Class 2b: Natural Resources and Energy

Today's class

- What is a resource?
- Ecological footprints
- Natural resources and resource-based economies
- Example: Gabon
- Energy and oil

What is a resource?

- Naturally occurring material
- Useful to society
- Able to be exploited (used)
- Availability depends on:
  - Physical characteristics of the resource
  - Economic and technological condition of society

Renewable resources

- Regenerated as fast as they’re used
- Energy sources
- Potentially renewable: must be carefully managed
  - Water
  - Forests
  - Soils

Nonrenewable resources

- Finite on a human time scale
- All minerals
- Fossil fuels
  - Generated like sedimentary rocks
  - Coal, oil, natural gas

Tragedy of the commons

- Resources held in common; free access
- Wealth measured by resource use
- No incentive to conserve
- Tragedy is inevitable: an individual will overuse public resources when it is in his or her best interests
- Solutions?

Example: Atlantic cod

- Grand Banks off Canadian East Coast
- For 500 years, rich commercial fishery
- 1950s technology led to 4x catch rate
- Population crashed in 1980s; 70% decrease in catch
- Now moratorium on Northern Cod

Resource consumption

- Ecological footprint
- Average productive land per person: 4.5 acres
- Average land used by US residents: 24 acres
- What’s your footprint?

Mineral resources

- Mineral: inorganic; specific chemistry, hardness, density, crystal
- Location depends on geology: large size or luck
- No one country has everything

Mineral resources

- Six stages in mineral exploration
  - Exploration
  - Extraction
  - Concentration
  - Refining
  - Transporting
  - Manufacturing
- Each stage has its own geography

Mineral exploration

- Where does exploration take place?
  - Geology
  - Politics
  - Economics
  - Technology
- The less risk and cost, the better
- Exploration determines where reserves are

Resource reserves

- Estimated vs. proven
- Remember: economics and technology

Mineral extraction

- Where does extraction take place? See Step 1!

Mineral concentration and refining

- Two similar stages
- Ex: Copper uses 0.5% ore: where?

Mineral processing/manufacturing

- Depends on the mineral: small or large quantities?
- Ex: Copper in small pieces: where?

Example: Gold

- Long history as a valuable metal
  - Conducts electricity; ductile
  - Used as currency
  - Aesthetic value
- Occurs everywhere, even in seawater
- Placer vs. lode gold
  - Weathered gold washed downstream
  - Veins under the surface

Example: California Gold Rush

- Geologically right: former seabed
- Politically right: just transferred from Mexico
- Technology evolved to extract more gold
  - Initially placer mining
  - Then hydraulic mining
  - Then cyanide heap leaching

Example: California Gold Rush

- Gold helped Union win Civil War
- Population boom made CA a state in 2 years
- Agriculture began to boom
- San Francisco as gateway

- Massive amounts of erosion and deposition
  - More flooding in Sacramento
- Processing involved mercury and arsenic
- Don’t eat American River fish!

Example: Coltan

- Mineral that includes tantalum
- Used in cell phones, laptops, etc.
- Found in Australia, Central Africa

Example: Coltan

- Mineral that includes tantalum
- Used in cell phones, laptops, etc.
- Found in Australia, Central Africa
  - Good source of income for Congolese
  - But, militias overrun protected areas and smuggle out coltan
  - So Nokia et al. go to Australia instead

Energy

- The capacity to do work or transfer heat
- (Nearly) All energy comes from the sun
- Primary energy sources: heat or do work directly
- Secondary sources: turn turbines to generate electricity

Energy

- 90% of US energy from fossil fuels
- Remainder nuclear, hydro
- Different geography for each source
  - Coal, natural gas
  - Hydro
  - Nuclear
  - Solar
  - Wind

Oil

- Worldwide and in US, 40% of energy
- 2/3 of US use is transportation
- Cheaper to import oil than extract it here (60% imported)
- Depends on relationships with exporters
- 2002: Canada, Saudi Arabia, Mexico, Venezuela, Nigeria, Iraq

OPEC

- Organization of Petroleum Exporting Countries
- Cartel that sets oil prices and supply
  - Formed to resist European companies
  - Holds 70% of reserves
- Iran, Iraq, Kuwait, Qatar, Saudi Arabia, UAE; Algeria, Libya, Nigeria; Venezuela; Indonesia

1970 oil crises

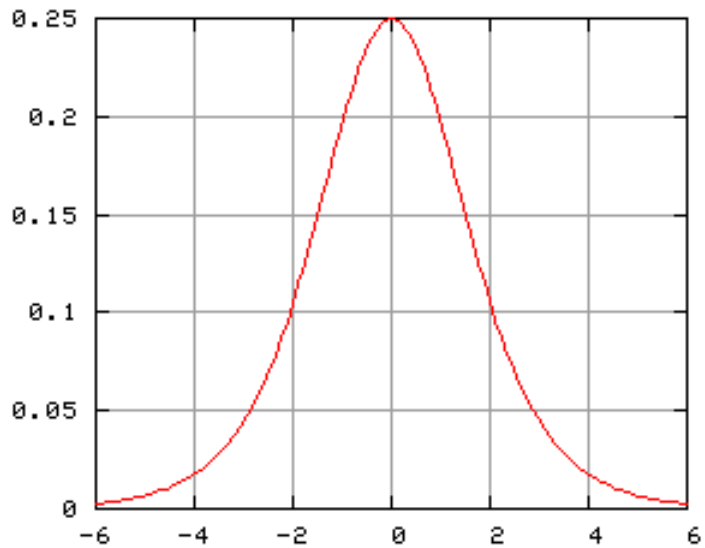
- 1973 Israel fights off Egypt and Syria
- OPEC wanted to punish Israel's allies
- Plus frustration with 6% of population using 33% of energy
- Quadrupled oil prices
- Led to gas shortages, efficiency improvements
- Today, conservation no longer a concern

Oil reserves

- When will we run out? No, when will production decline?
- 10% rule: production is about 10% of reserves
- New discoveries needed to keep production high
- In 2003, 25 billion barrels were used, but only 8 billion were discovered
- And consumption is only increasing

Oil reserves

- Resource use follows Hubberts curve



- When is the peak of production?
- Between 1999 and 2010
- What happens economically?