FAO’s long-term Outlook for Global Agriculture Uncertainties from higher energy prices and climate change

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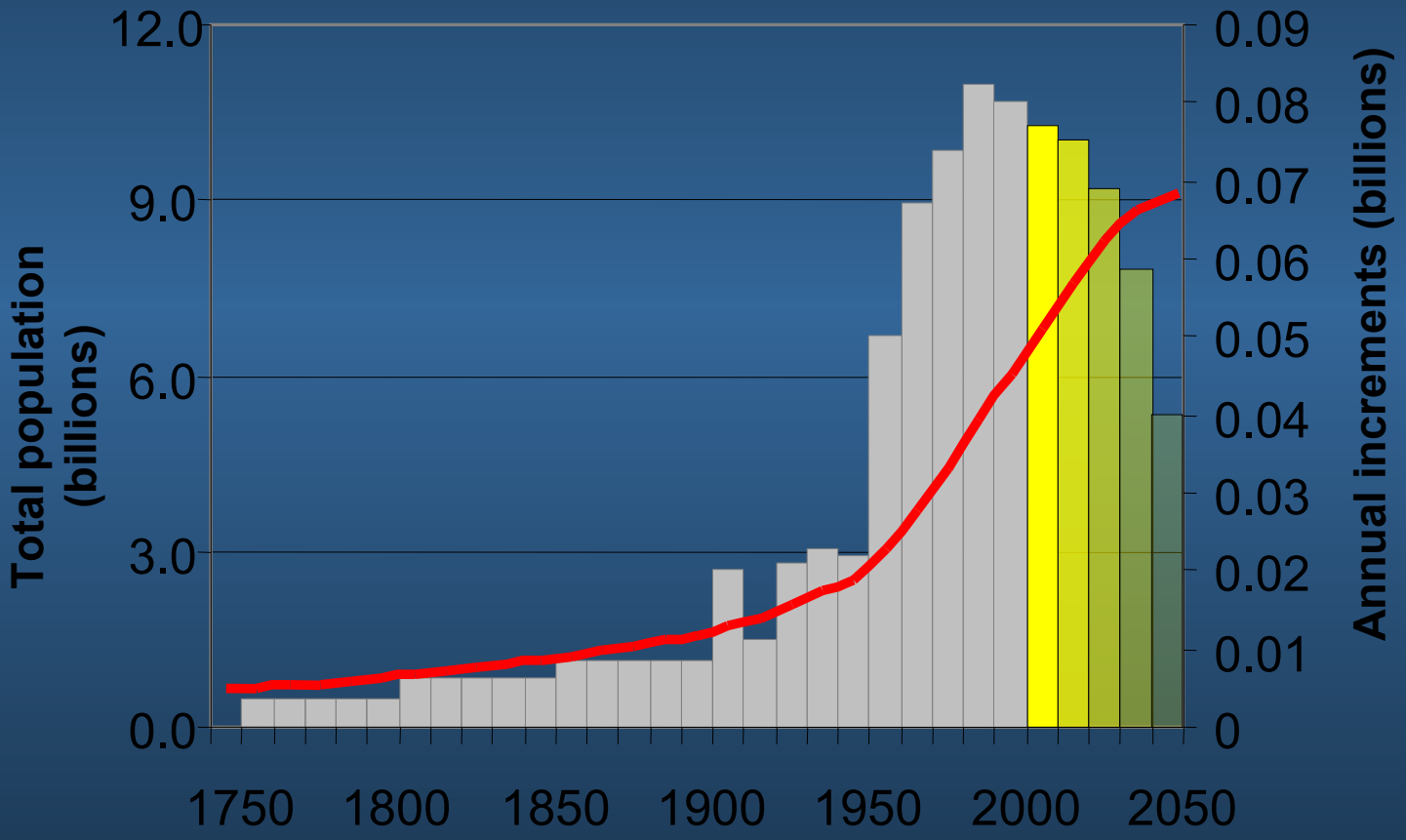
Population growth to continue, but at a slower pace



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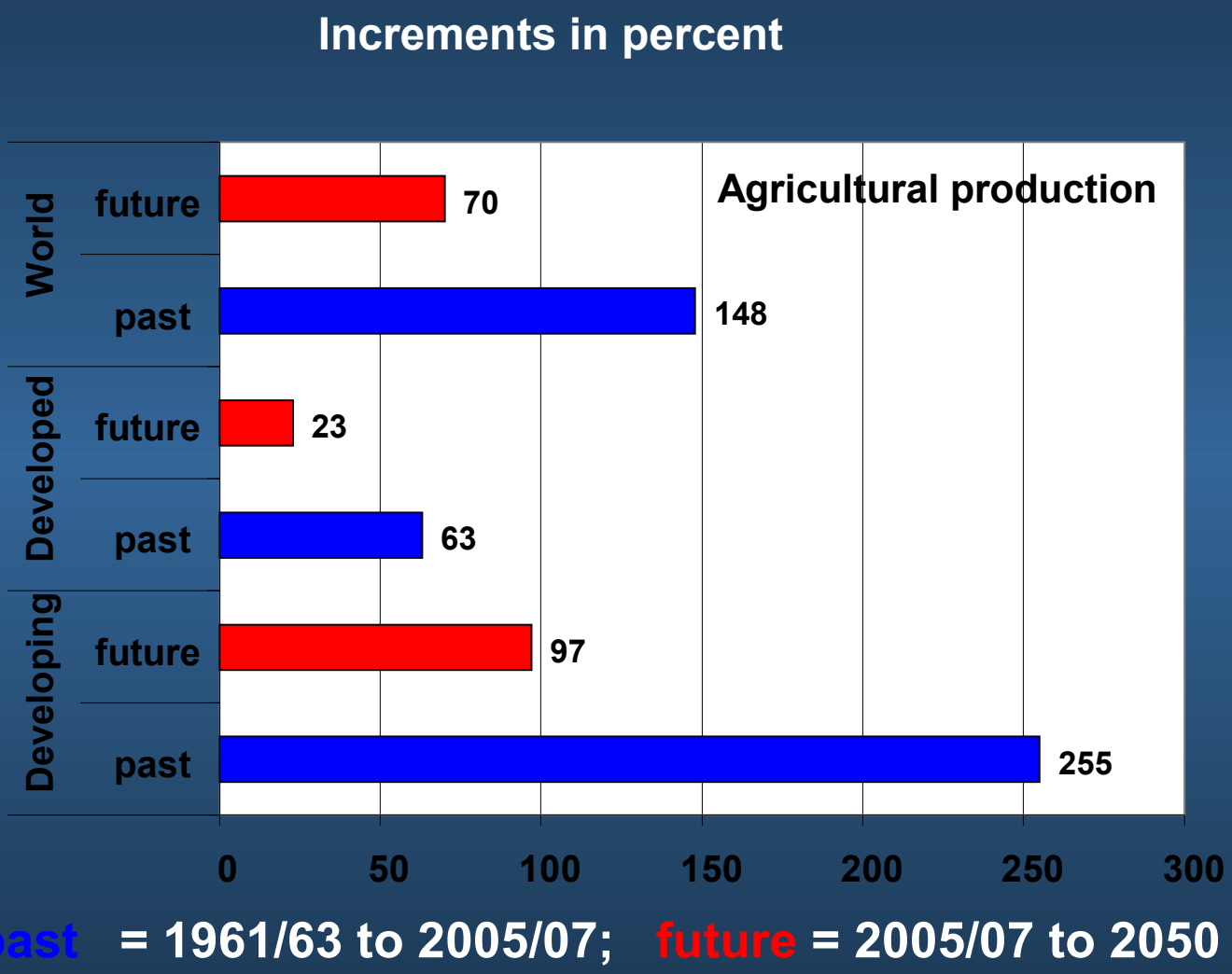
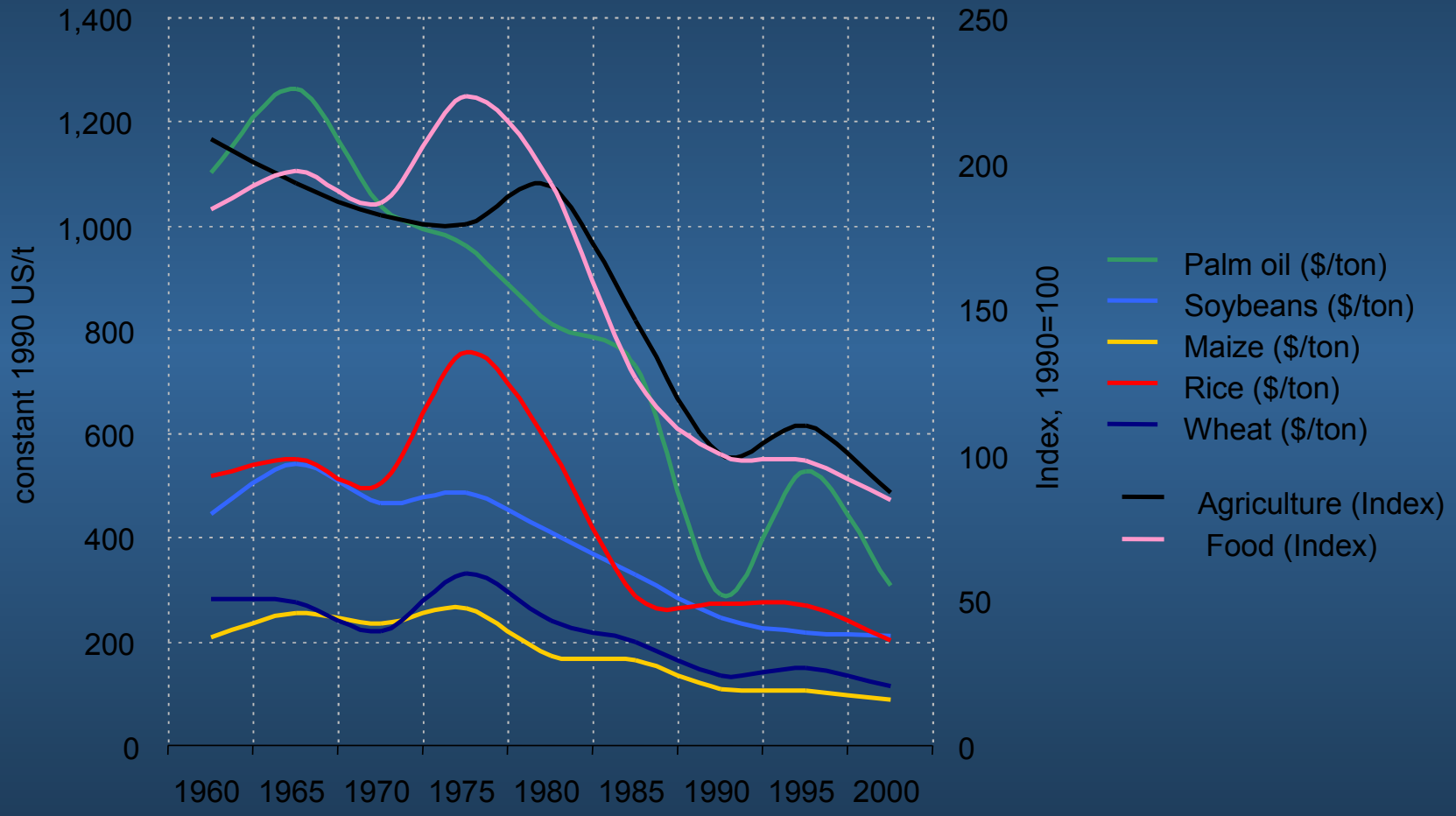
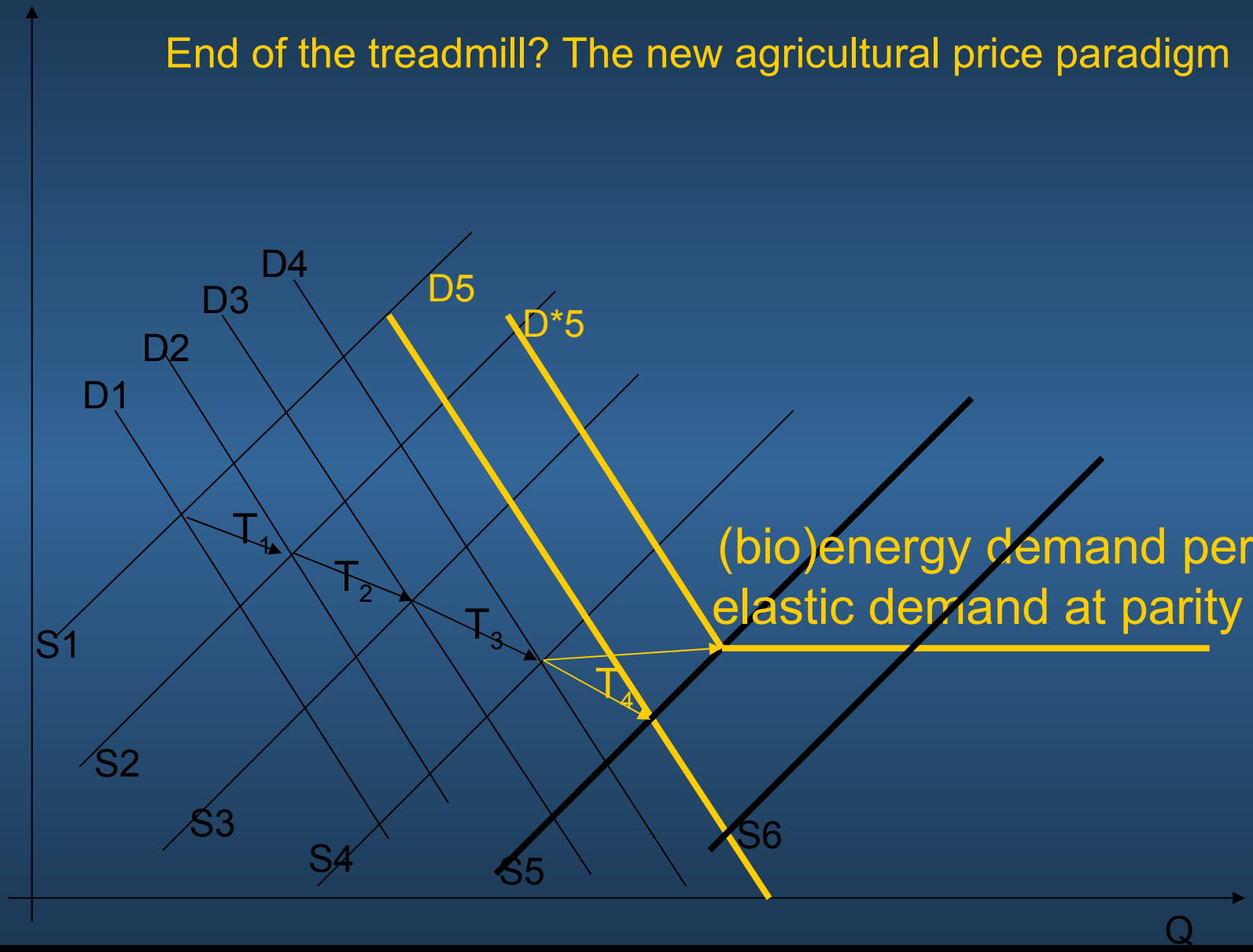
How much more needs to be produced by 2050?



The traditional paradigm: treadmill effect and falling real prices



End of the treadmill? The new agricultural price paradigm



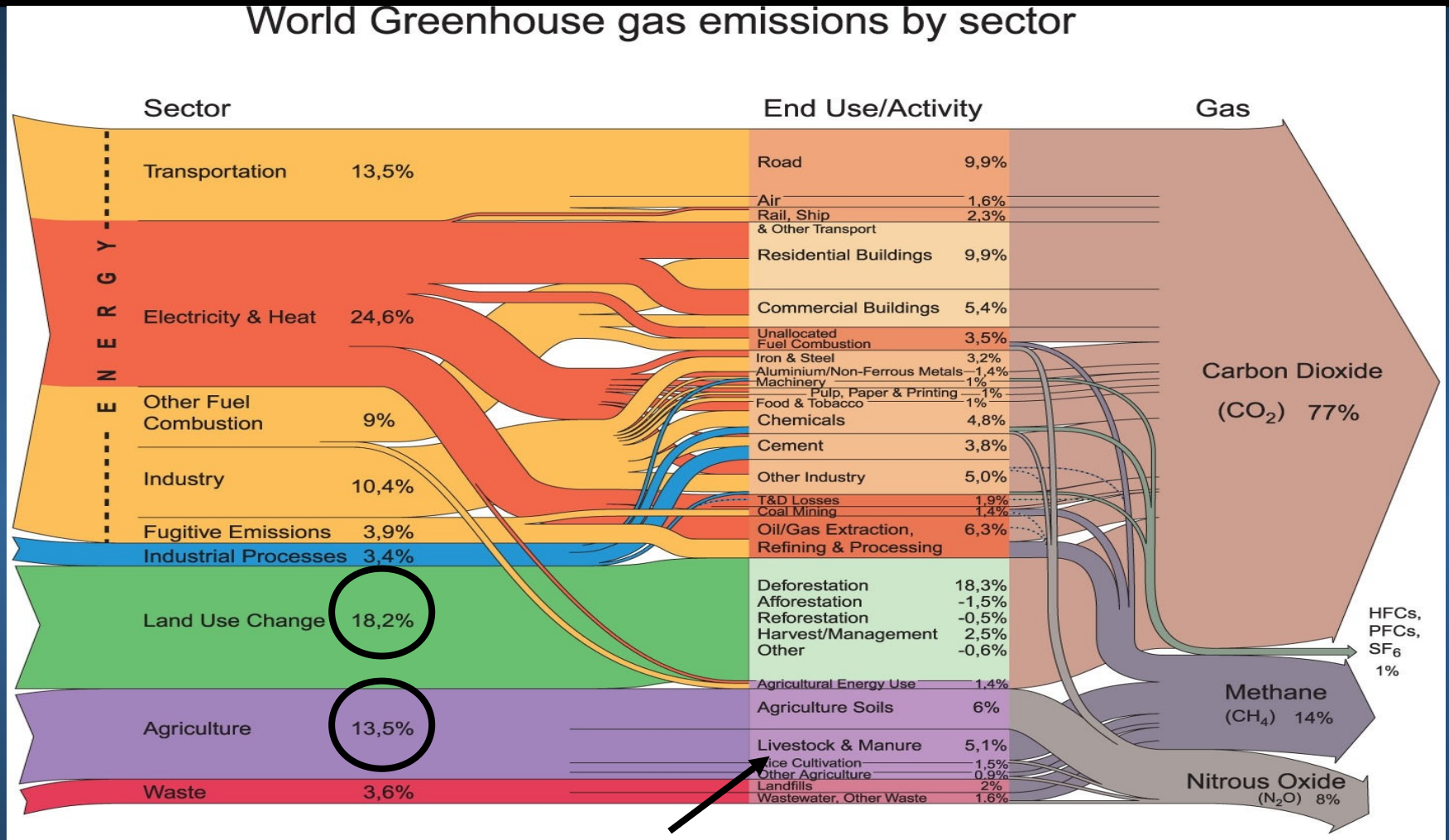
How big is the energy market?

1. Energy market (TPES): nearly 500 EJ
2. Biomass: 50 EJ (80% in developing countries)
3. Biofuels: 2.1 EJ, on ca. 26 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.
6. Energy market is large, creates perfectly elastic demand for agricultural produce at break-even points (parity prices).

Agriculture and energy markets

1. Low energy price trajectory: still need to raise production (70%) but increasingly saturated demand
2. High energy price trajectory: bioenergy market with difficult-to-saturatedemand for agricultural produce and resources
3. Consequence: food prices no longer set by food demand but by energy prices

Climate change: the role of agriculture



All data is for 2000. All calculations are based on CO_2 equivalents, using 100-year global warming potentials from the IPCC (1996), based on a total global estimate of 41 755 $MtCO_2$ equivalent. Land use change includes both emissions and absorptions. Dotted lines represent flows of less than 0.1% percent of total GHG emissions.

Source: World Resources Institute, Climate Analysis Indicator Tool (CAIT), Navigating the Numbers: Greenhouse Gas Data and International Climate Policy, December 2005; Intergovernmental Panel on Climate Change, 1996 (data for 2000).

Climate change: the impact on agriculture

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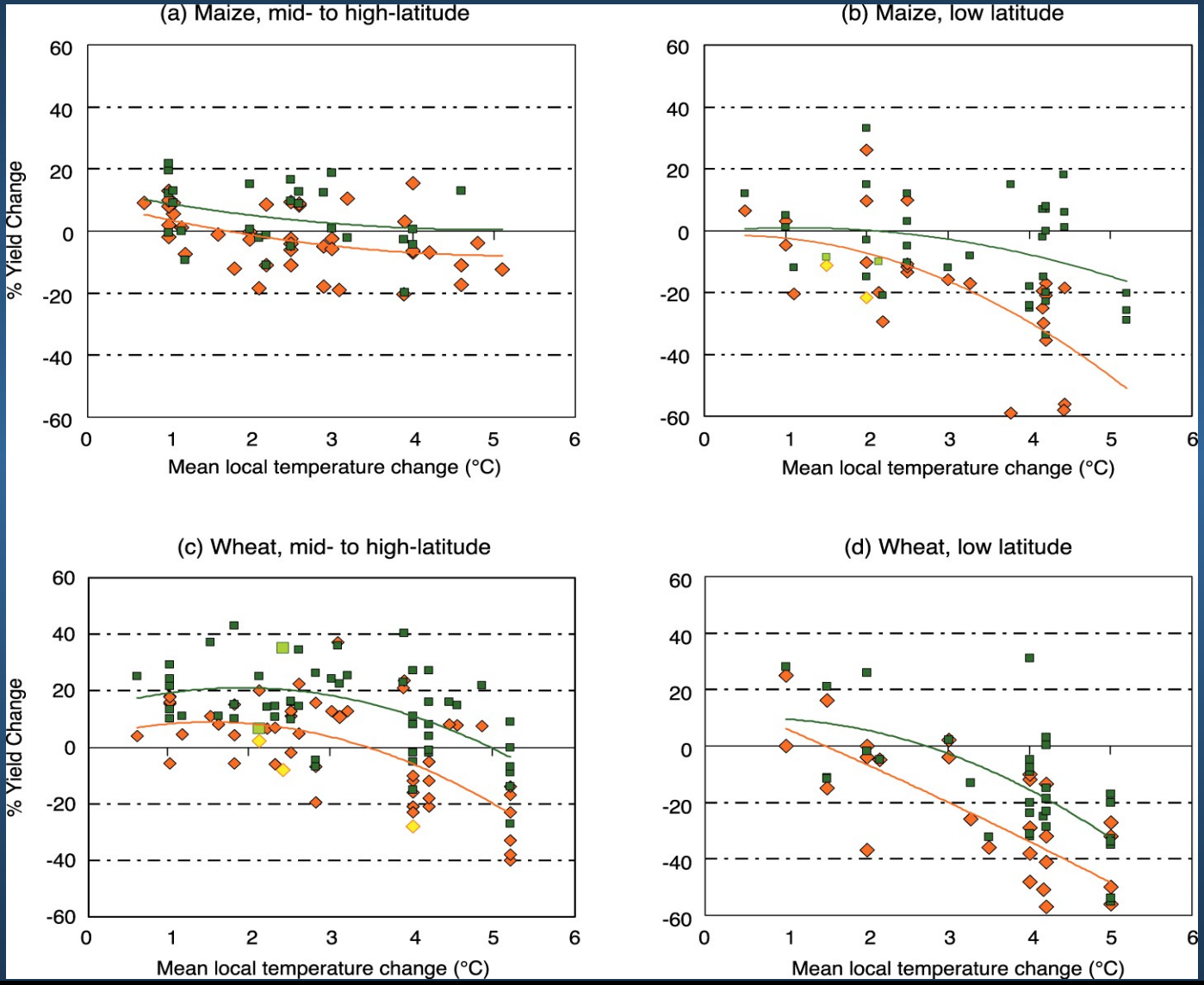
biophysical changes:

- higher temperatures and more evaporation
- more precipitation and higher rainfall variability
- more frequent extreme weather events
- coastal areas flooded
- glaciers, water circulation, irrigation potentials
- higher atmospheric CO_2 concentration

impacts on agriculture/food

- high latitude areas: ↑yields for GMT <2.5°C, ↓yields >2.5°C GMT
- low latitude areas: ↓yields even for ↑temp 1-2°C
- ↑irrigation water demand +5-20% by 2080s (globally)
- high latitudes: more land suitable for agricultural production (+160 million ha)
- low latitudes: less land for agricultural production (-110 million ha)
- land losses due to inundation (temporary and permanent)
- CO_2 fertilization at low temperature increases
- CO_2 benefits at higher Δtemperatures are diminishing
- fire risks, pests and diseases, food safety, e-coli, malaria, etc.
- livestock: diseases (e.g. bluetongue), heat and water stress, Δforage quality

Sensitivity of cereal yield to climate change



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

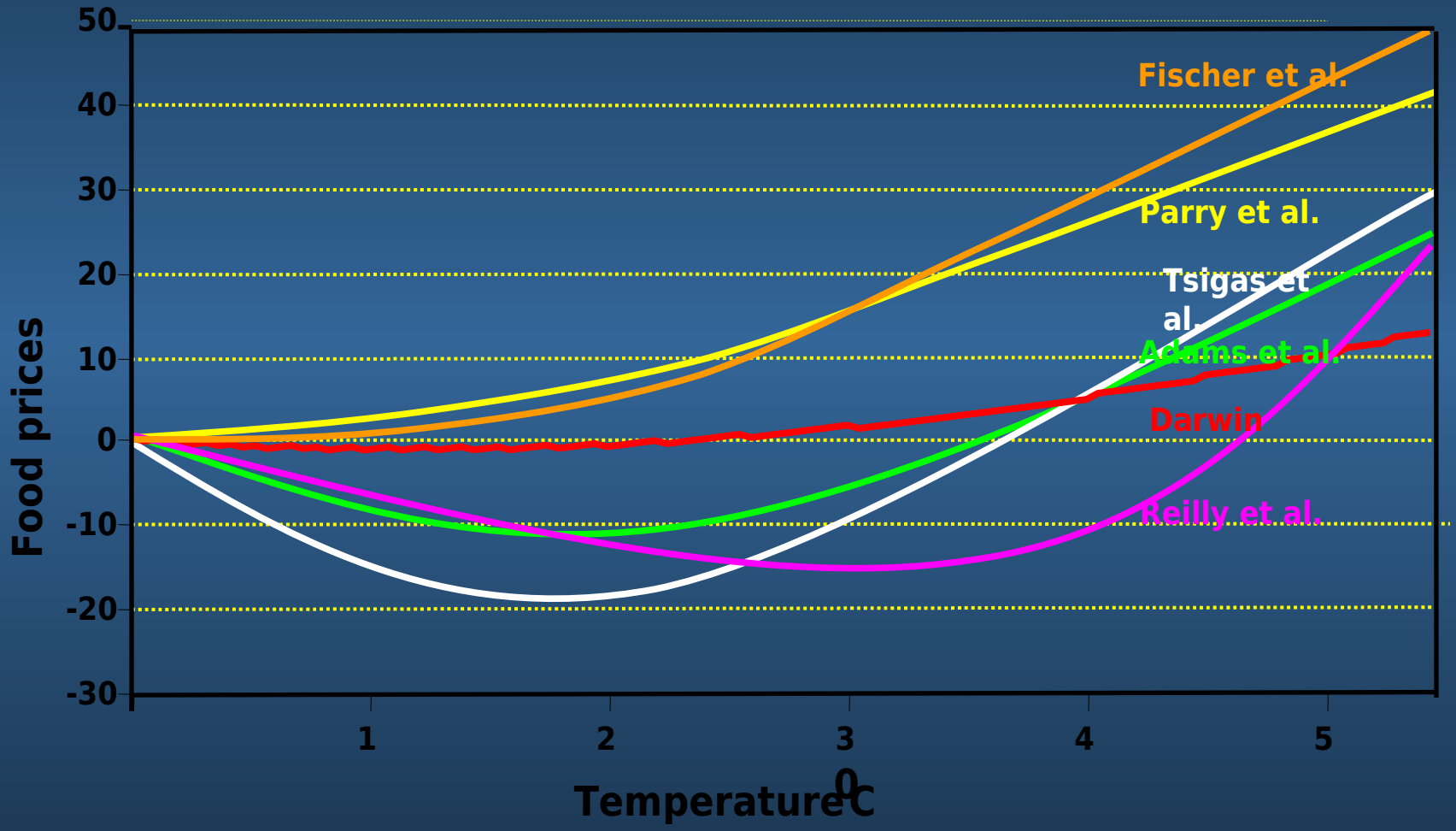


Table 1. The impacts of climate change and socio-economic development paths on the number of people at risk of hunger in developing countries

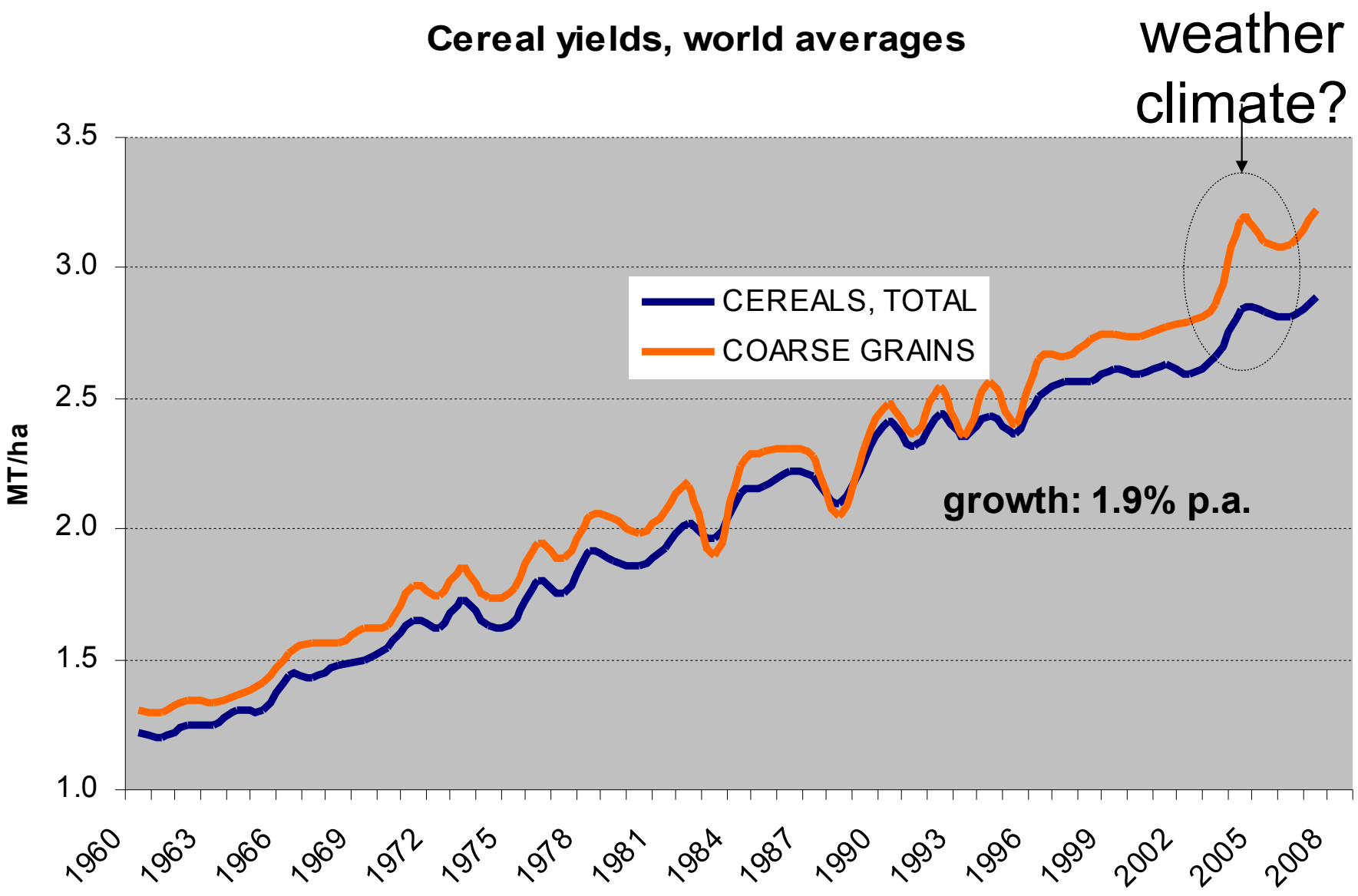
	No. of people at risk of hunger in developing countries, in millions					
	Year 2020		Year 2050		Year 2080	
Scenario	AEZ-BLS	DSSAT-BLS	AEZ-BLS	DSSAT-BLS	AEZ-BLS	DSSAT-BLS
Reference						
A1	663	663	208	208	108	108
A2	782	782	721	721	768	769
B1	749	749	239	240	91	90
B2	630	630	348	348	233	233
CC						
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_2						
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

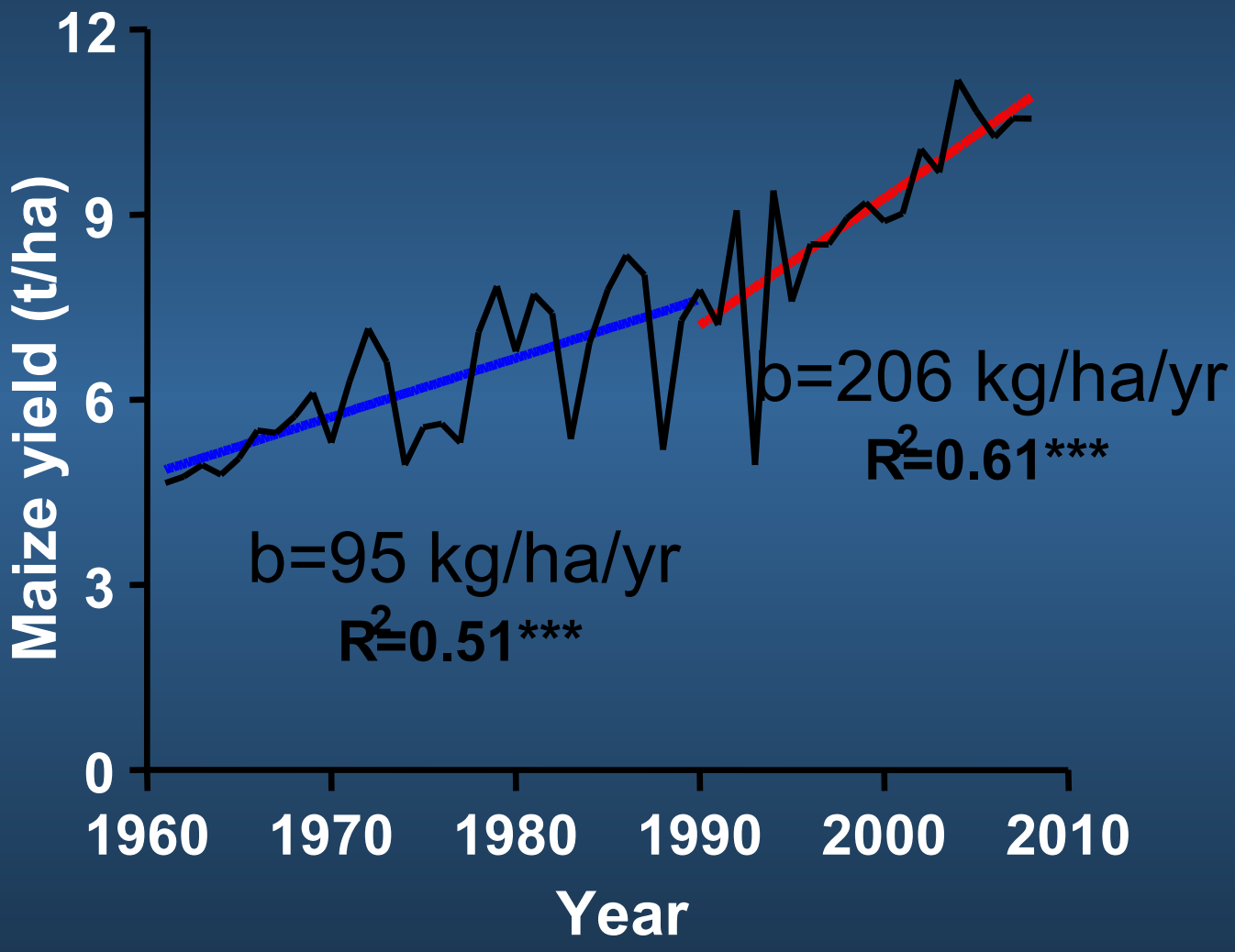
2. CC is bad for FS

3. SRES>>CC

4. CO2 fertilization is important

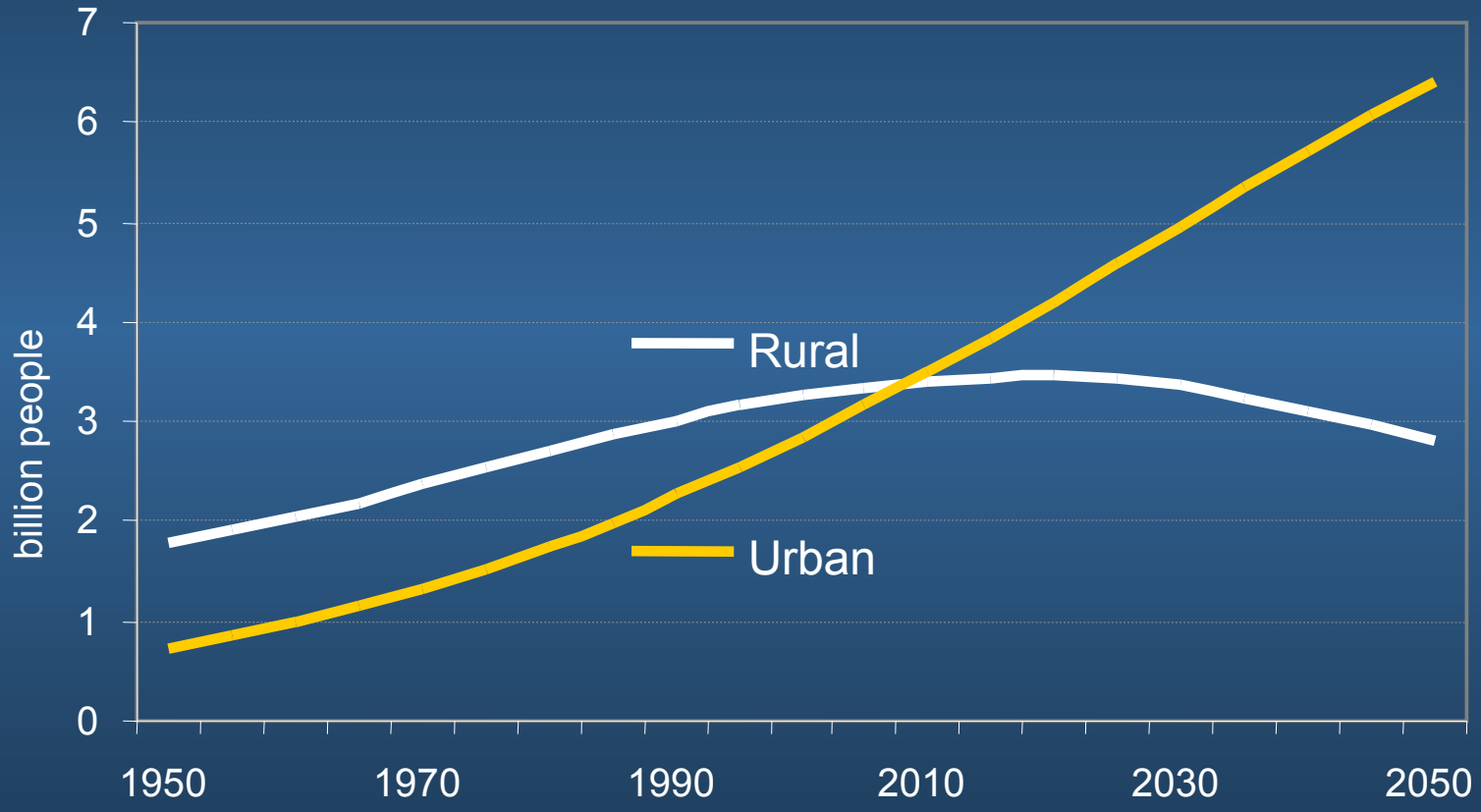

Cereal yields, world averages
weather
climate?
MT/ha
3.5
3.0
2.5
2.0
1.5
1.0
CEREALS, TOTAL
COARSE GRAINS
growth: 1.9% p.a.
1960
1963
1966
1969
1972
1975
1978
1981
1984
1987
1990
1993
1996
1999
2002
2005
2008

Iowa maize yield 61-90; 90-08

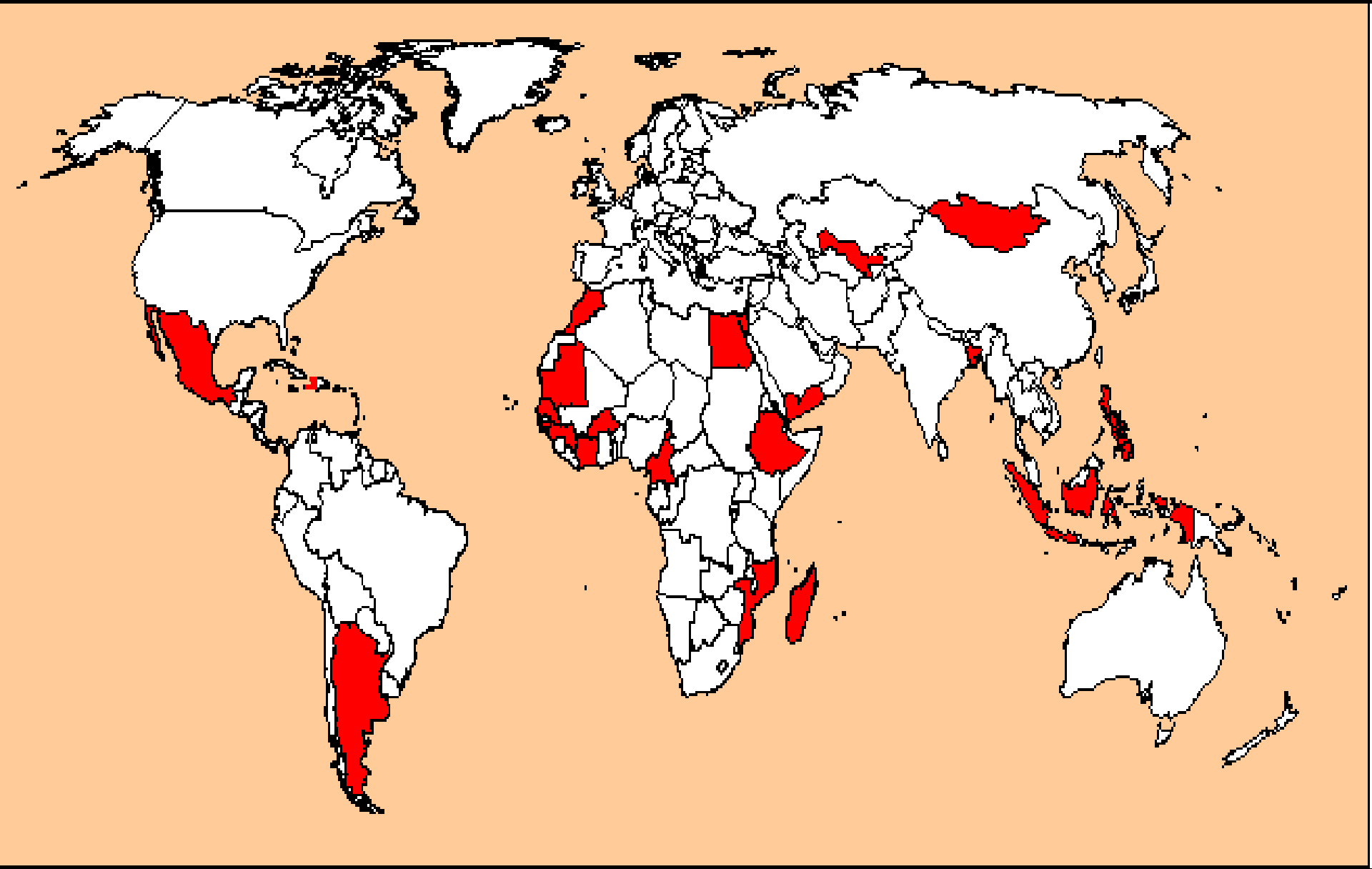


Climate change, food and national security

Urbanization to accelerate

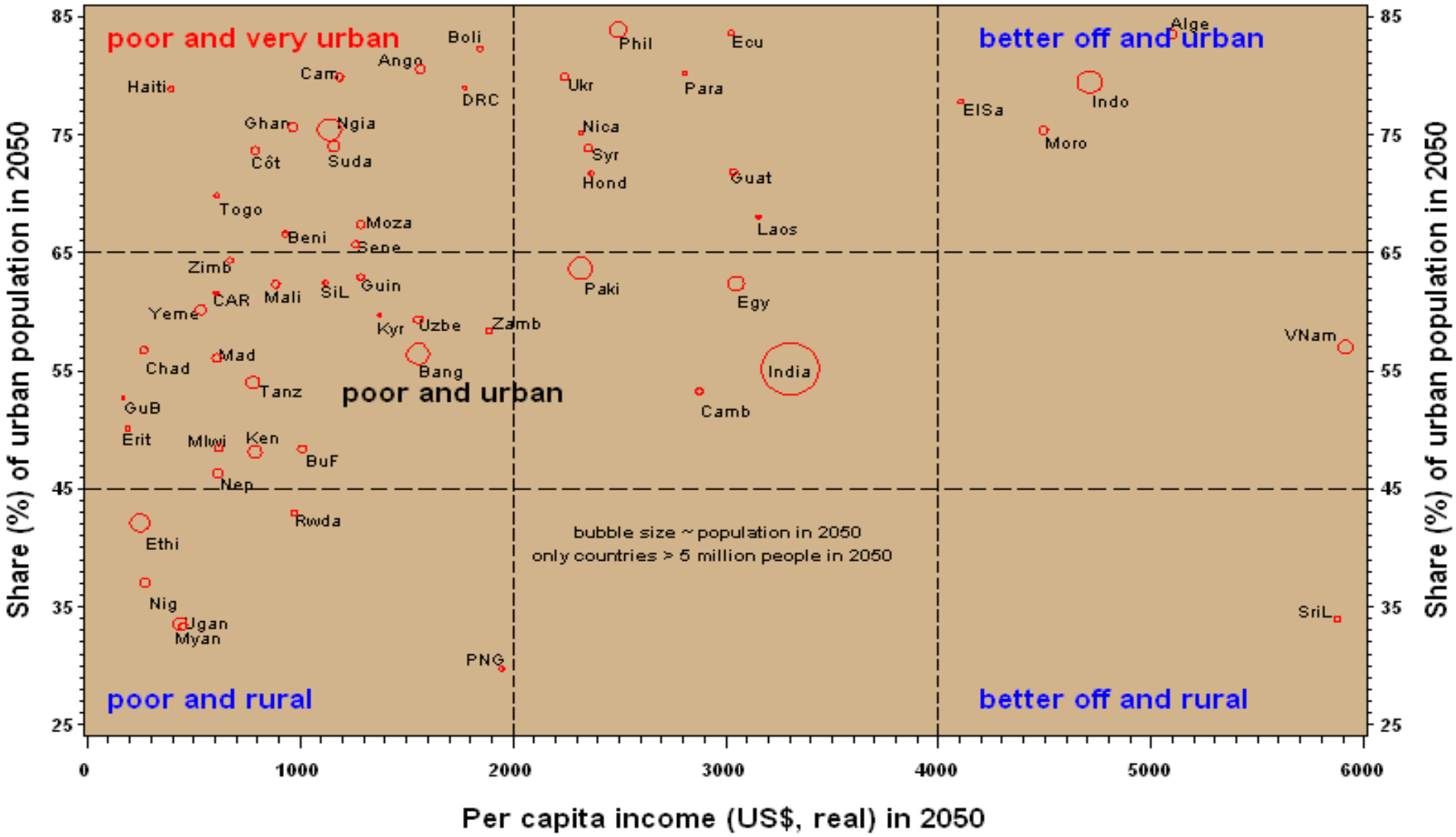


FAO‘s long-term outlook for global agriculture, climate change and energy prices



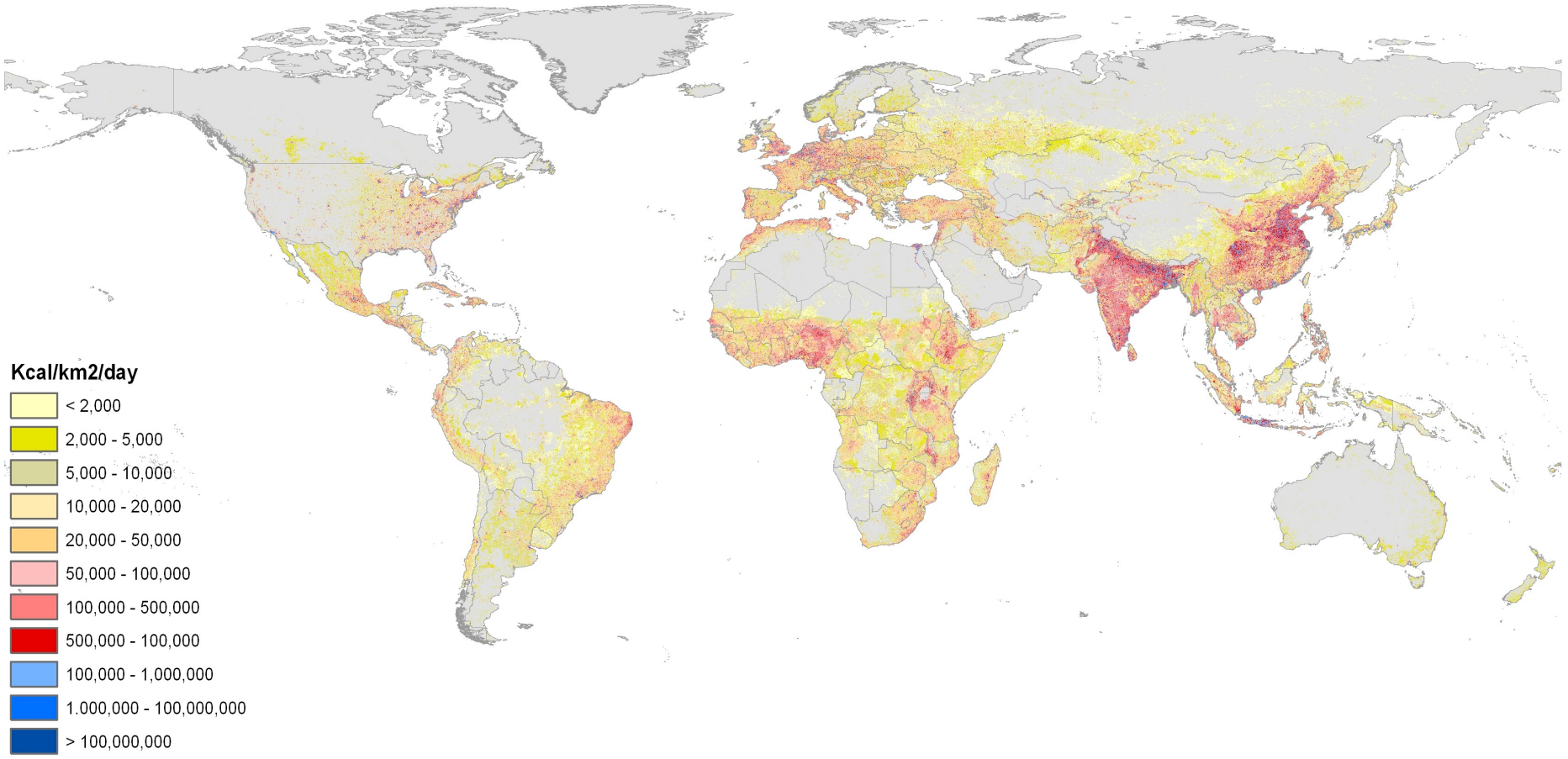
Urban and Poor: The Centres of Future Food Conflicts?

Urbanization ratios and per capita income levels in 2050

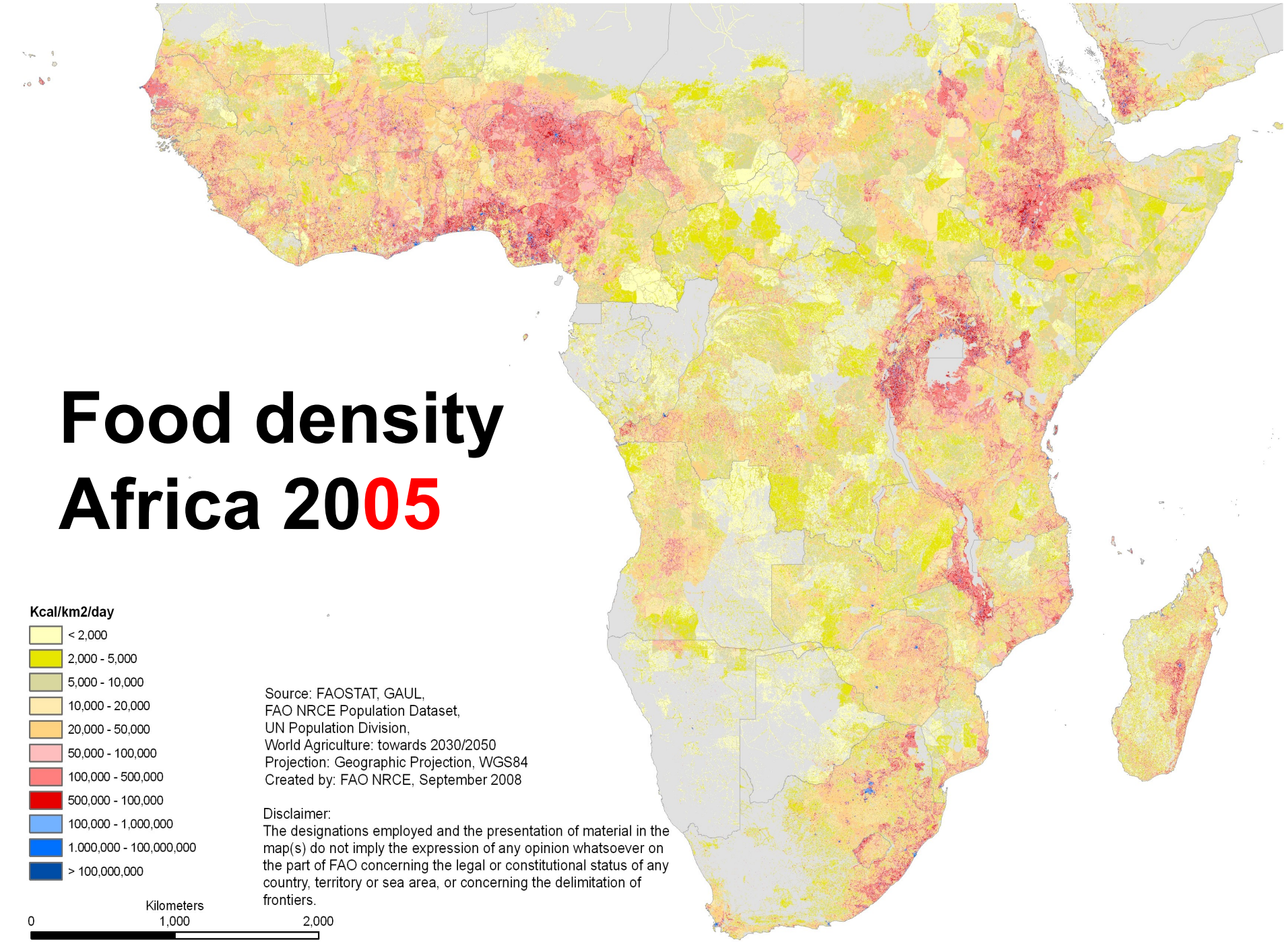


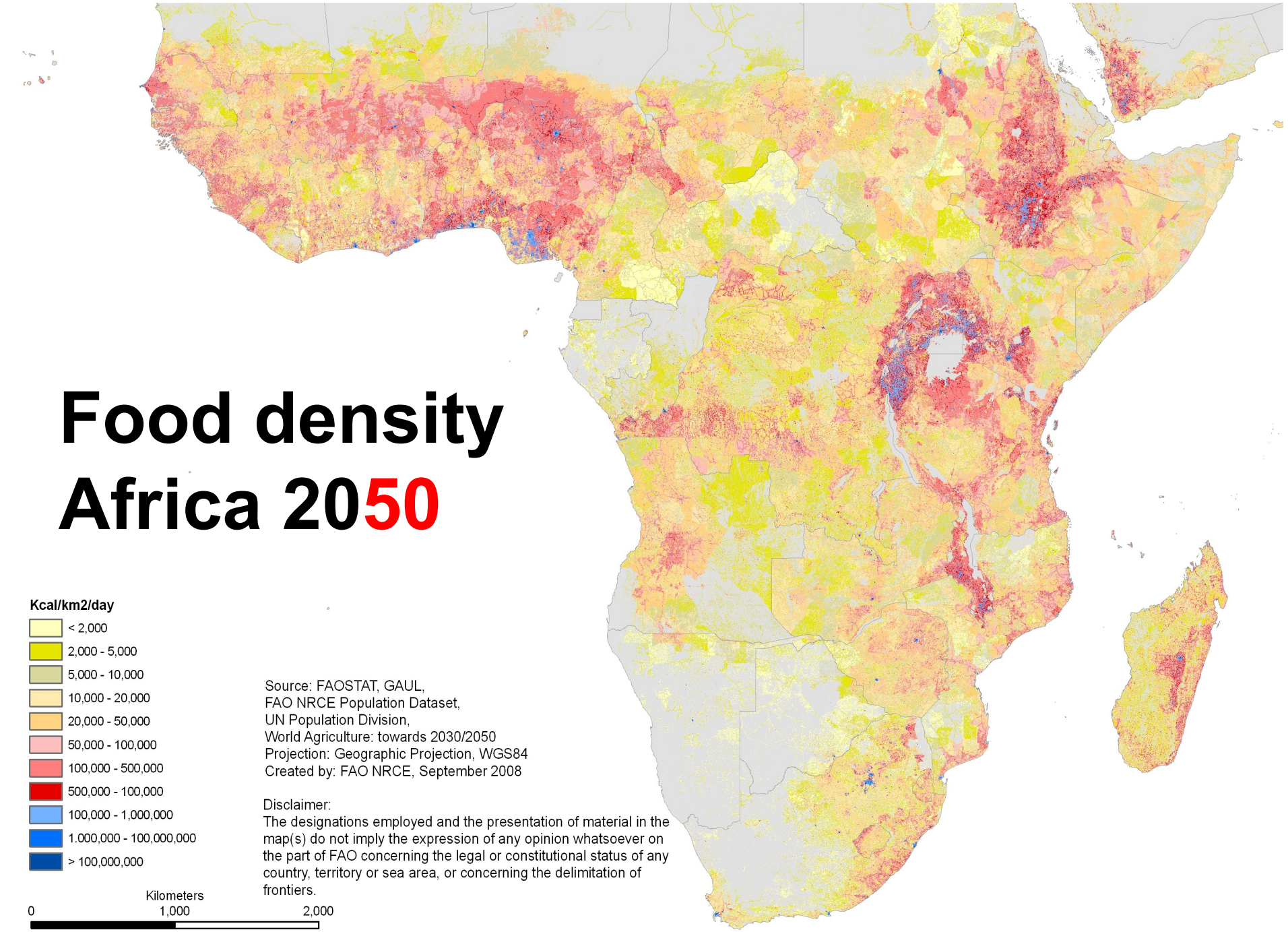
Source: Own calculations based on World Bank and UN Urbanization Assessment 2007

Food Density 2005



Source:
FAOSTAT, GAUL, UN Population Division,
FAO NRCE Population Dataset,
World Agriculture: towards 2030/2050
Projection: Geographic Projection, WGS84
Created by: FAO NRCE, September 2008


Food density
Africa 2005
Kcal/km2/day
< 2,000
2,000 - 5,000
5,000 - 10,000
10,000 - 20,000
20,000 - 50,000
50,000 - 100,000
100,000 - 500,000
500,000 - 100,000
100,000 - 1,000,000
1.000,000 - 100,000,000
> 100,000,000
Kilometers
0
1,000
2,000
Source: FAOSTAT, GAUL,
FAO NRCE Population Dataset,
UN Population Division,
World Agriculture: towards 2030/2050
Projection: Geographic Projection, WGS84
Created by: FAO NRCE, September 2008
Disclaimer:
The designations employed and the presentation of material in the map(s) do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal or constitutional status of any country, territory or sea area, or concerning the delimitation of frontiers.


Food density
Africa 2050
Kcal/km2/day
< 2,000
2,000 - 5,000
5,000 - 10,000
10,000 - 20,000
20,000 - 50,000
50,000 - 100,000
100,000 - 500,000
500,000 - 100,000
100,000 - 1,000,000
1.000,000 - 100,000,000
> 100,000,000
Kilometers
0
1,000
2,000
Source: FAOSTAT, GAUL,
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Summary and conclusions

1. Food markets are still growing, but increasingly saturated
   - +70% more production, but slow down in growth
   - overall enough resources (land, water, genetics)
1. Energy demand cannot be met by agriculture
   - creates perfectly elastic demand for agricultural output (and resources) at break-even points (parity prices)
   - high energy prices will set prices for food (effective floor price)
1. Climate change and resources
   - Climate change: globally production neutral up to +2GMT
   - Vast local differences, less production potential in more food insecure areas
   - Greater weather variability, could increase production variability
   - Higher saturation in food demand, lower demand responsiveness could augment price swings
   - Larger price swings, more urban food and poverty concentration could make food riots a more frequent feature in the future.

Thanks.
Questions?

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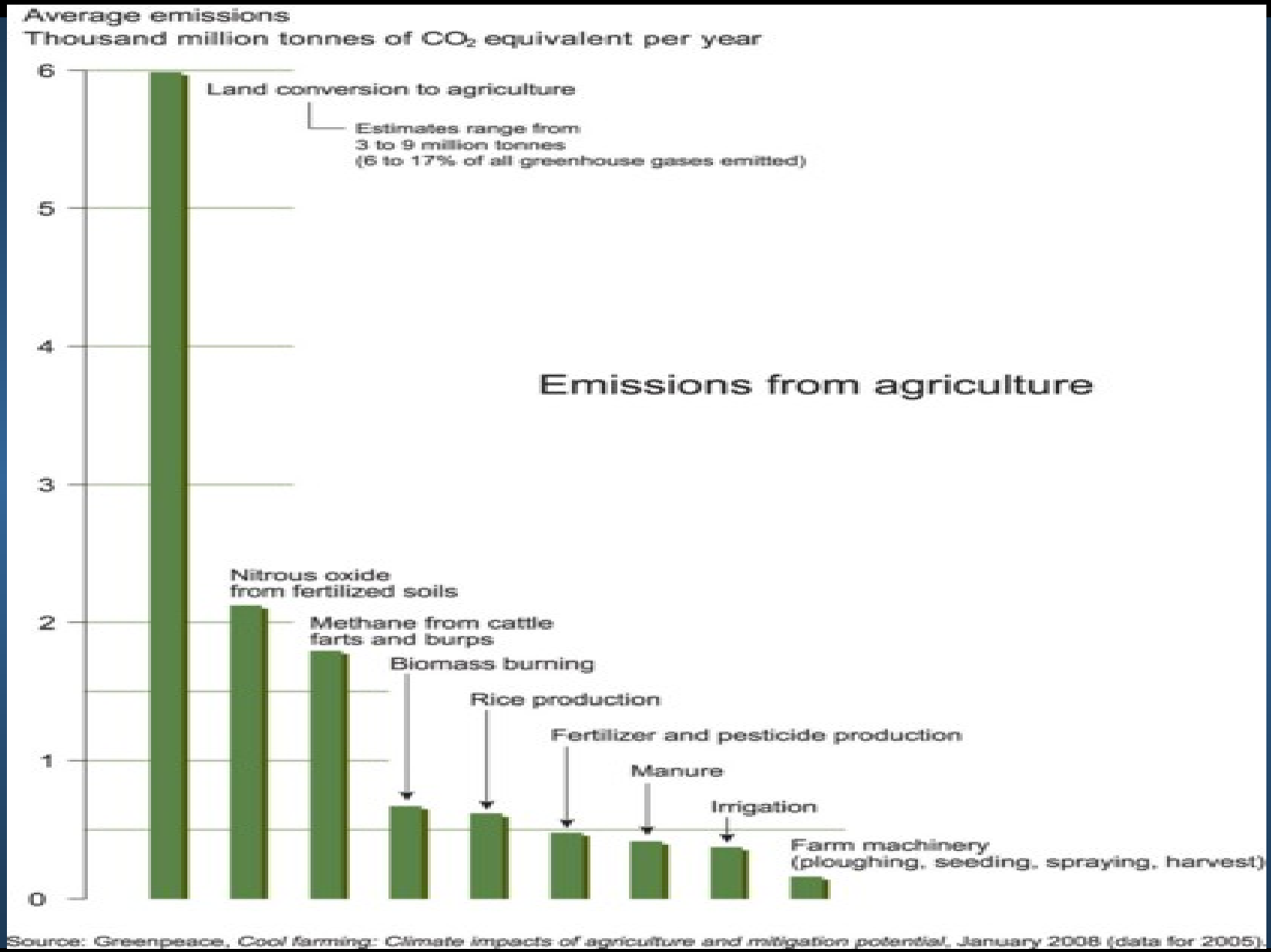

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