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
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

ENERGY RESOURCES

- Biomass
- Solar
- Geothermal
- Water
- Wind
Crude Petroleum production, consumption and major inter-regional flows in 2005
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).

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

Total vs. Renewable

* GWth
** Billion liters/year
## Introducing the main renewable energies

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Principle</th>
<th>Advantages</th>
<th>Drawbacks</th>
<th>Site Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wind</strong></td>
<td>Two or three propeller-like blades, mounted on a rotor, run wind turbines.</td>
<td>High investment rate, no CO₂ emissions</td>
<td>Landscape (large, visible areas), Biodiversity (birds), Noise</td>
<td>Needs high wind blow intensity (high points and plateaux)</td>
</tr>
<tr>
<td><strong>Photovoltaic</strong></td>
<td>A semiconductor cell (usually made from silicon) converts sunlight directly into electricity.</td>
<td>High investment rate, no CO₂ emissions</td>
<td>Needs large panel surface, Used cells are hazardous waste</td>
<td>Depends on daily sunshine duration and solar intensity</td>
</tr>
<tr>
<td><strong>Geothermal</strong></td>
<td>The natural heat of the Earth warms up an underground water circulation system.</td>
<td>Energy bill reduction, no CO₂ emissions</td>
<td>Needs outside surface (garden), High installation cost, Needs electricity to run the heat pump (unless wood is used)</td>
<td>Greatest efficiency in regions of active volcanoes</td>
</tr>
<tr>
<td><strong>Thermal solar</strong></td>
<td>A surface absorbs and transfers heat and light radiated from the sun to a fluid.</td>
<td>Energy bill reduction, no CO₂ emissions</td>
<td>Needs large panel surface, Used cells are hazardous waste</td>
<td>Depends on daily sunshine duration and solar intensity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy Source</th>
<th>Principle</th>
<th>Advantages</th>
<th>Drawbacks</th>
<th>Site Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wood</strong></td>
<td>The steam from wood burning runs a turbine or is used directly for the building.</td>
<td>Feedstock can be wastewood, no CO₂ emissions</td>
<td>Problematic at an industrialised scale (planting of fast-growing trees)</td>
<td>Distance to wood production zones</td>
</tr>
<tr>
<td><strong>Ocean</strong></td>
<td>The power of the tide flows or the swell runs turbines.</td>
<td>High production rate, no CO₂ emissions</td>
<td>Landscape (in case of big coastline infrastructures), Community and economic use loss (tourism), Biodiversity harm</td>
<td>Needs accessible coastline, High tidal fluctuation</td>
</tr>
<tr>
<td><strong>Waste</strong></td>
<td>Methane from waste decomposition is harnessed to produce heat or run a turbine.</td>
<td>Uses waste as a resource, no CO₂ emissions</td>
<td>Biogas needs to be “cleaned” of corrosive hydrogen sulfide</td>
<td>Distance to landfill / manure production zone</td>
</tr>
<tr>
<td><strong>Hydroelectricity</strong></td>
<td>Failing water runs turbines.</td>
<td>High production rate, no CO₂ emissions</td>
<td>Water basin disruption: - big dams flood regions, - community and economic use loss, - biodiversity harm</td>
<td>Availability of water resource</td>
</tr>
</tbody>
</table>

**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

Thousands of Barrels

Dollars per Bushel

Monthly Biodiesel Production - (thousands of barrels)

Cash Price Soybean - Central Illinois ($ / bushel)

Freshwater and wastewater cycle
Water withdrawal and pollutant discharge

Sources: WHO; FAO; UNESCO; IWMIL.
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, $\text{CO}_2 \rightarrow \text{O}_2$
- Loss of agricultural land to desertification
- Increased erosion: topsoil + soil stability
- Salinization of topsoil
LAND: DESERTIFICATION

http://www.youtube.com/watch?v=a4lYcJEUzkg
WASTE

Paper and paperboard
Ferrous metals
Aluminum
Other nonferrous metals
Glass
Plastics
Yard waste
Other

Millions of tons

Copyright © 2008 Pearson Prentice Hall, Inc.
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 proportional to the traffic.

China receives 90% of the Asian recycling market...

Around 100,000 workers (including children) undrinkable water

Main e-waste recycling countries

E-waste recycling sites
- known
- suspected

Main ports where e-waste is received and dispatched
Wise management of resources entails:

- Conservation/Avoidance
- Reuse
- Substitution
  - Limits scarcity
  - Stabilizes prices
- Social innovation
- Technological innovation
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?
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?