THE GEOGRAPHY OF NATURAL RESOURCES

Introduction to Geography
GEH 101/GEH 501
Lehman College
Spring 2011

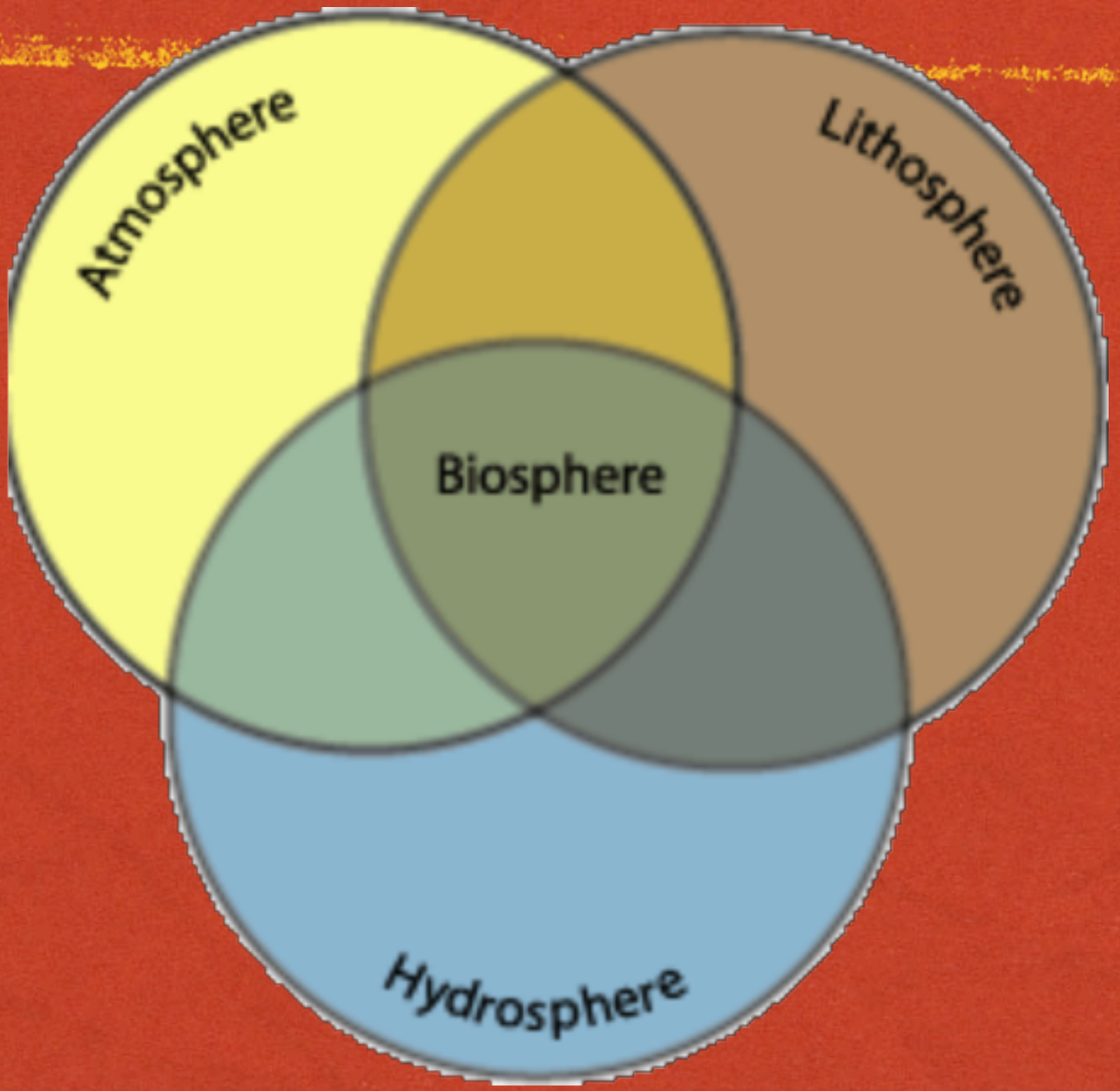
TERM PAPER DISCUSSIONS (20 MIN.)

- Describe your topic in 1-2 sentences.
- Explain the geographic nature of your topic and why geographic thinking might inform your understanding of the topic.
- What is the time and place in which it is situated?
- What are some physical and social characteristics of the place(s) and time(s) in which it is situated?
- What types of information sources are appropriate for this topic?

WHAT IS A NATURAL RESOURCE?

- Naturally occurring, exploitable material that a society perceives to be useful
- What makes some things useful and others less useful to different populations?
- How does "useful" change over time?
  - Supply and demand
  - Industrial revolution
  - Different uses: e.g., precious metals, cereal/fuel

GEOGRAPHY OF RESOURCES



RENEWABLE RESOURCES

- Replaced by natural processes
- Perpetual
  - From sources that are virtually inexhaustible
  - Sunlight, wind, waves, geothermal energy
- Potentially renewable
  - Can last indefinitely if natural replacement rate is not exceeded
  - e.g., More is produced than is used
  - Fresh water, plants and animals, soil

NON-RENEWABLE RESOURCES

- Exist in finite amounts
- Not able to be replenished within a human lifetime
- May be reusable (e.g., minerals)
- Fossil fuels, minerals such as copper and uranium

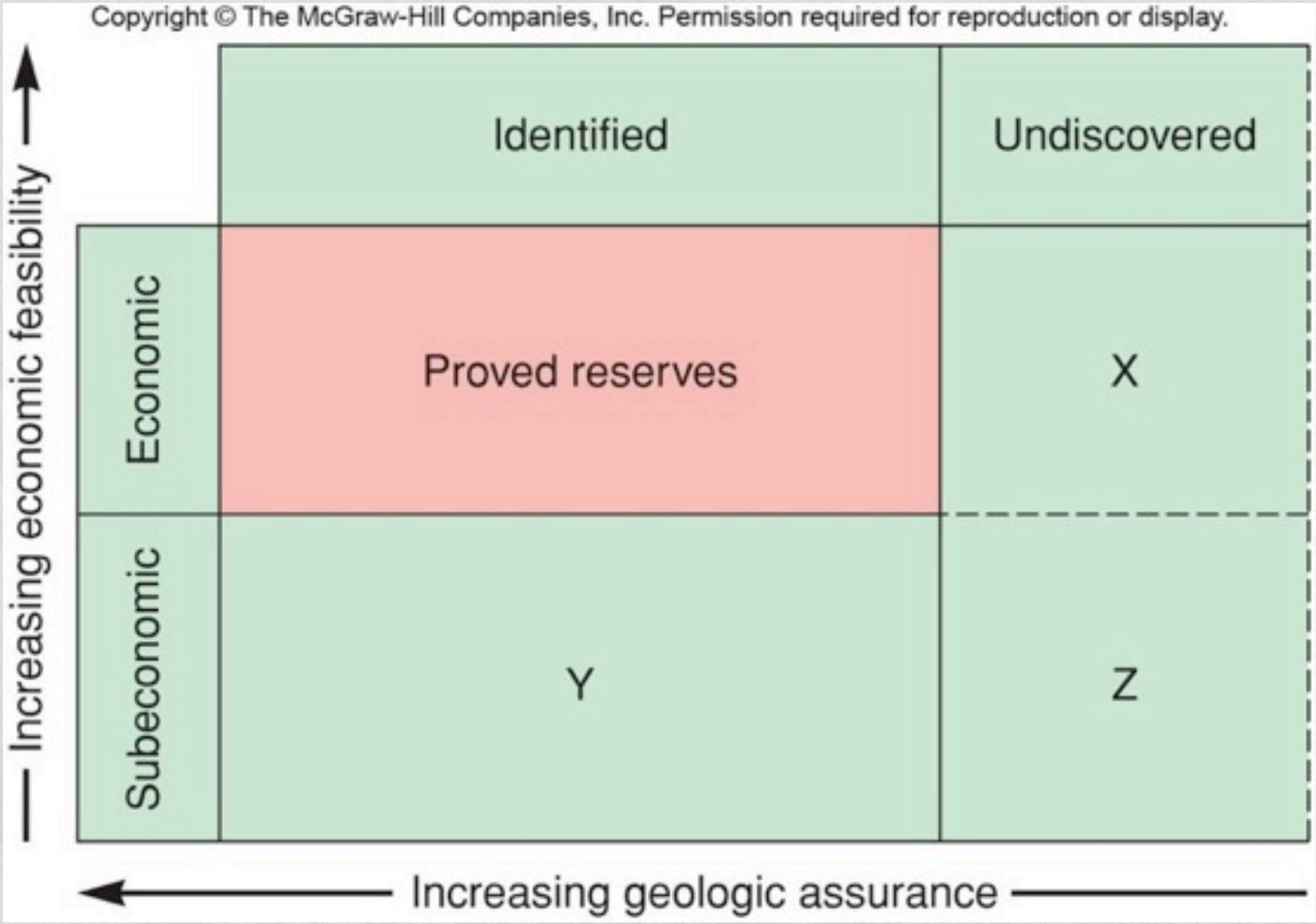


RESOURCE RESERVES

- Some have been identified, others undiscovered
- Proved reserves
  - Can be extracted profitably from known deposits
- Subeconomic
  - May become economic with improved technology or increased prices

RESOURCE RESERVES

- What happens when reserves are depleted?
- What happens when an alternative resource is developed?
- What happens when technologies decrease the cost of extracting a resource?



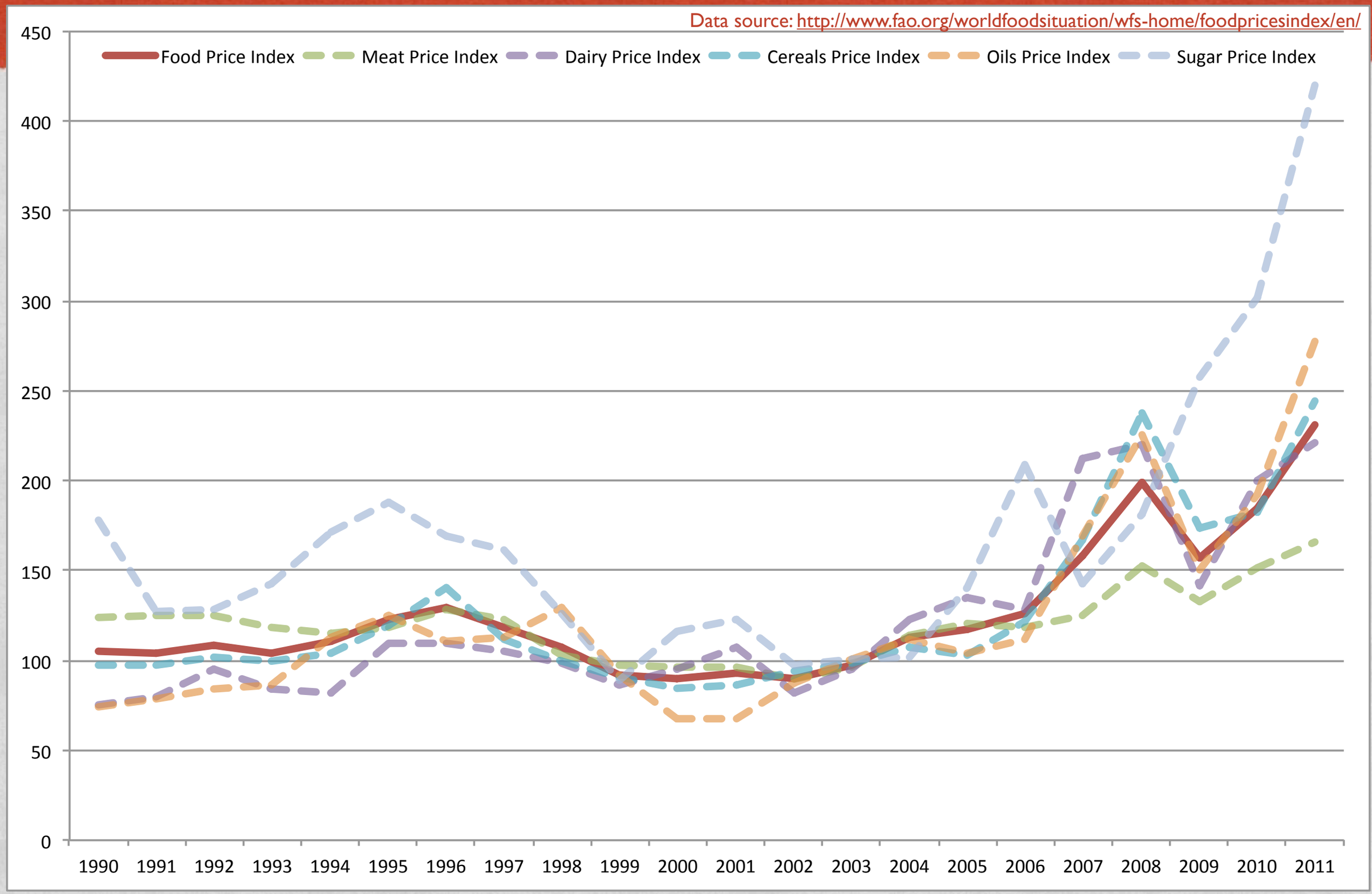
UNEVEN DEVELOPMENT

- Comparative advantage
  - Investment in industries with lower resource, environmental and labor costs
  - e.g., mining, commercial agriculture
- Export-oriented industrialization and export substitution
  - Production of export goods in favor of higher-cost local production
  - Creates dependence on foreign economies

FOOD, FUEL, AND REVOLT

GLOBAL FOOD PRICES

Data source: http://www.fao.org/worldfoodsituation/wfs-home/foodpricesindex/en/



Industralized countries

Developing countries

Multi-national Company

Subsidiary companies
Numerous shortlived subsidiary networks

Special advisors
ex-intelligence, mercenaries

Bribes

Arms-delivery

Exclusive contracts

Local officials
law enforcement, military, politicians and bureaucrats

"Concessions"

Blind-eye

Direct-assistance

Natural Resources
timber, minerals, fuels, water, etc

Consumers

Resellers, dealers

Processing, Value-added services

Money laundering

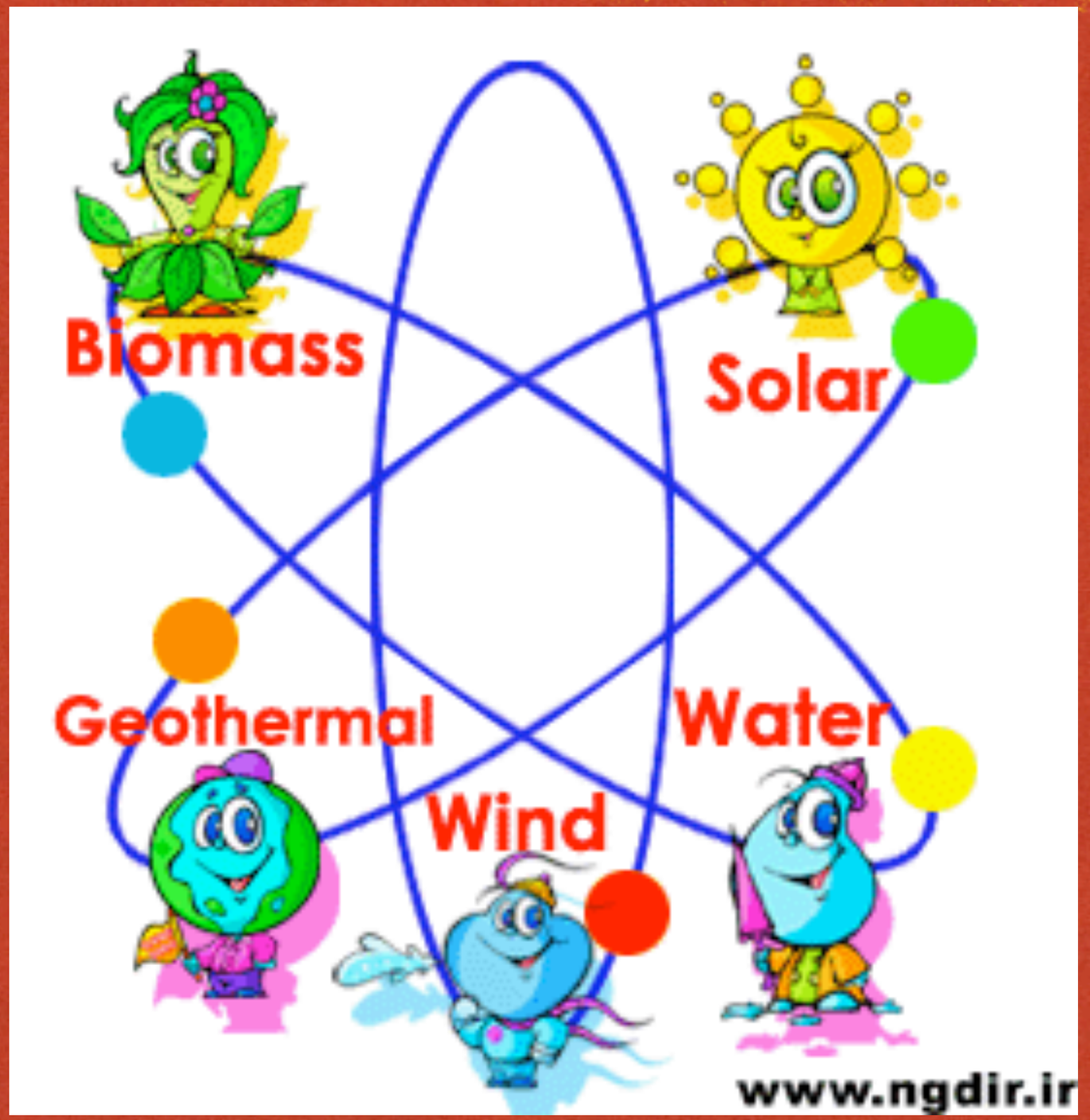
Excessive transport

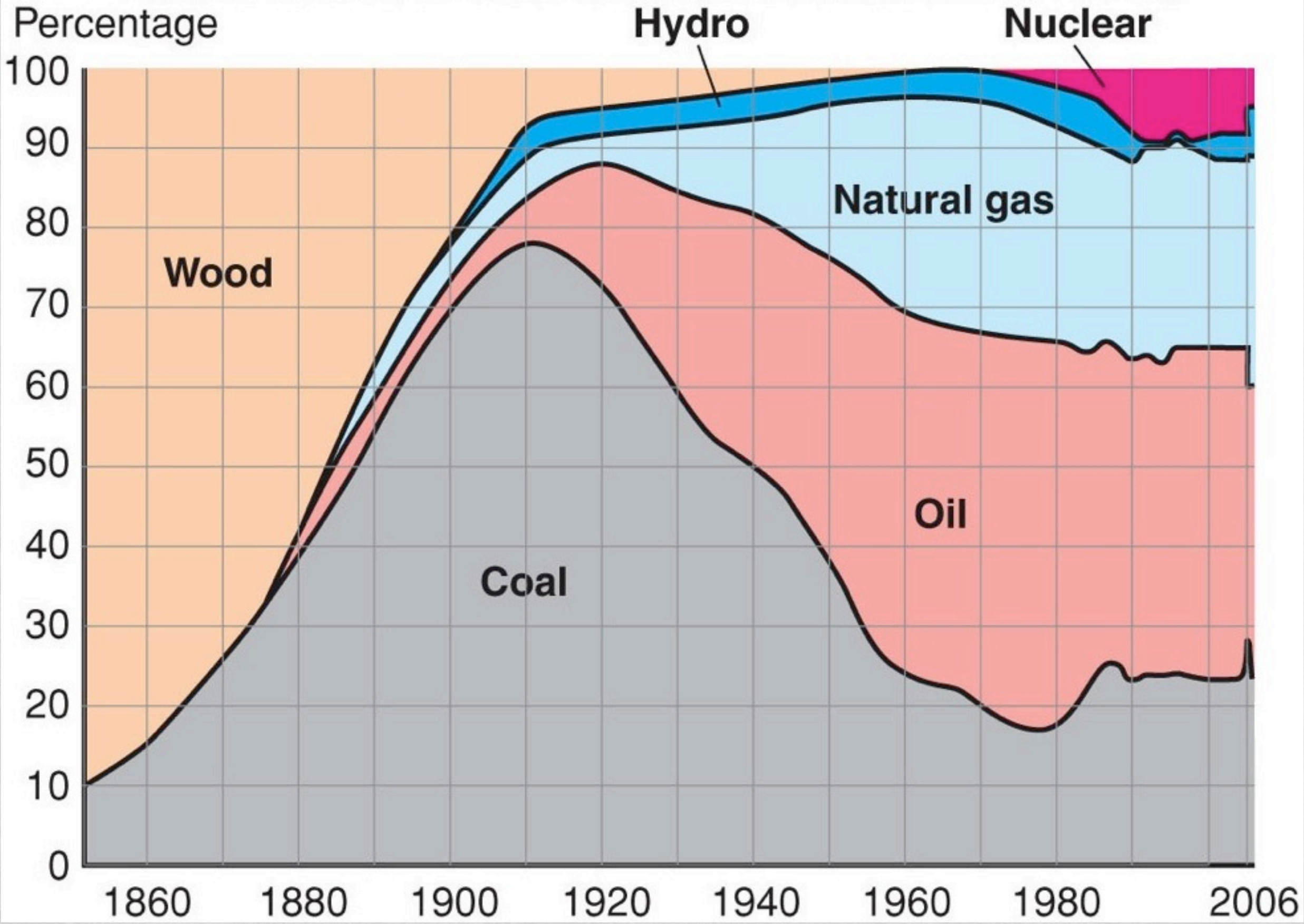
Ownership changes

Side-effects, such as road construction, conflicts, habitat destruction

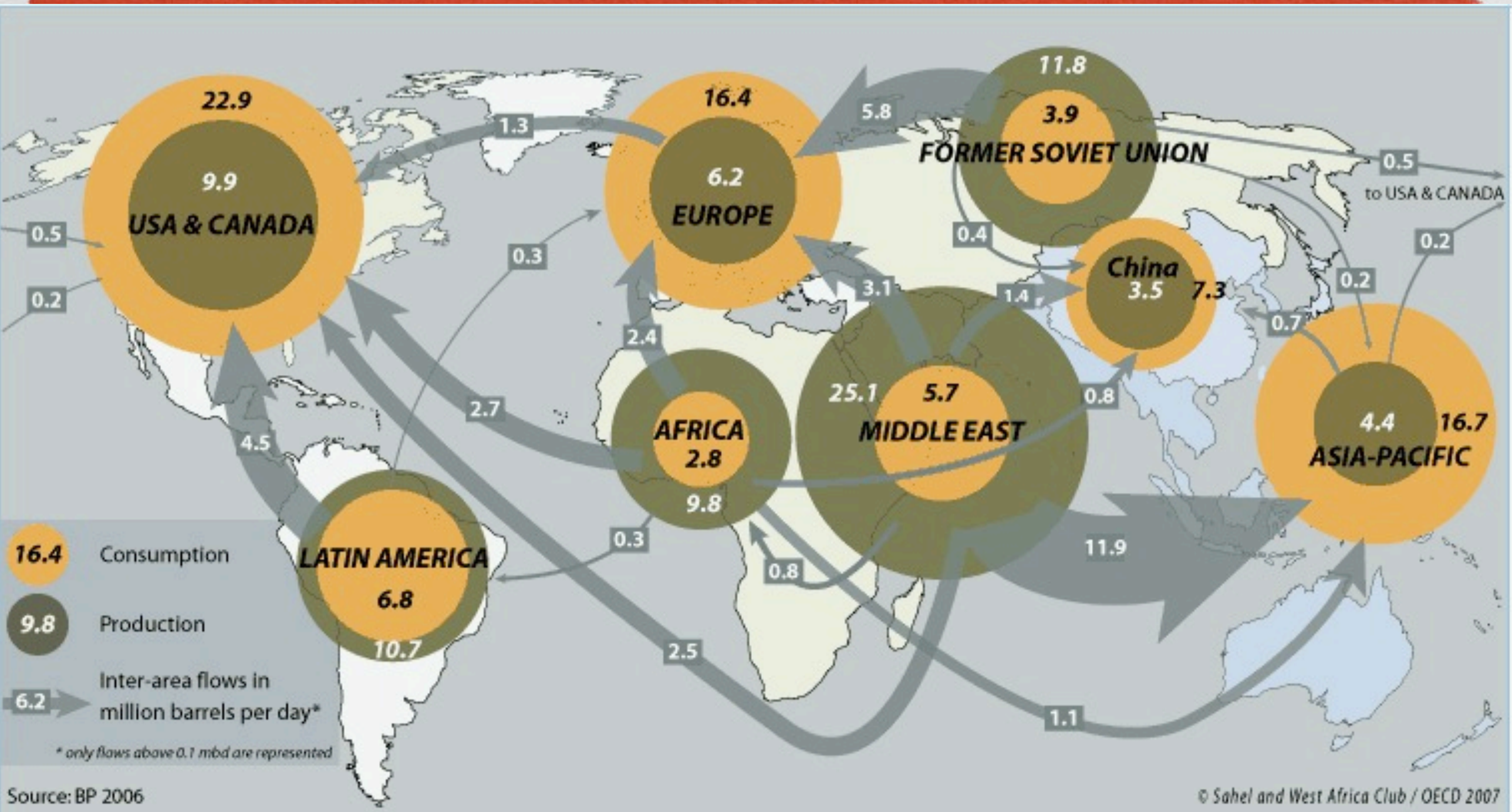
Exploitation

ENERGY RESOURCES

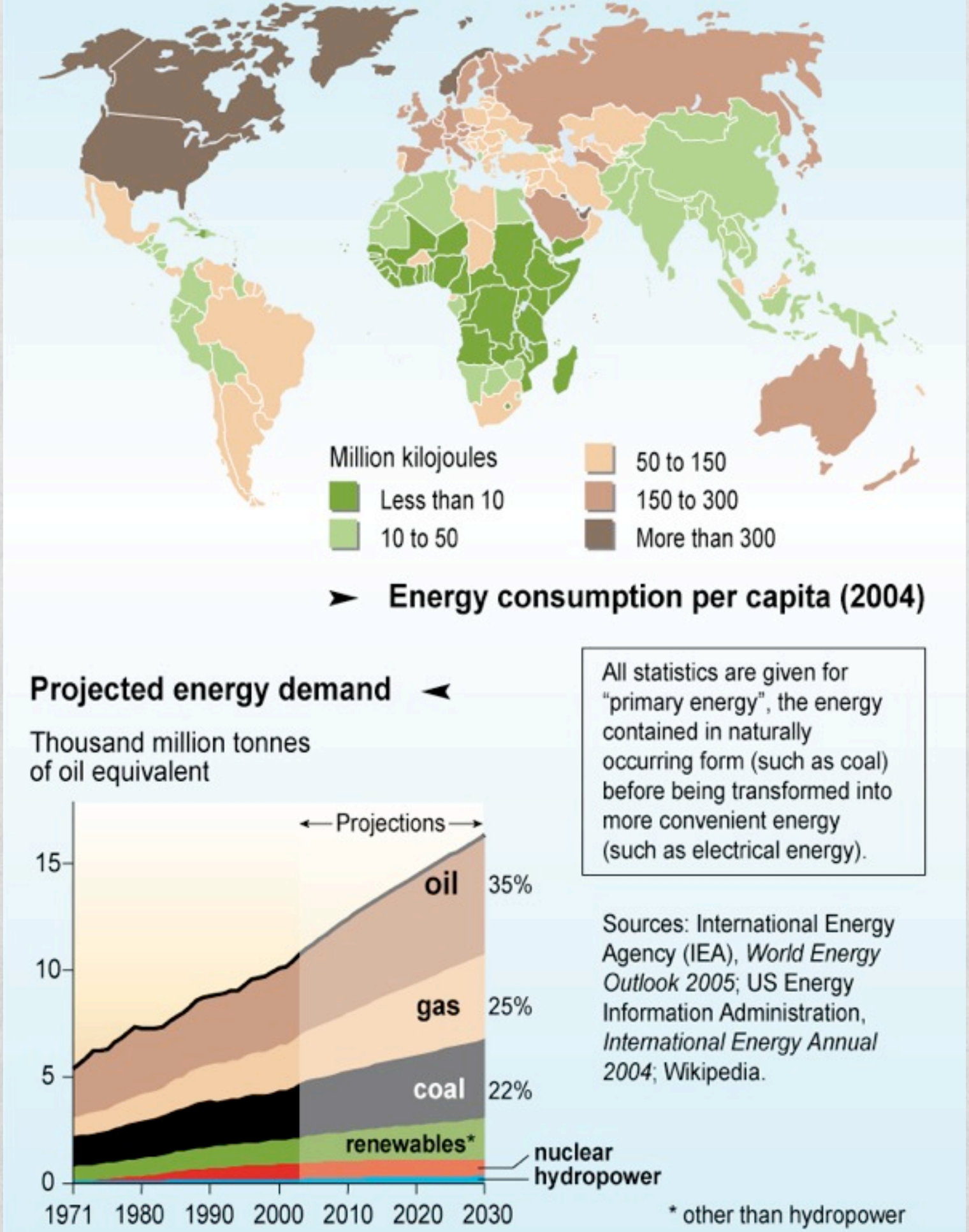




CRUDE OIL



Crude Petroleum production, consumption and major inter-regional flows in 2005



Energy consumption per capita (2004)

Projected energy demand

Thousand million tonnes of oil equivalent

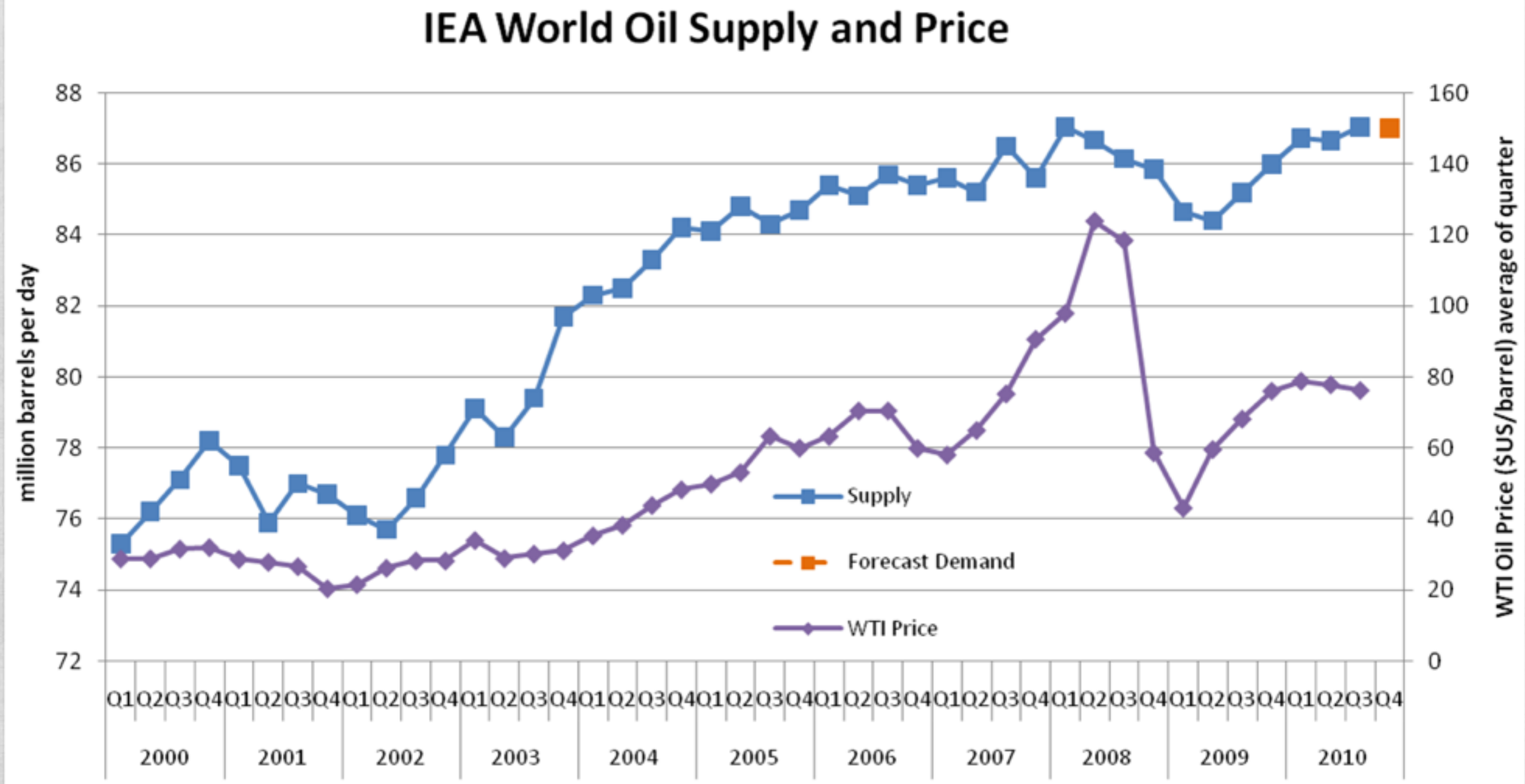
All statistics are given for "primary energy", the energy contained in naturally occurring form (such as coal) before being transformed into more convenient energy (such as electrical energy).

Sources: International Energy Agency (IEA), *World Energy Outlook 2005*; US Energy Information Administration, *International Energy Annual 2004*; Wikipedia.

* other than hydropower

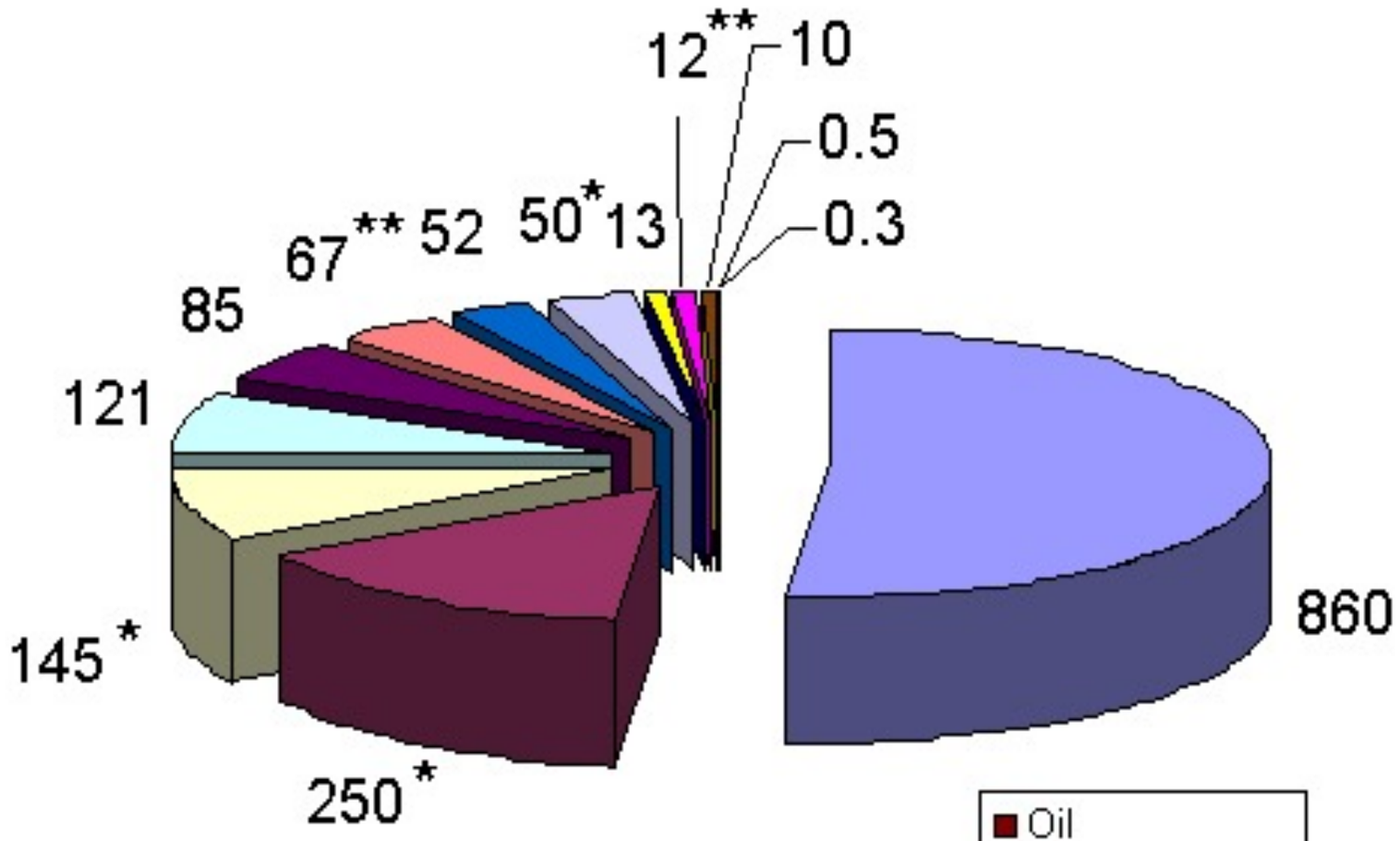
http://maps.grida.no/go/graphic/energy_consumption_per_capita_2004

OIL SUPPLY AND PRICE

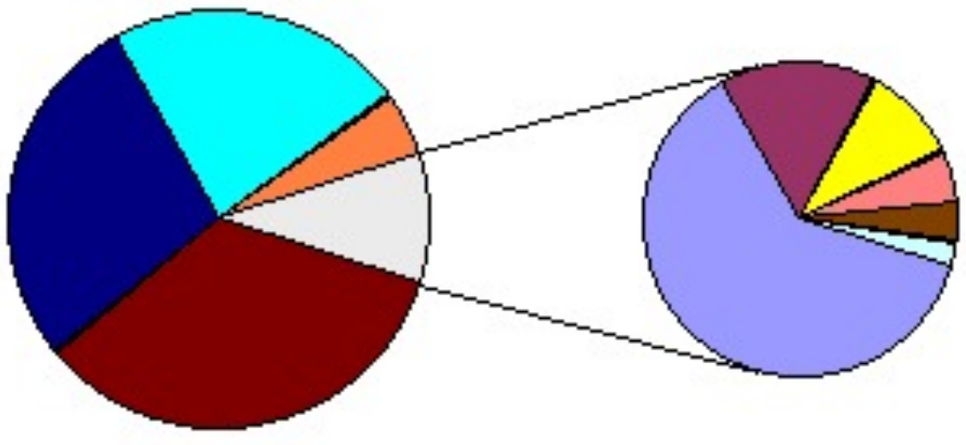


Source: http://chartingtransport.wordpress.com/2010/03/14/peak-oil/ based on International Energy Agency data

Renewable energy, end of 2008 (GW)



- Large hydropower
- Biomass heating*
- Solar collectors for hot water/space heating*
- Wind power
- Small hydropower
- Ethanol production**
- Biomass power
- Geothermal heating*
- Solar PV, grid-connected
- Biodiesel production**
- Geothermal power
- Concentrating solar thermal power (CSP)
- Ocean (tidal) power



- Oil
- Coal
- Natural Gas
- Nuclear Energy
- Hydroelectricity
- Biomass
- Solar
- Biofuel
- Geothermal
- Wind

Total vs. Renewable

*** GWth**

**** Billion liters/year**

Introducing the main renewable energies

	Wind	Photovoltaic	Geothermal	Thermal solar
	●	●	● ● ●	● ● ★
Principle	Two or three propeller-like blades, mounted on a rotor, run wind turbines.	A semiconductor cell (usually made from silicon) converts sunlight directly into electricity.	The natural heat of the Earth warms up an underground water circulation system.	A surface absorbs and transfers heat and light radiated from the sun to a fluid.
Advantages →	High investment rate no CO_2 emissions	High investment rate no CO_2 emissions	Energy bill reduction no CO_2 emissions	Energy bill reduction no CO_2 emissions
Drawbacks	Landscape (large, visible areas) Biodiversity (birds) Noise	Needs large panel surface Used cells are hazardous waste	Needs outside surface (garden) High installation cost Needs electricity to run the heat pump (unless wood is used)	Needs large panel surface Used cells are hazardous waste
Site constrains	Needs high wind blow intensity (high points and plateaux)	Depends on daily sunshine duration and solar intensity	Greatest efficiency in regions of active volcanoes	Depends on daily sunshine duration and solar intensity

	Wood	Ocean	Waste	Hydroelectricity
	● ● ● ★	●	● ● ●	●
Principle	The steam from wood burning runs a turbine or is used directly for the building.	The power of the tide flows or the swell runs turbines.	Methane from waste decomposition is harnessed to produce heat or run a turbine.	Falling water runs turbines.
Advantages →	Feedstock can be wastewood no CO_2 emissions	High production rate no CO_2 emissions	Uses waste as a resource no CO_2 emissions	High production rate no CO_2 emissions
Drawbacks	Problematic at an industrialised scale (planting of fast-growing trees)	Landscape (in case of big coastline infrastructures) Community and economic use loss (tourism) Biodiversity harm	Biogas needs to be "cleaned" of corrosive hydrogen sulfide	Water basin disruption: - big dams flood regions - community and economic use loss - biodiversity harm
Site constrains	Distance to wood production zones	Needs accessible coastline High tidal fluctuation	Distance to landfill / manure production zone	Availability of water resource

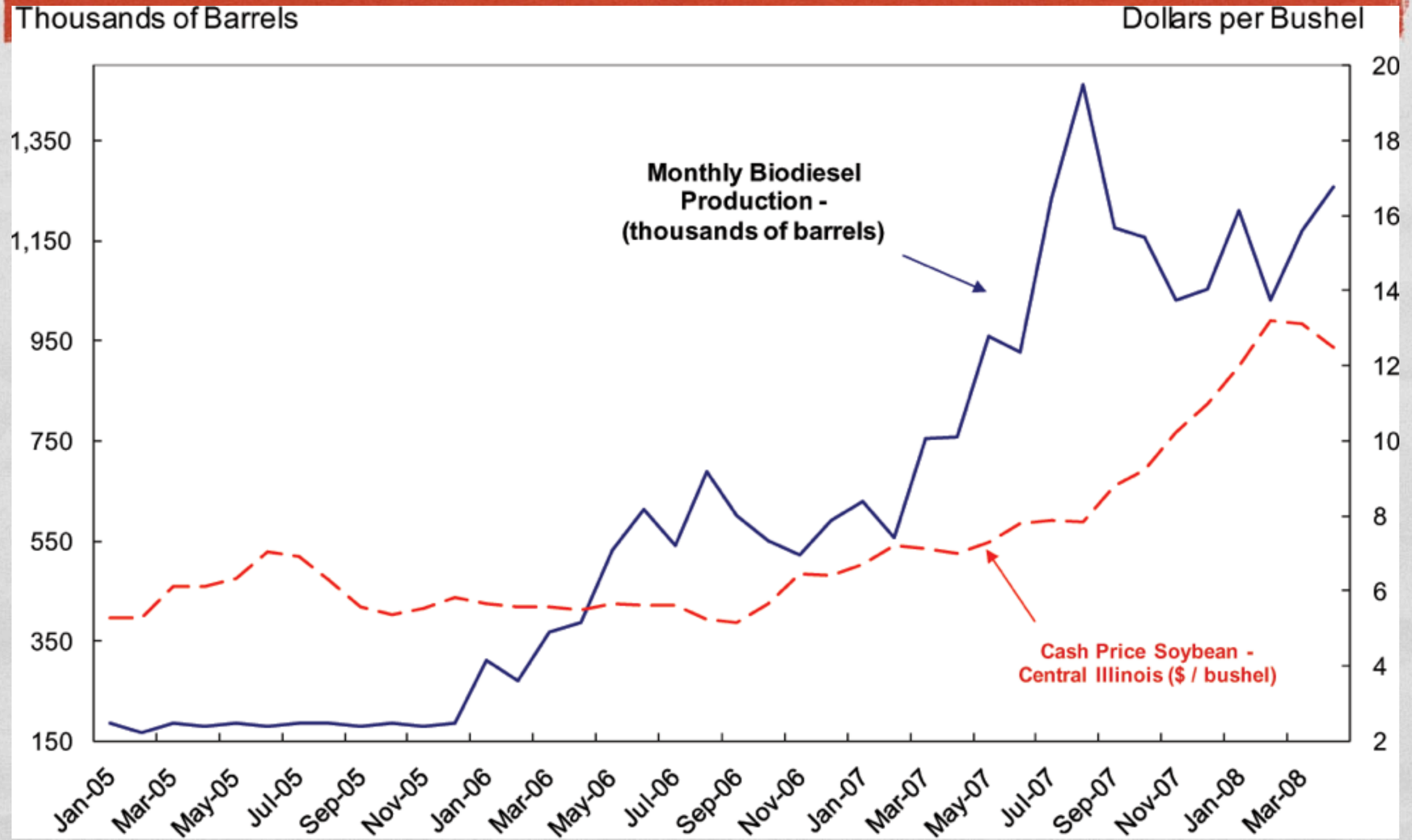
First / direct application(s) ● electricity production ● industrial process ● heating or cooling buildings ● warming water ★ on-site use only

Sources: Quercy Energies, California Energy Commission Glossary.

FOOD VS. FUEL

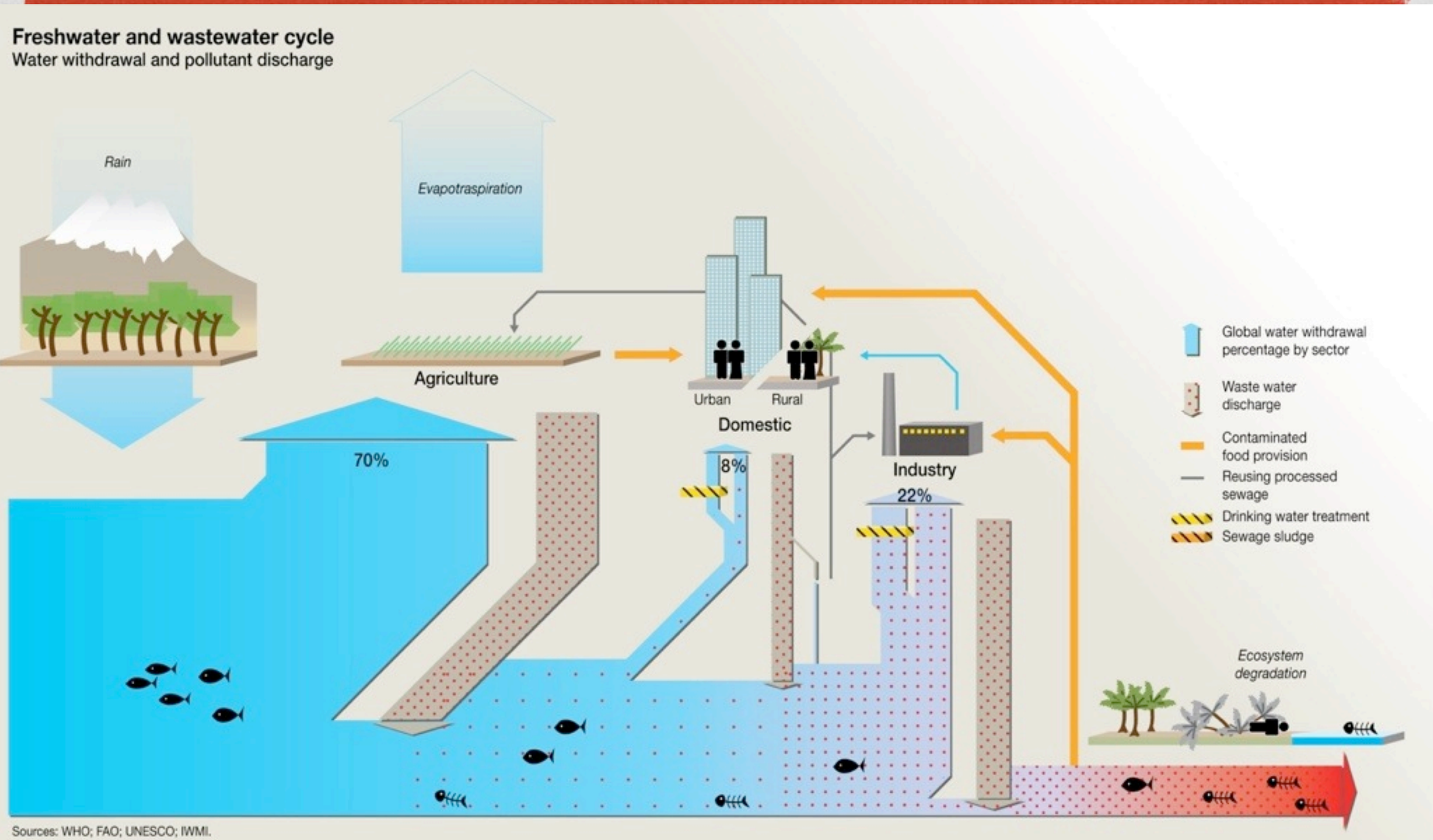
http://www.youtube.com/watch?v=9XDgztR5IPA

FOOD VS. FUEL



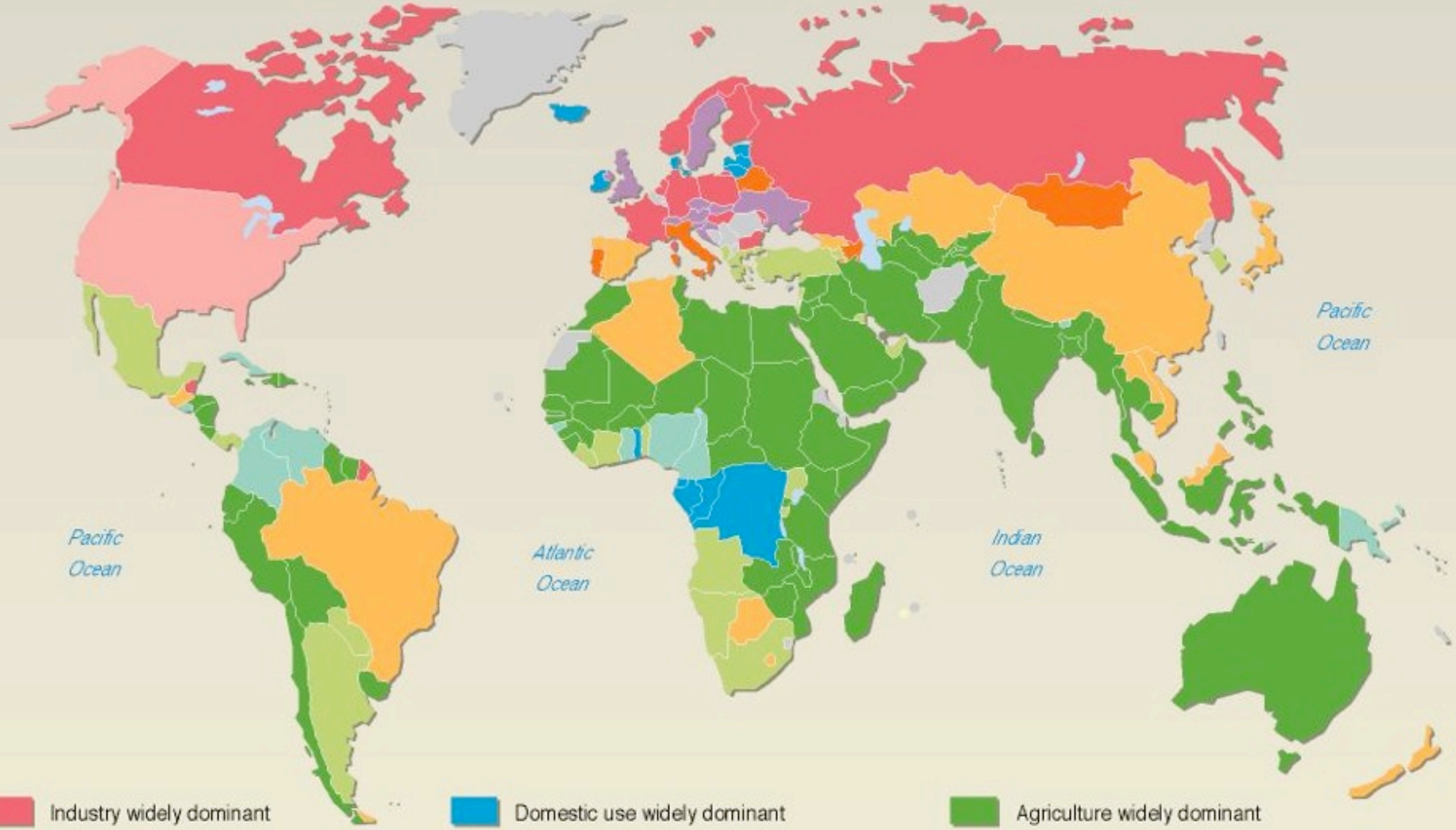
http://www.federalreserve.gov/pubs/ifdp/2009/967/ifdp967.htm

WATER


Freshwater and wastewater cycle
Water withdrawal and pollutant discharge
Rain
Evapotraspiration
Agriculture
Urban
Rural
Domestic
Industry
70%
8%
22%
Global water withdrawal percentage by sector
Waste water discharge
Contaminated food provision
Reusing processed sewage
Drinking water treatment
Sewage sludge
Ecosystem degradation
Sources: WHO; FAO; UNESCO; IWMI.

Global Freshwater Withdrawal

Country Profiles Based on Agricultural, Industrial and Domestic Use



Source: Based on data fromTable FW1 in *World Resources 2000-2001, People and Ecosystems: The Fraying Web of Life*, World Resources Institute (WRI), Washington DC, 2000.

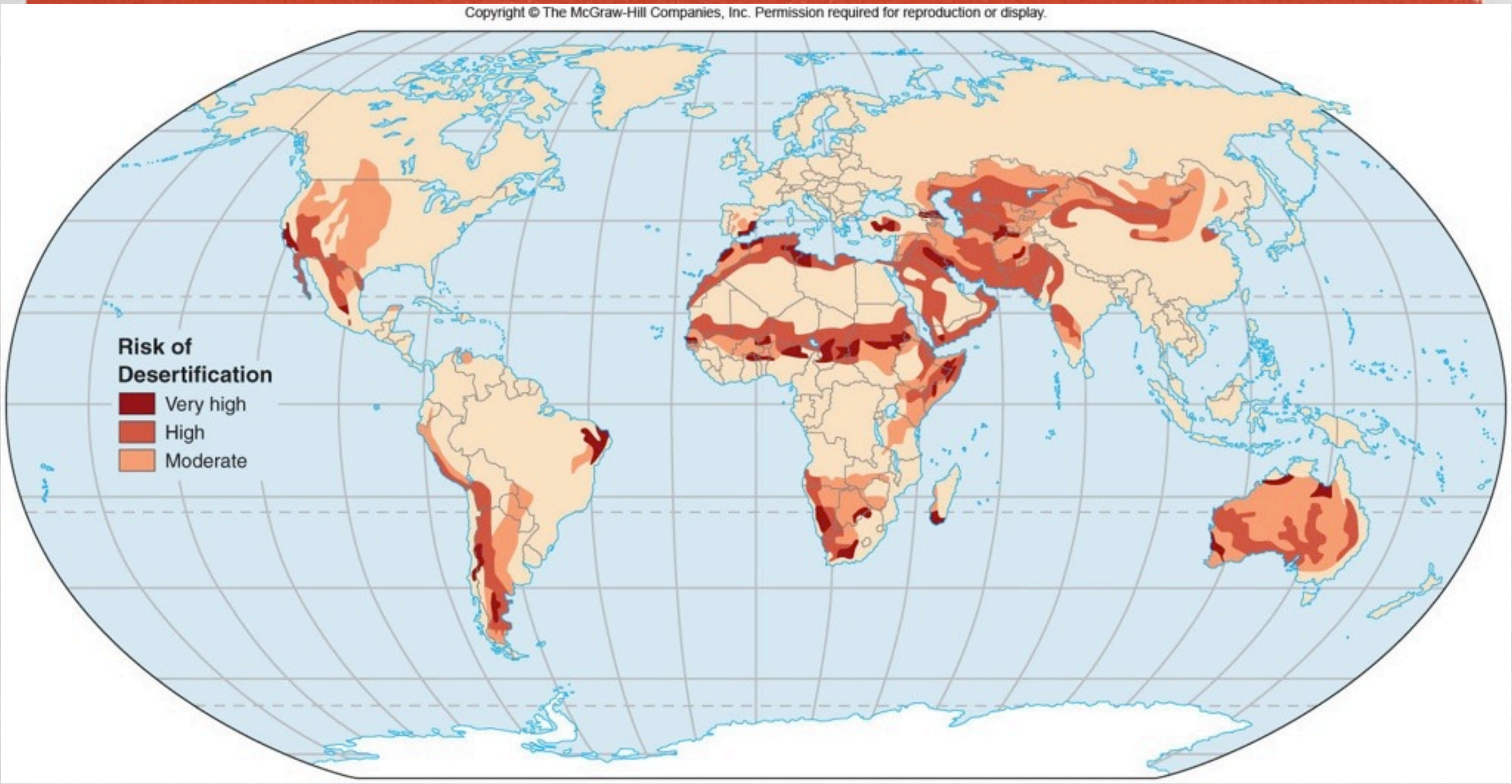
WATER

http://www.youtube.com/watch?v=FsGaKVlyjUk

LAND

- Clearing of forests + wetlands for agriculture, livestock, and construction
  - Loss of habitat, wildlife, indigenous lands, soil/water filtering, flood protection, watershed function, CO_2->O_2
- Loss of agricultural land to desertification
- Increased erosion: topsoil + soil stability
- Salinization of topsoil

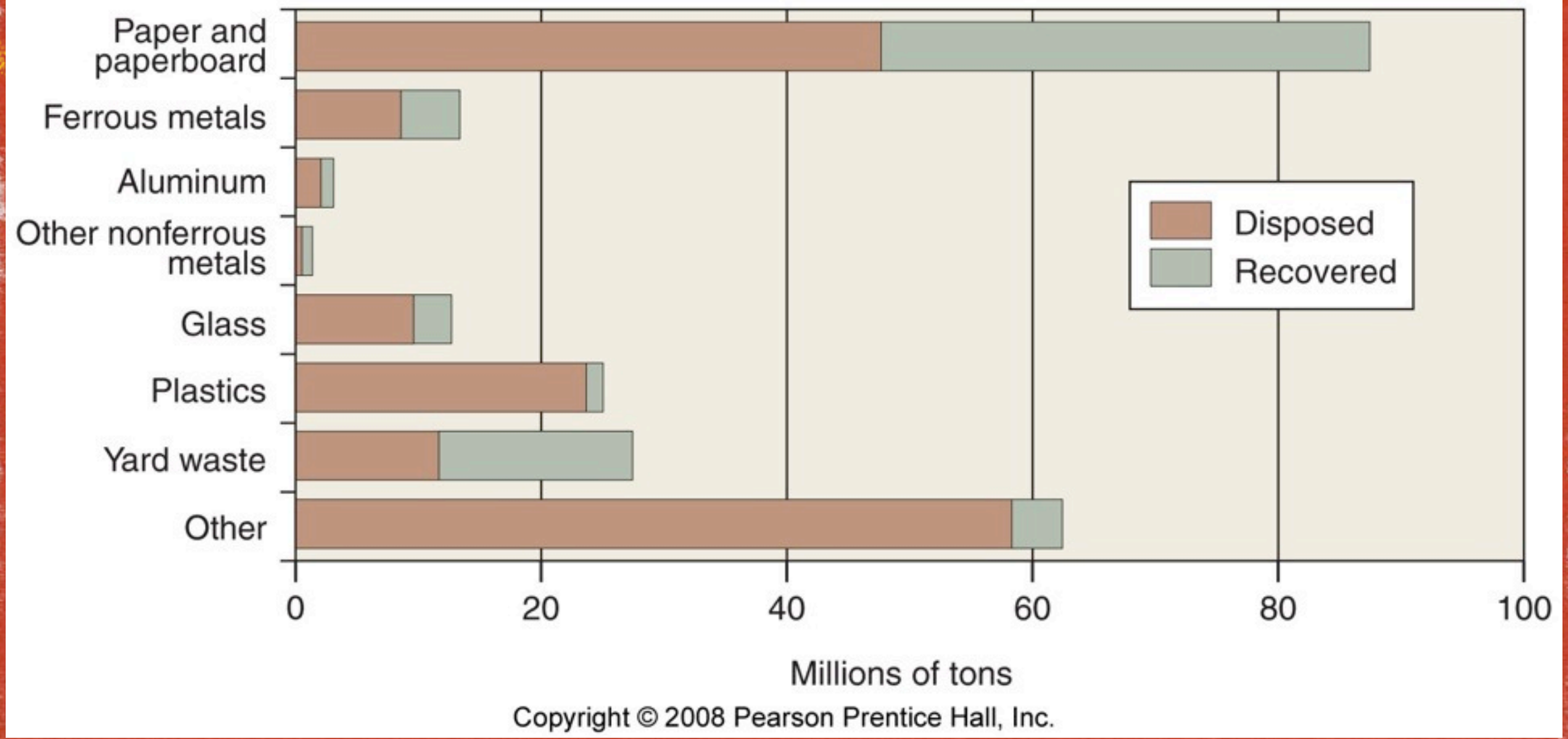
LAND: DESERTIFICATION



http://www.youtube.com/watch?v=a4IYcJEUzkg

LAND: DESERTIFICATION

WASTE



e-Waste...

Who gets the trash?

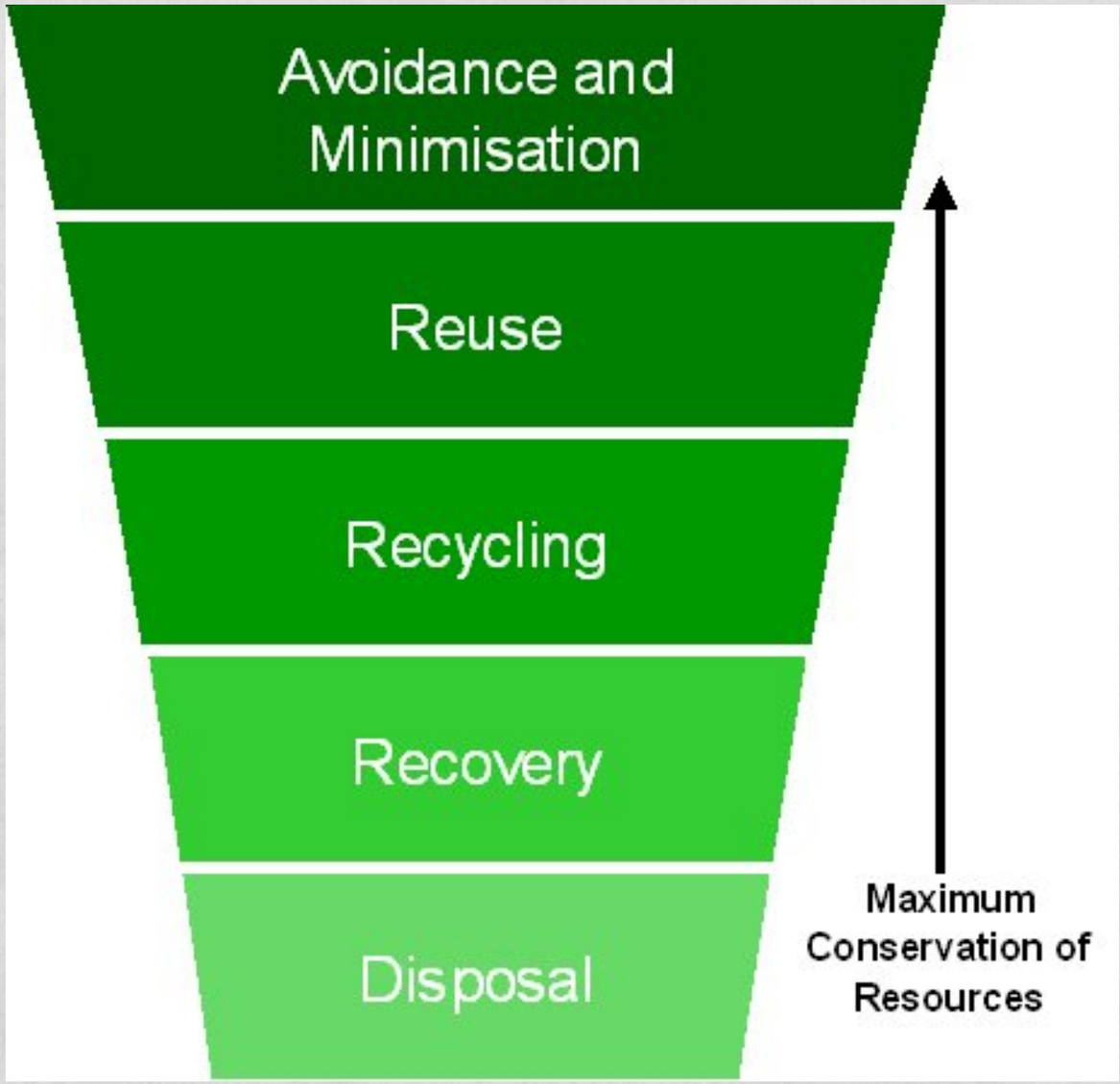
Sources: Basel Action Network, Silicon Valley Toxics Coalition, Toxics Link India, SCOPE (Pakistan), Greenpeace China, 2002.
NB: the arrows thicknesses are not proportionnal to the traffic.

WASTE

http://www.youtube.com/watch?v=3nPG6mqM0Bg

RESOURCE MANAGEMENT

- Wise management of resources entails:
  - Conservation/Avoidance
  - Reuse
  - Substitution
    - Limits scarcity
    - Stabilizes prices
  - Social innovation
  - Technological innovation



RESOURCE MANAGEMENT: SUSTAINABILITY

- Sustainable use of resources
  - Using resources at rates within their capacity for regeneration
  - Satisfies current needs without jeopardizing the ability of future generations to meet their own needs
  - **Whose needs?**
- Regulation and management: markets, governments, commons
  - Who gets to decide? How is it enforced?

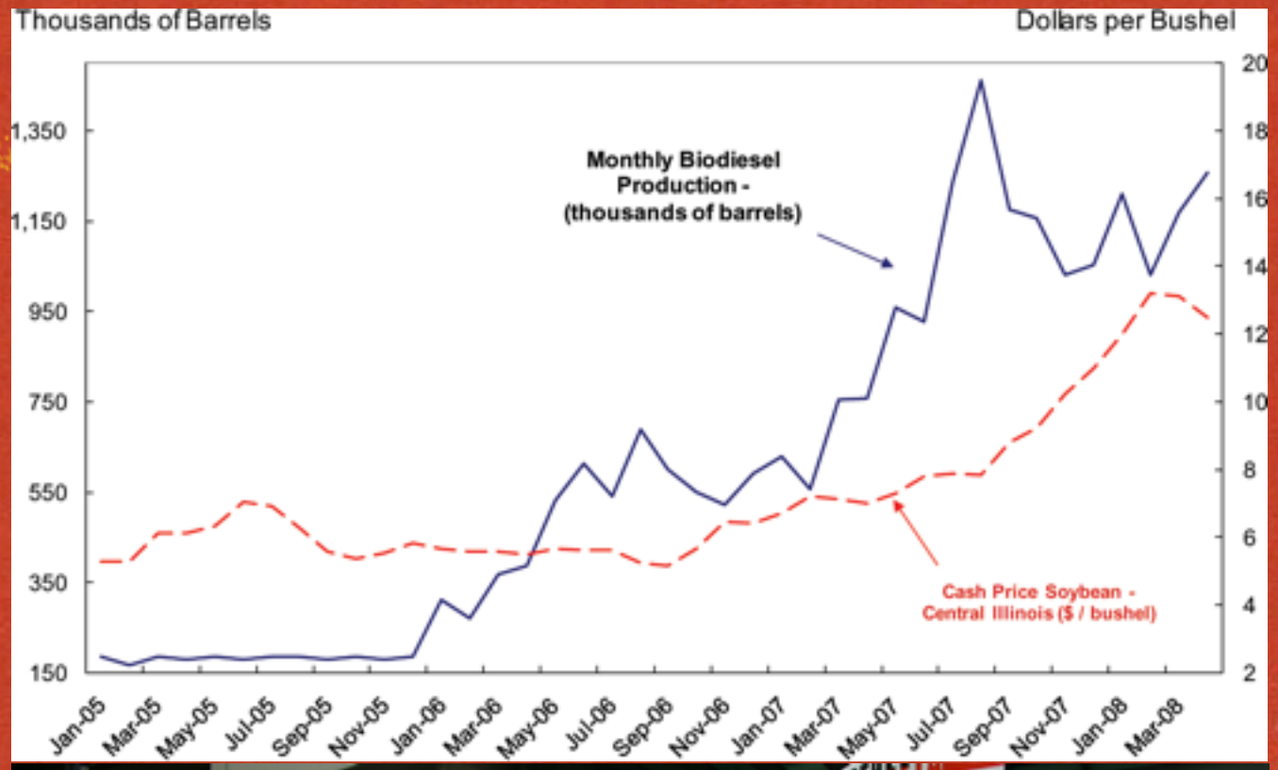
THE "COMMONS"

?

- Government/cooperation
- Privatization/enclosure
- Education/culture

THE MARKET

- Prices:
  - Supply & Demand
  - Speculation
  - Exchange Rates
  - Inflation
  - Labor, environmental, production costs
  - Political activity



SUSTAINABILITY?

- Environmental Sustainability and Economic Sustainability
  - What is being sustained? Inequality?
  - Sustainability vs. redistribution?
  - Needs vs. desires
- Overpopulation? Overconsumption? Overproduction?
- Conservation? of what? why? at what cost?

DISCUSSION QUESTIONS

- Should natural resources be treated as private property and regulated through supply and demand?
- What does "sustainability" mean to you? How do sustainability programs impact wealthy countries versus developing countries?