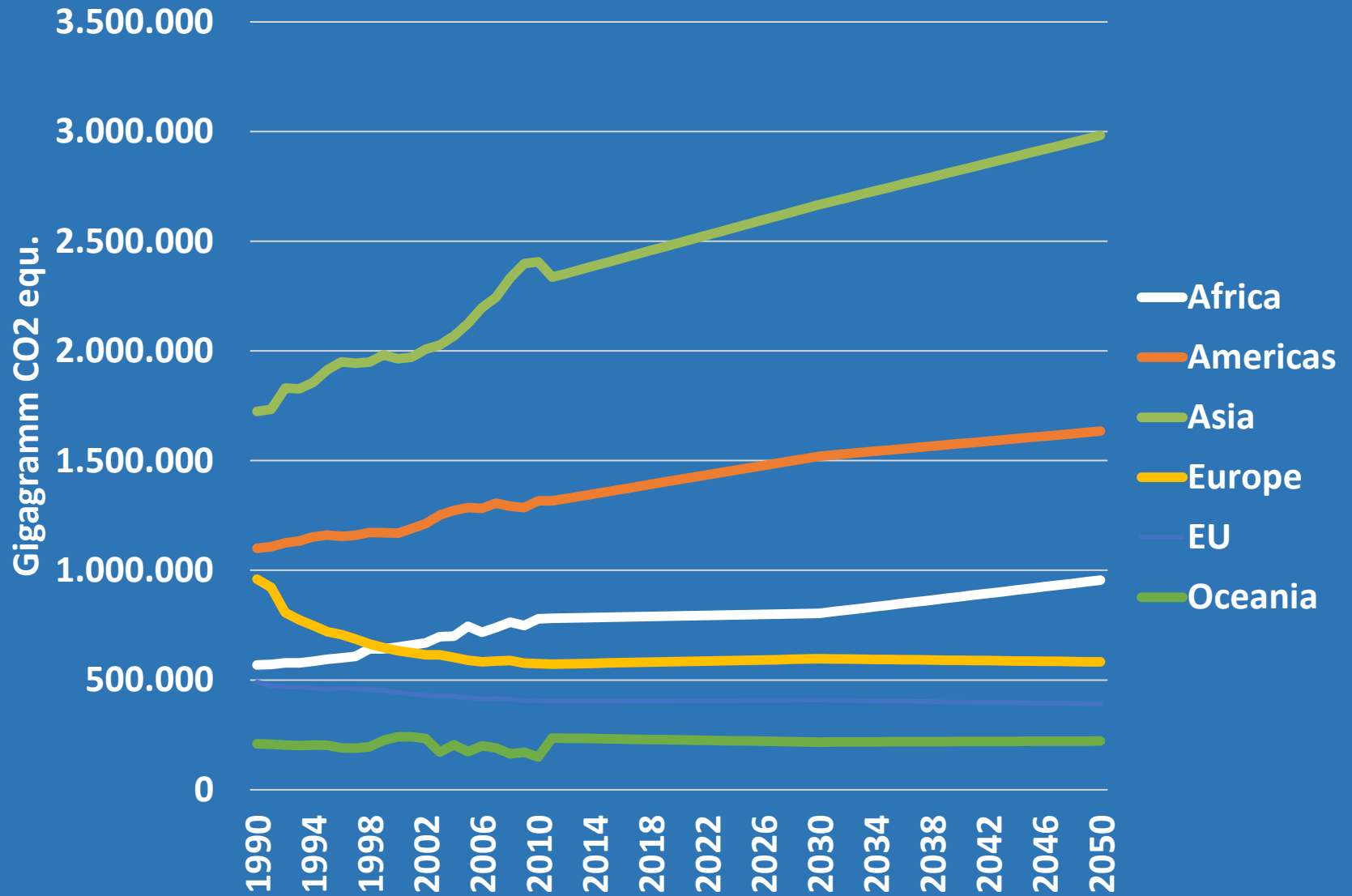


**What does agriculture  
contribute to GHG emissions?**

# GHG Emissions from Agriculture, global, 1990-2050

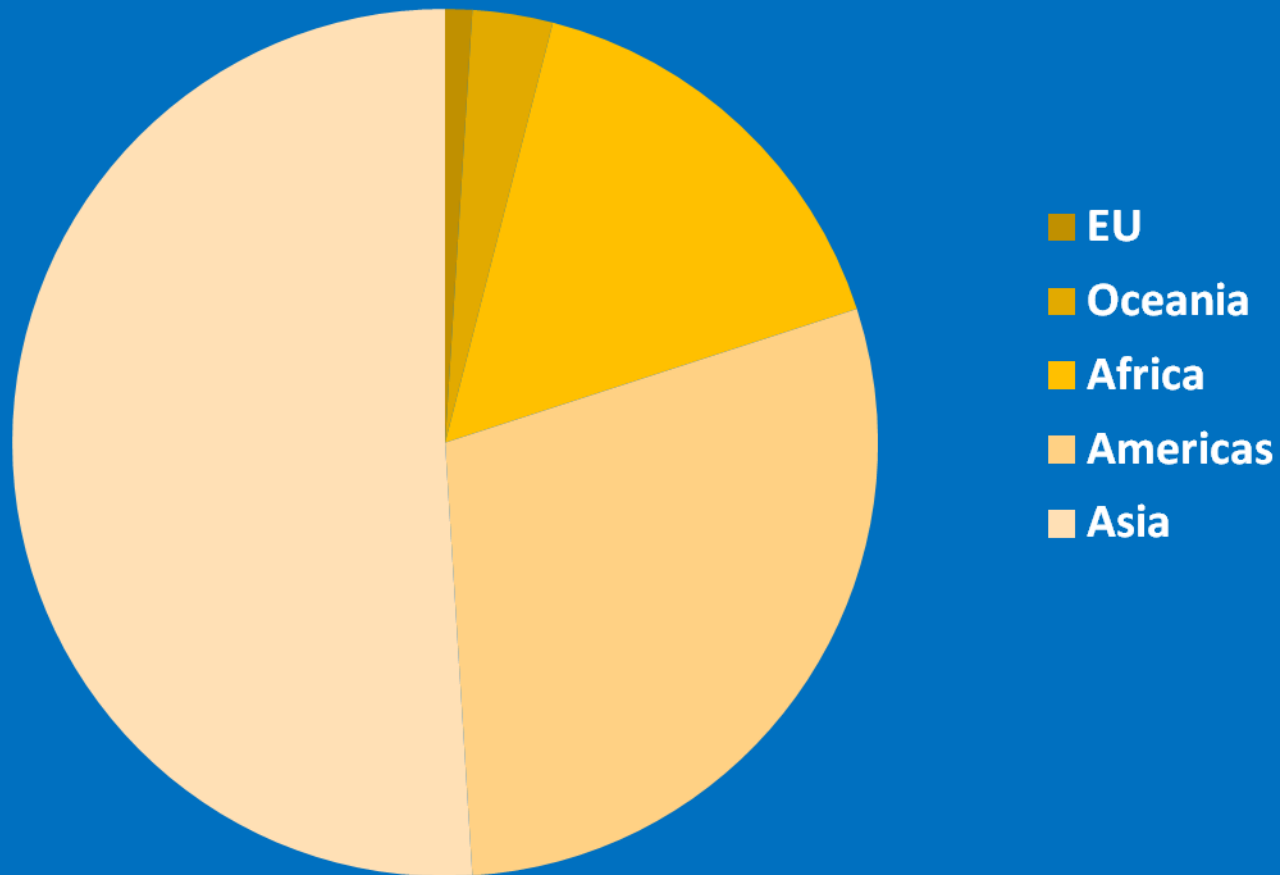


# GHG Emissions by Region, 1990-2050





# Share of additional CO2 Emissions from Agriculture, 2010-2050





**How does Climate Change affect agriculture and food security?**

# Percentage change in world food (cereal) prices in relation to changes in temperatures

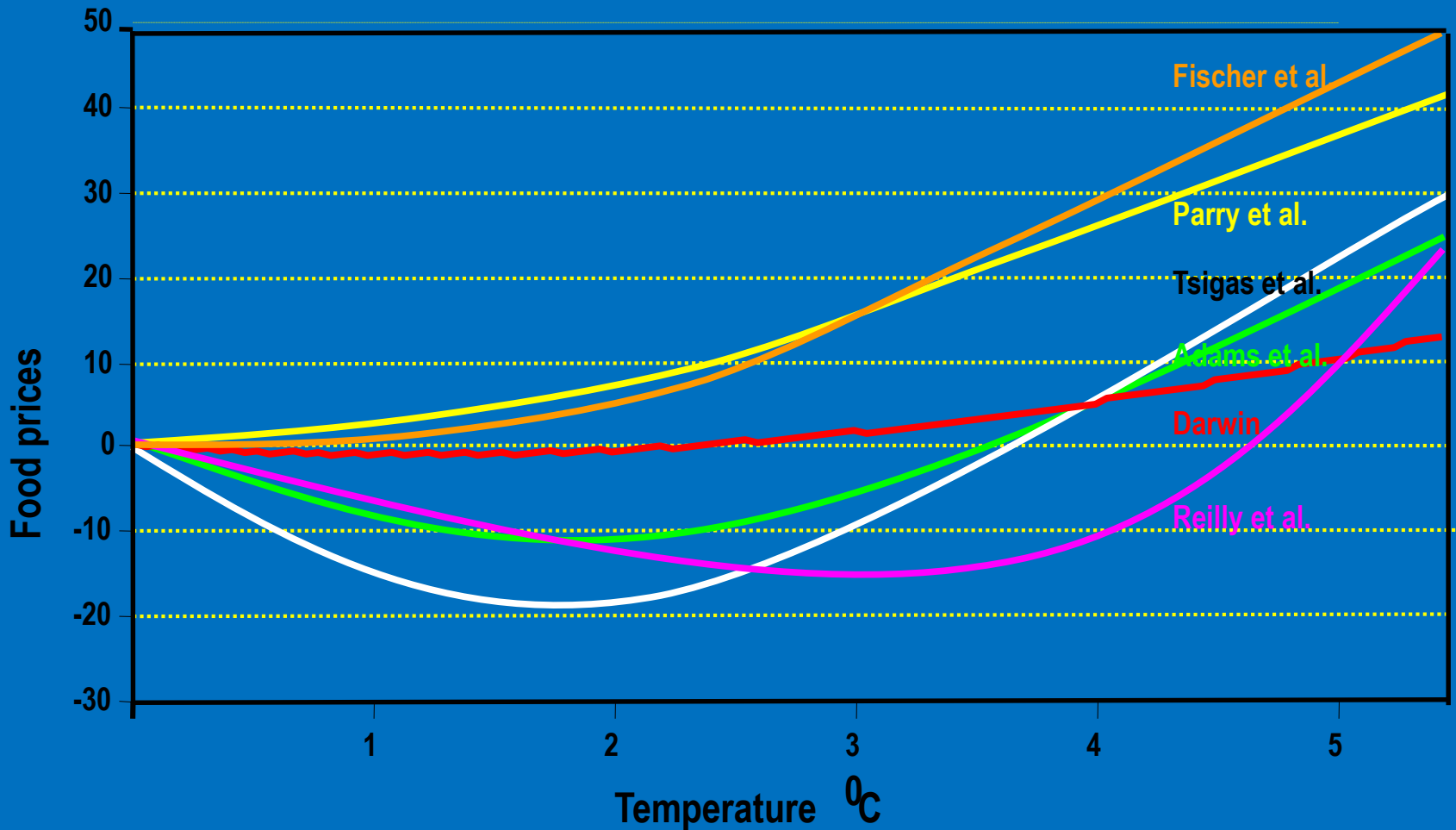


Table 1. The impacts of climate change and socio-economic development paths on the number of people at risk of hunger in developing countries

No. of people at risk of hunger in developing countries, in millions

Scenario	Year 2020		Year 2050		Year 2080	
	AEZ-BLS	DSSAT-BLS	AEZ-BLS	DSSAT-BLS	AEZ-BLS	DSSAT-BLS
Reference						
A1	663	663	208	208	108	108
A2	782	782	721	721	768	769
B1	749	749	239	240	91	90
B2	630	630	348	348	233	233
CC						
A1	666	687	219	210	136	136
A2	777	805	730	722	885	742
B1	739	771	242	242	99	102
B2	640	660	336	358	244	221
CC, no CO <sub>2</sub>						
A1	NA	726	NA	308	NA	370
A2	794	845	788	933	950	1,320
B1	NA	792	NA	275	NA	125
B2	652	685	356	415	257	384

1. Improvements over time

2. CC is bad for FS

3. SRRES >> CC

4. CO<sub>2</sub> fertilization is important

**THANKS**

