

ENERGY

MYTHS AND REALITIES

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SOME IMPORTANT GLOBAL TRENDS

Year	Population (million)	Energy use (GJ/capita)	Economic product (2000\$/capita)	Life expectancy	Global phytomass stock (Gt C)
5000 bp	20	< 3	< 100	20	>1,000
0	200	< 5	500	< 25	1,000
1000	300	< 10	500	< 30	900
1801	900	23	600	35	750
1900	1,600	27	1,200	40	660
2000	6,100	75	6,500	67	600
2010	6,900	75	7,500	69	<600



Chimpanzee
Gombe
Tanzania
0.25-1 kg/ha

DENSITY OF HUMAN POPULATIONS

	Population density people/km ²	live weight in kg/ha
Foraging	0.01 – 1	0.005 – 0.5
Shifting cultivation	20 – 30	9 – 14
Traditional farming		
predynastic Egypt	100 – 110	45 – 50
medieval England	150	75
global mean in 1900	200	100
Chinese mean in 1900	400	180
Modern agriculture		
global mean in 2000	400	200
Chinese mean in 2000	900	410
Jiangsu province in 2000	1,400	630

Densities for foragers are per unit of exploited of land; all densities for traditional and modern agriculture are per unit of arable land.

Tokyo anthropomass 6,000 kg/ha



Paris anthropomass 10,000 kg/ha



Mongkok anthropomass 20,000 kg/ha



Wildebeest LW 20 kg/ha



African elephants LW 30 kg/ha



African cattle LW 150 kg/ha

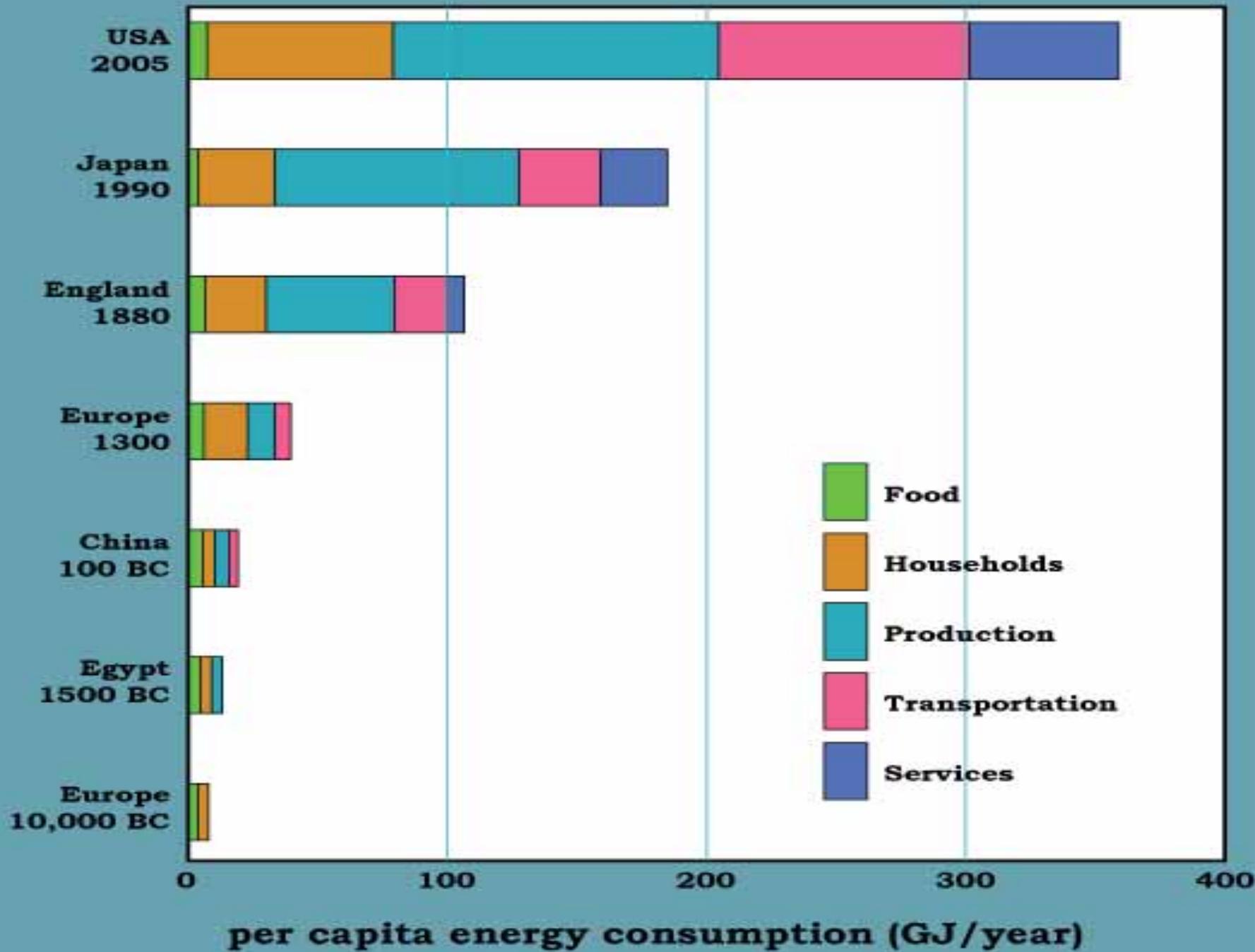


Egyptian water buffalo LW 350 kg/ha

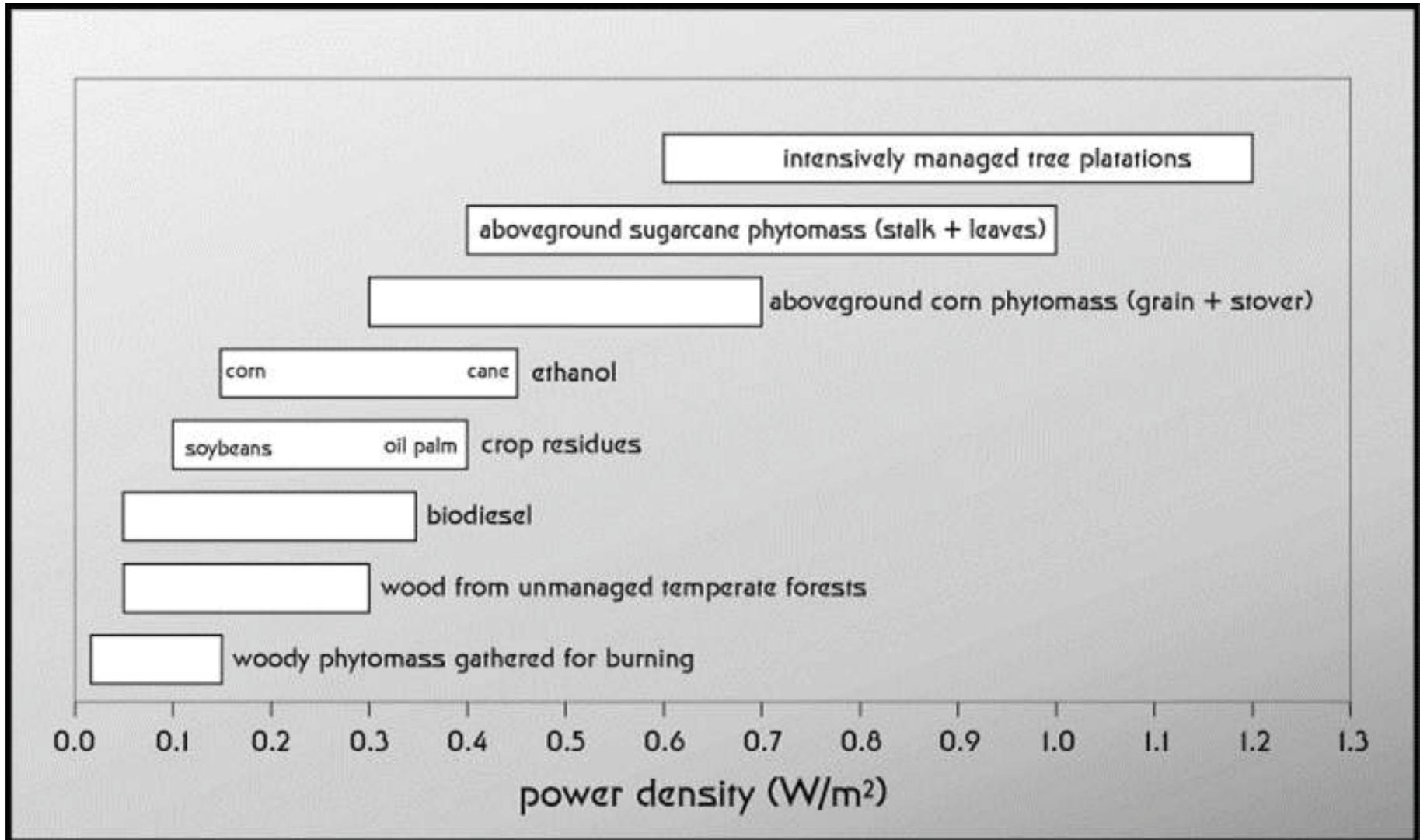




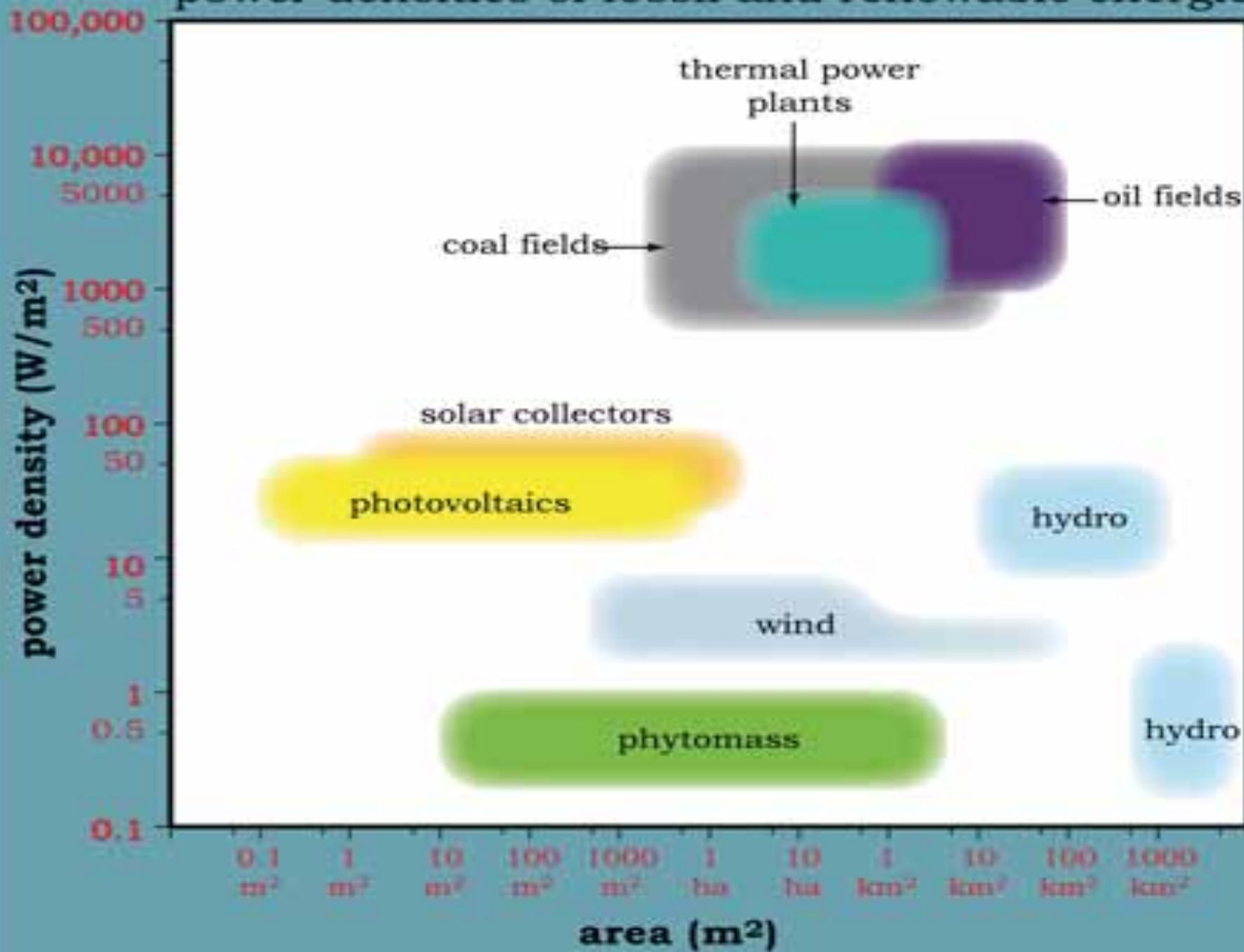
Dutch cows 750 kg/ha

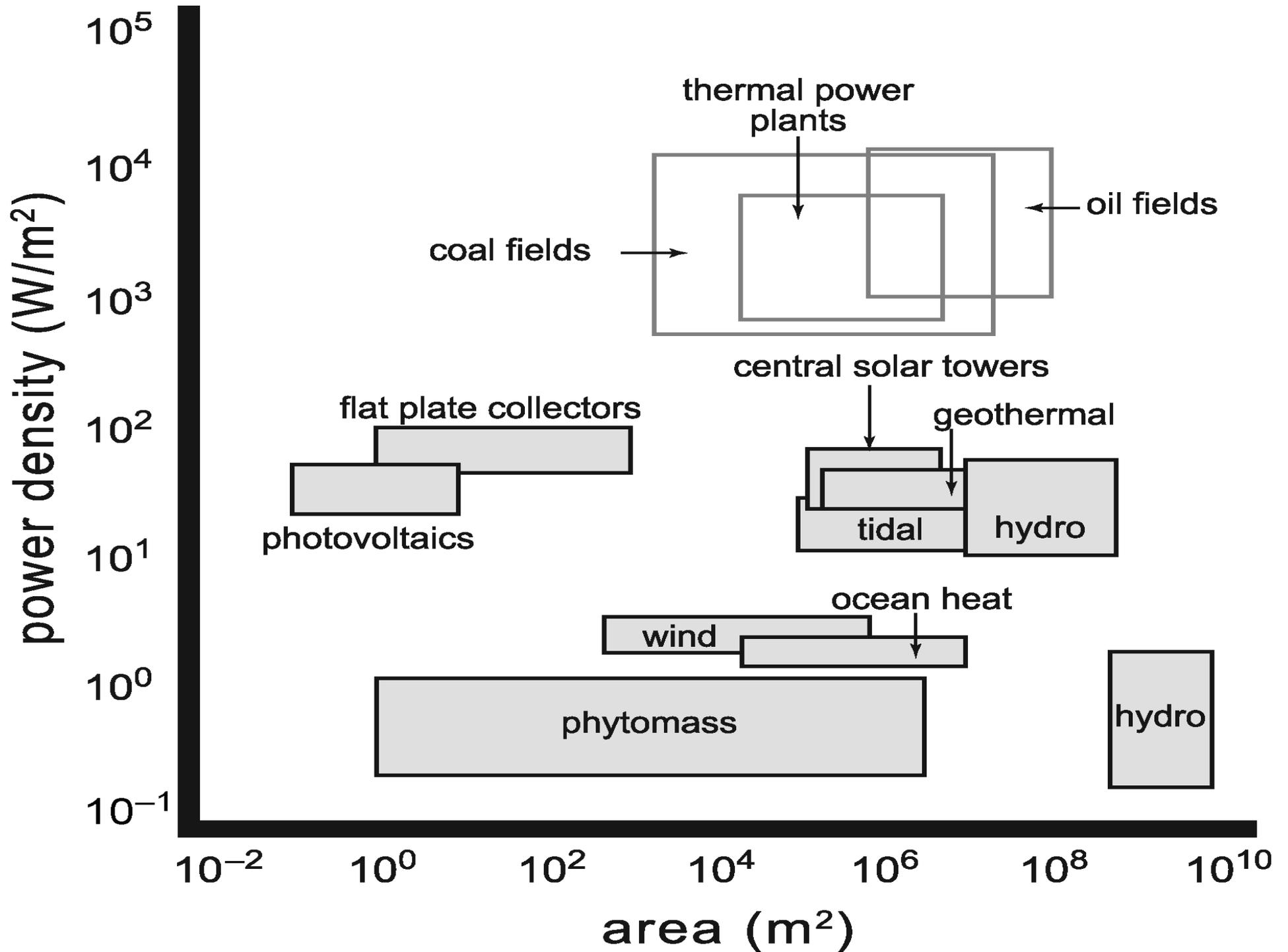


Power densities of harvests

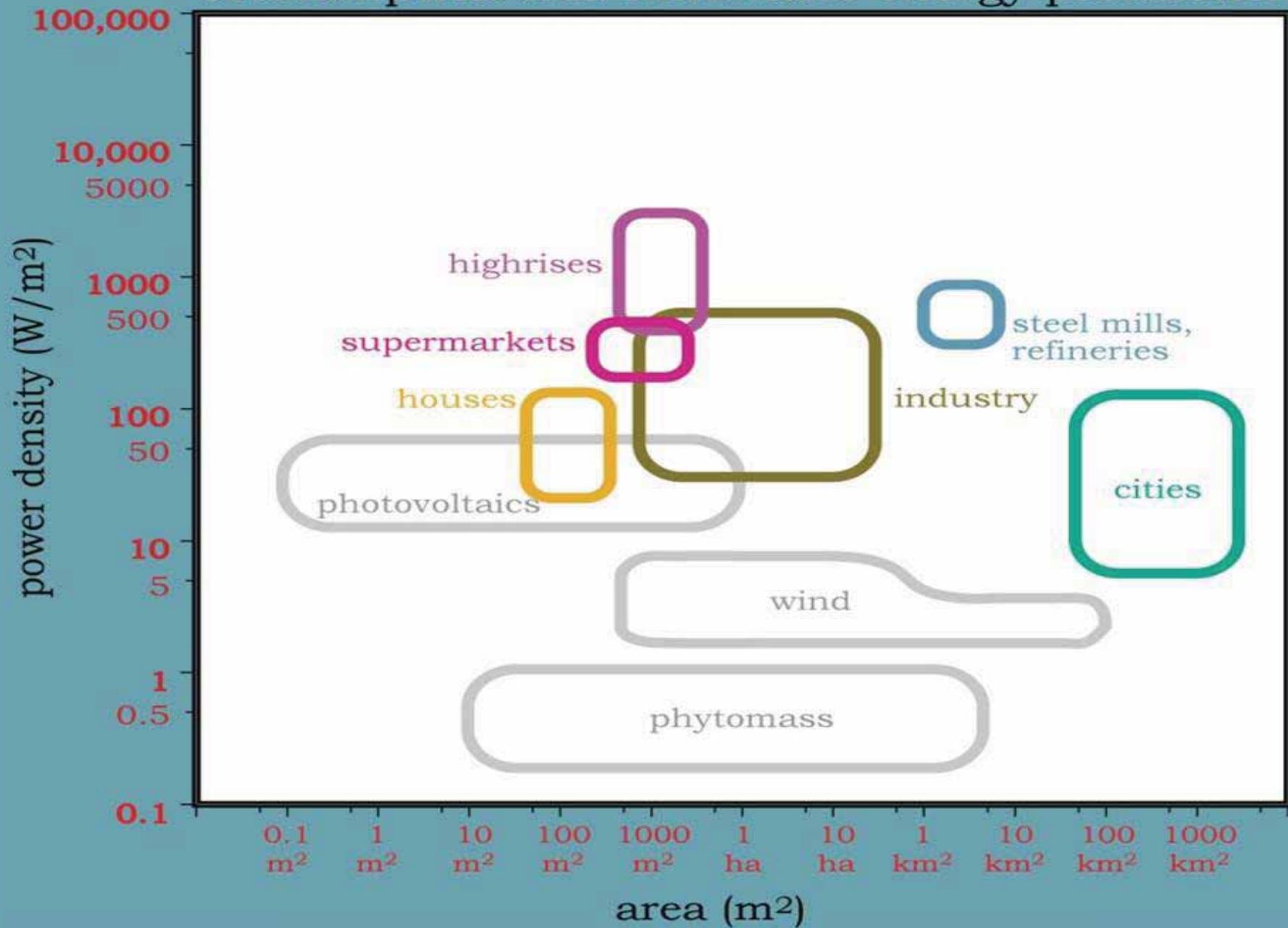


power densities of fossil and renewable energies





comparison of power densities of energy consumption and renewable energy production



GRAIN:STRAW

Traditional cereals had G:S ratio 0.25:1.

Joachim Patinir's 1514 *Rest on the flight to Egypt* (in Prado) illustrates that reality.

Grain yield just 0.5-1 t/ha.





Modern short-stalked wheat just before harvesting

G:S ratio 1:1, grain yield 4-8 t/ha

Yunnan rice yield 6 t/ha



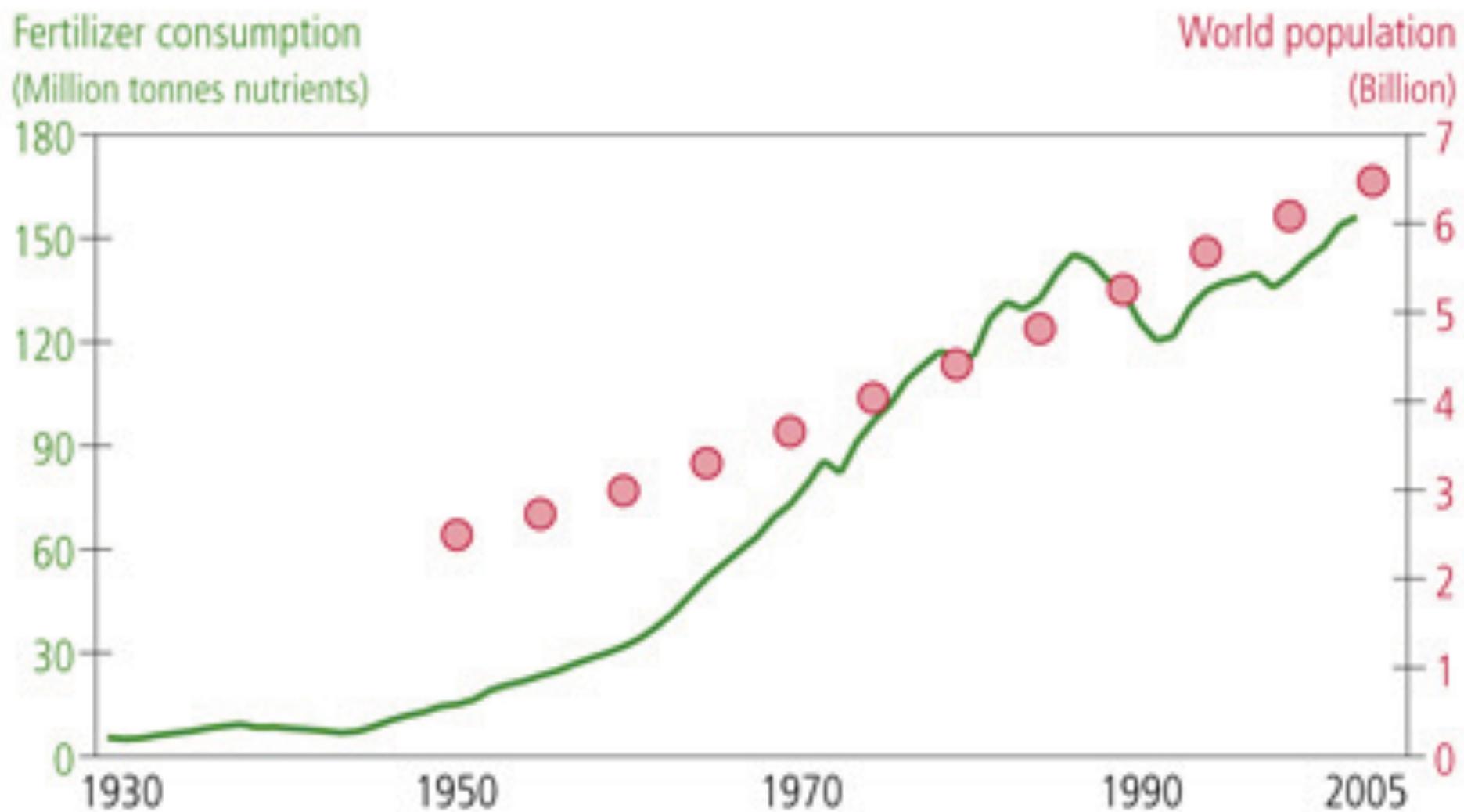
lowa corn yield 11 t/ha



East Asian rice fertilizer 250 kg N/ha



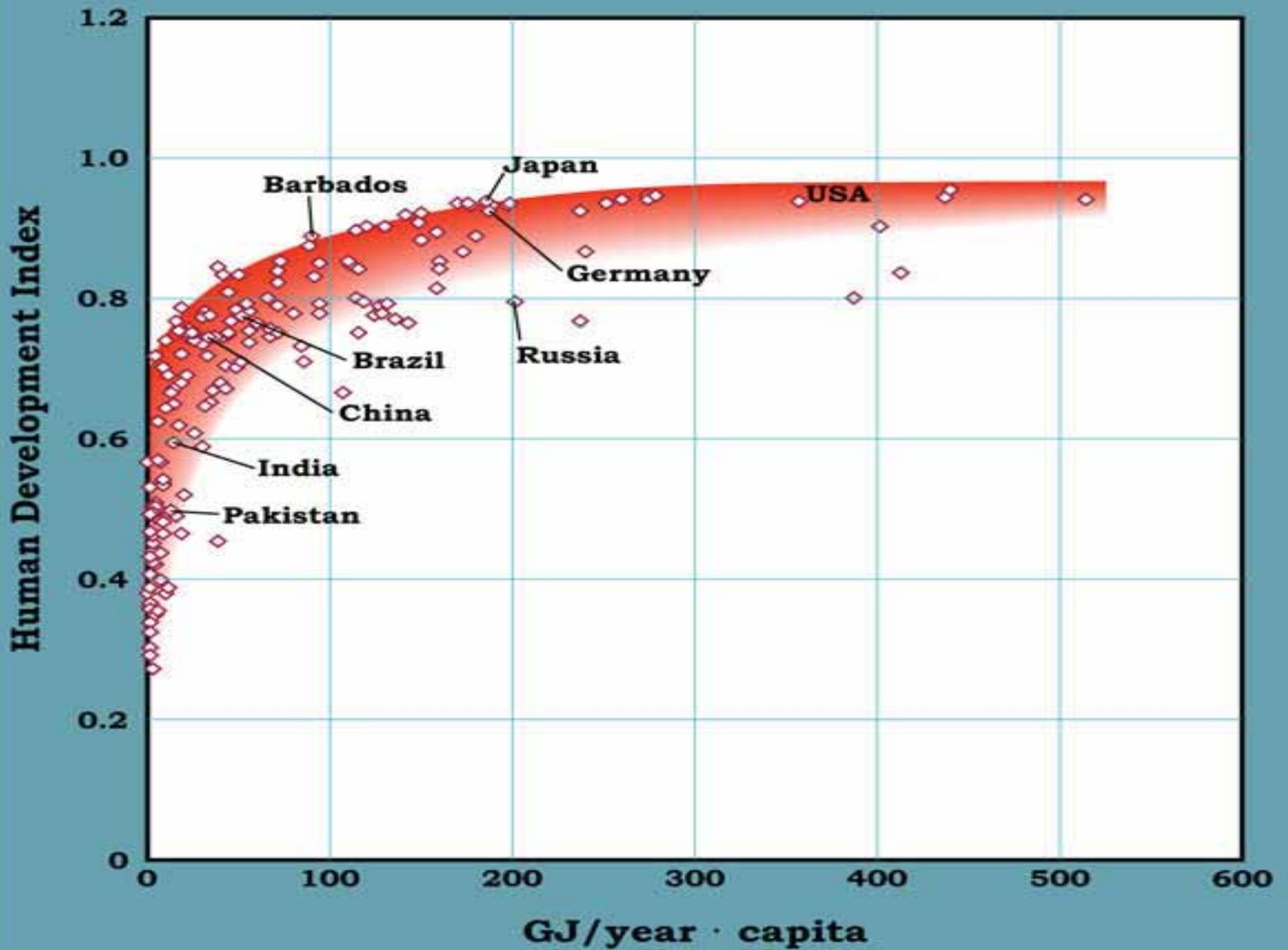
World fertilizer consumption and population in the past century



Sources: IFA and UN Population Division

May this be the best it ever gets?

- Aging populations
- Weak economic growth and recessions
- Stagnant or declining per capita energy consumption
- Concerns about global environmental change
- Affluent economies may have reached a temporary plateau to be followed by . . . ?
- But it may not matter: well-being and energy use are poorly correlated



Energy use and subjective well-being

<http://www.thehappinessshow.com/HappiestCountries.htm>

Level of subjective well-being

Average annual energy use in 2010 (GJ/capita)

• 1. Puerto Rico	100
• 2. Mexico	70
• 3. Denmark	160
• 4. Colombia	35
• 10. Canada	390
• 13. Venezuela	110
• 15. USA	345
• 33. Spain	130
• 39. Japan	170