

## The Geography of Human Health and Environmental Health

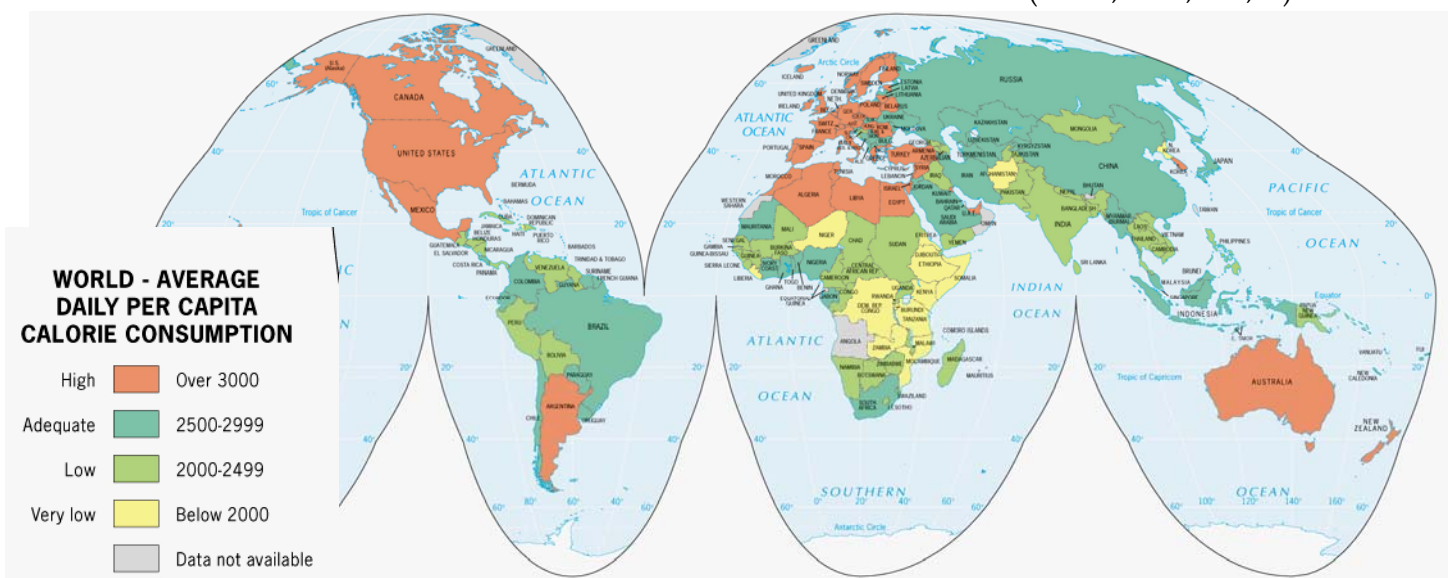
**Medical** geography is the study of health in geographic context. Diseases typically have source areas (cores), identifiable diffusion routes, and affect clusters of populations (regions). Regions where malnutrition prevails are also areas of poverty, inadequate medical services, poor sanitation, and sub-standard housing. The **Infant Mortality Rate (IMR)** of a state reflects the overall health of a society (diarrhea & malnutrition are leading killers of children worldwide). 27 countries still have IMRs greater than 100. **Child Mortality Rate (CMR)** measures deaths between 1-5 yrs. Unfortunately, CMRs are still high in much of Africa & Asia. Certain conditions perpetuate this problem, such as **marasmus**, a condition related to a lack of protein early in life. Another severe condition is **kwashiorkor**, resulting from inadequate protein & insufficient calories. This life-threatening condition affects millions of children worldwide, mostly in the LDCs (least developed nations). Life Expectancy is reported as very low in areas with high IMRs and CMRs. Women almost always outlive men with the exception of a handful of countries. It is notable that **life expectancy** doesn't always accurately portray the average life span of many countries, as high IMRs and CMRs may drastically reduce this measure. A person who has survived beyond childhood is likely to live well beyond life expectancy. Another population concern dealing with health has to do with the "graying" (or aging) of populations. 600 million people age 60 and older worldwide, and this number is increasing mostly in the MDCs (most developed

nations). Nations with graying populations must deal with health conditions associated with aging, such as diabetes, heart conditions, and other chronic ailments. They must also deal with the added economic burden of caring for so many people's social welfare, which may strain health facilities and the overall ability of the state to adequately handle the demand for health coverage.

### The Distribution of Disease

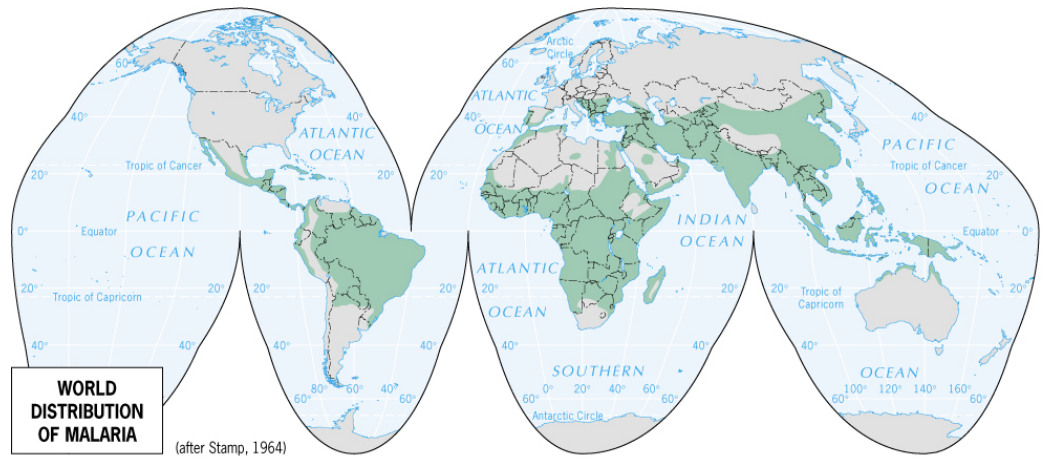
There are three major types of diseases. **Infectious** diseases result from an invasion of parasites; 65% of all illnesses are of this type. **Chronic** (degenerative) diseases are those of longevity or age, associated with long-term deterioration. Lastly, **genetic** (inherited) diseases are traced to genetic factors, impacted by deficiencies with chromosomes and genes.

To understand the geography of disease, many terms must be identified. An **epidemic** is when an outbreak affects a large number of people in a region (may be associated with a large number of deaths). A **pandemic** is when the outbreak spreads to other regions around the world (e.g. influenza – 1918). The term **endemic** is used to describe a disease that is particular to a region. **Agents** are organisms (e.g. worms, insects, viruses, bacteria,...) that infect people (hosts). When a population contains a large number of hosts it is said to be a **reservoir** for that disease. Now, a **vectored** disease is one that is carried from one host to the next by an intermediate host. A **non-vectored** disease can survive longer outside the body and can be spread through contact, with no intermediate host (vector). Lastly, a **vehicle** is a mechanical vector (water, food, soil,...).



## Vectored Infectious Diseases

**Malaria** occurs worldwide, but not at higher latitudes. Mosquitoes are the vectors. Symptoms include fever, chills, reduced energy, and higher susceptibility to other diseases (kills b/w 2-3 million yearly). In 1955, the **WHO** (World Health Organization) used **DDT** (a pesticide) to eliminate malaria in Sri Lanka (Ceylon); DDT is carcinogenic: trade one problem with another.

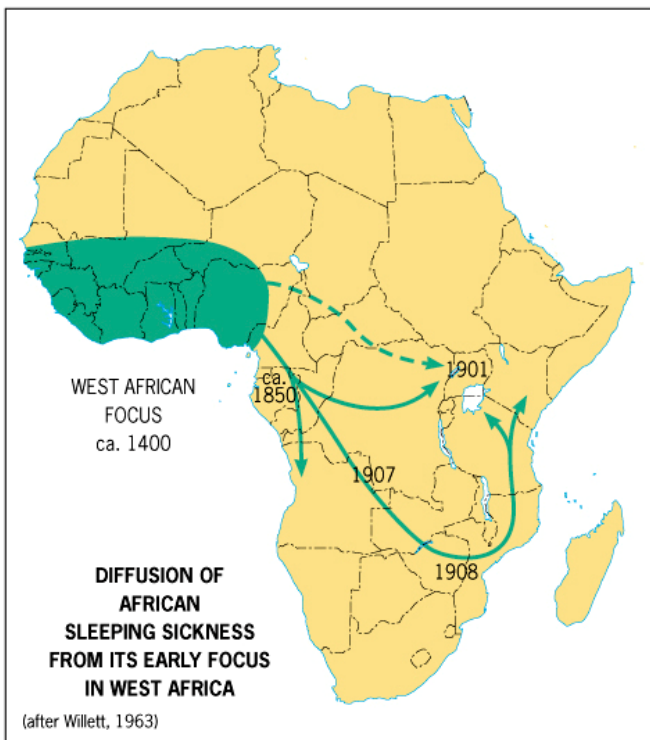


cord (lethargy). **West Nile Virus** is very recent; a seasonal epidemic in North America that flares up in the summer and continues into the fall; mosquitoes are the vectors; symptoms of WNV may include fever, aches, nausea,... (affects the central nervous system); 80% show no symptoms at all.

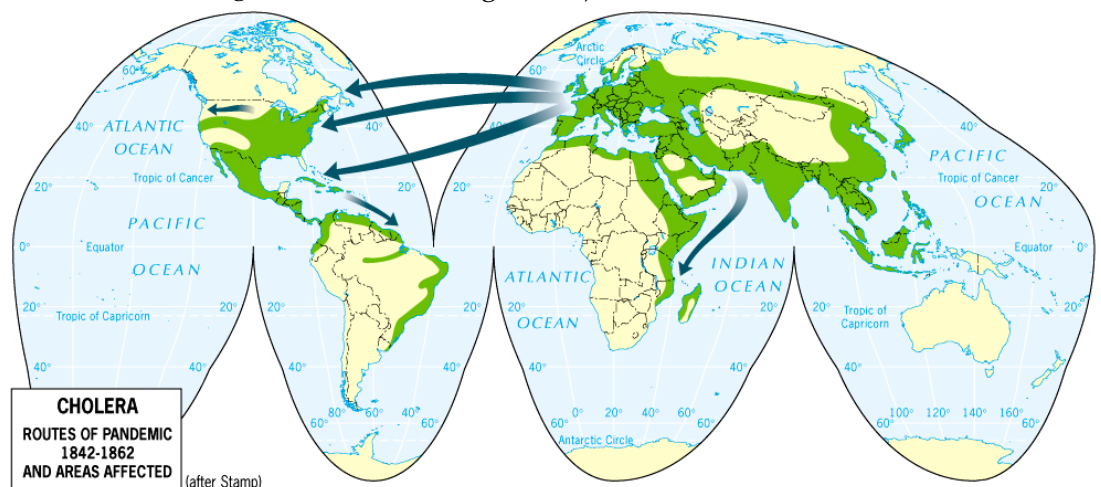
## Non-vectored Infectious Diseases

These diseases are passed by direct transmission through 1) bodily contact (w/o the vectors), 2) contamination of food or water (e.g., fecal matter), 3) contamination of the air (saliva - sneezing). **Influenza's** source is often in China; transmitted from birds to pigs, from pigs to humans (but the virus survives in the air long enough to be transmitted w/o vectors); 1918 - worst pandemic in history (20-30 million died worldwide).

The source of **AIDS** is in tropical Africa; spreads through exchange in bodily fluids; breaks down the immune system; people can carry **HIV** (Human immunodeficiency virus) for years w/ no symptoms; 1980 - 200,000 cases; 2002 - >40 million cases. **Cholera** has its source in India; symptoms include diarrhea & dehydration (death can be convulsive); hygiene prevents it (e.g. boiling water) - this fact was first discovered in



**Yellow Fever** is now confined to tropical & near-tropical areas; mosquitoes are the vectors; symptoms - high fever w/ aches & vomiting; can color eyes and skin yellow (jaundice). **African sleeping sickness** has its source in West Africa; tsetse flies are the vectors & Africa's huge wildlife population acts as a reservoir; symptoms - fever w/ swelling of lymph nodes, and swelling of limbs in some cases; inflammation can go to brain & spinal





England by Dr. John Snow in the 1850s; he mapped out the reported cases, and saved hundreds of lives.

### Other Disease Types

Chronic (degenerative) diseases occur over time; often concentrated in urban/industrial cores (infectious is most common in the periphery); the U.S. top four causes of death - 4) lung diseases (5%); 3) stroke (23%); 2) cancer (23%); 1) heart disease (31%) Genetic (inherited) diseases result from gene mutations or accidents to chromosomes (e.g. radiation, viruses); some examples include **Down's Syndrome**, **galactosemia** (lactose intolerance).

### The "Little Ice Age" in Europe

The **Mongols** diffused from Central Asia (e.g. China) to the west during the 14<sup>th</sup> c.; in the process they brought with them the **Bubonic Plague**, and its vector - the flea (which bit into rats, which transferred the disease to cats, which transferred the disease to humans). The Plague killed an estimated 25 million in Europe from 1347 to 1352! The "Little Ice Age" necessitated the onset of the **Second Agricultural Revolution**; field methods improved (planting, sowing, watering, harvesting,...); transportation and storage of produce involved less waste & loss. The area around **Jamestown** (c. 1607) experienced the worst drought in eight centuries

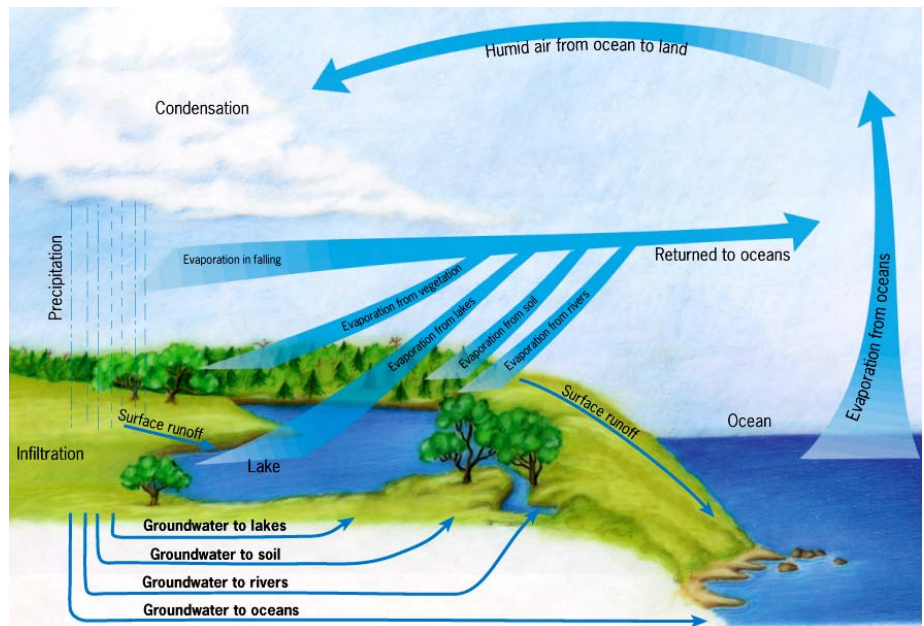
(1606-12)! The "real" Little Ice Age occurred from 1650-1850 (cooler temp. began in the 14<sup>th</sup> c.). The Laki eruption (1783, Iceland) lowered temperatures in N. America by ~7 degrees (e.g. corn didn't ripen in New England in the "year without a summer").

### The "Little Ice Age" in Asia (a.k.a. "Why we Don't Speak Chinese")

Early **Ming** (1368-1644) rulers (in China) had a huge oceangoing fleet (> 6,000 ships); they sponsored massive expeditions (their vessels (junks) were far superior to that of the Europeans). Colder weather caused famines, epidemics, especially in the North where wheat was primarily grown; the **Qing** (1644-1912) rulers ordered an end to overseas expeditions; built only ships for the Grand Canal (with cargoes of Southern rice brought to the North; rice became the staple crop of the Chinese). This is a classic example of environmental determinism. In the **Industrial Optimum** (the post-1850 phase; glaciers are retreating; global temperatures are warming; agriculture has expanded. The Industrial Optimum was interrupted by cooler decades from the 1940s-1970s (this led to the **Green Revolution**); but temperatures are rising again (natural or human-induced?).

### Water

Water, the essence of life, is a renewable resource; as opposed to non-renewable resources such as oil or natural gas. The available supply of fresh water is not evenly distributed across the globe; that distribution is sustained by the **hydrologic cycle** (depicted below), which brings rain and snow





**A** Aral Sea, mid-1960s



**B** Aral Sea, early 2000s



**Soil Erosion in Mexico**

from the oceans to the landmasses. Much of that water is lost through runoff & evaporation, but a substantial amount seeps downward into porous, water-holding rocks called aquifers. Nearly  $\frac{3}{4}$  of all the fresh water in the world is consumed in farming, not through the populations in cities as many contend. Industries use another 20%, sometimes contributing heavily to pollution.

One of the great ecological disasters of the 20<sup>th</sup> c. has involved the **Aral Sea**, located between Kazakhstan & Uzbekistan. Streams that fed this large sea were diverted to irrigate the surrounding desert (mainly for commercial cotton production). Chemical fertilizers have ruined the groundwater below, causing a major health crisis. The Aral Sea also began to dry up - by the 1990s it had lost more than  $\frac{3}{4}$  of its original surface area!

### Atmosphere

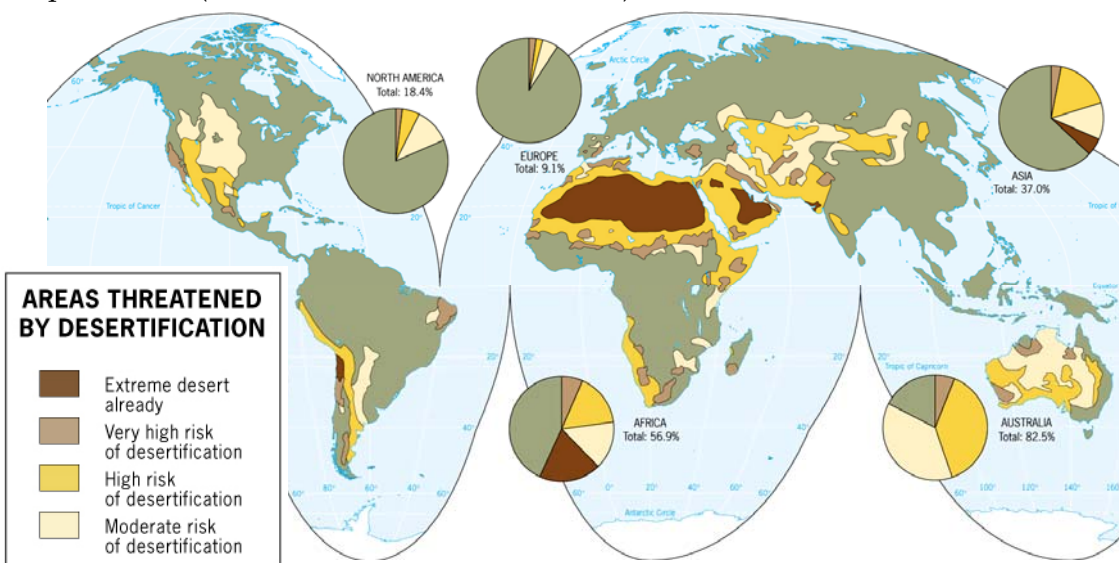
The atmosphere is a largely renewable resource. Global warming could be around 3.5°F - 5.5°F over the next 50 years; in March, 2002, a Rhode-Island sized chunk broke off Antarctica! **Greenhouse gases** are increasing at a rate of 2% per decade (CO<sub>2</sub>, methane, nitrous oxides,...).

**Acid rain** is caused by the burning of fossil fuels (coal, oil, natural gas); emitted by cars, industries,...; it can be **caustic** enough to do great damage over time; e.g. acidification of lakes, stunting of forests, loss of crops & fish,...

### The Land

**Desertification** is cyclic; the Sahara alone has lost 270,000 sq. mi. of non-desert land over the past 50 yrs.; accelerated by overgrazing, woodcutting, soil exhaustion,... In the 1980s, the Food & Agriculture Organization (FAO - part of the UN) studied the effects of **deforestation**; determined that 44% of global tropical rainforests are already affected by cutting.

1% logged is every year; at this rate the entire equatorial forest would be gone in less than 90 yrs. Forests convert CO<sub>2</sub> to oxygen (O<sub>2</sub>); counteract oxygen loss & greatly affect the oxygen cycle. **Soil erosion** has been a "quiet crisis;" population pressure has been a major cause - as agricultural land use intensifies, water & wind erosion increases. Soil is a renewable resource, but >25 billion tons of it is lost per year (that is, arable, or farmable land).



**Sand Dunes Encroaching on Nouakchott, the capital of Mauritania**

## Waste Disposal

The U.S. is the largest producer of **solid waste** (3.7 lbs. per person per day);

containers, packaging, etc... Core regions (US, EU, Japan) export

solid waste to the periphery. **Sanitary landfills** are prepared areas for waste disposal (includes a floor of materials to treat seeping liquids). Poorer countries: have open garbage dumps, decomposition sends methane into air (acid rain), contaminants seep into the groundwater.



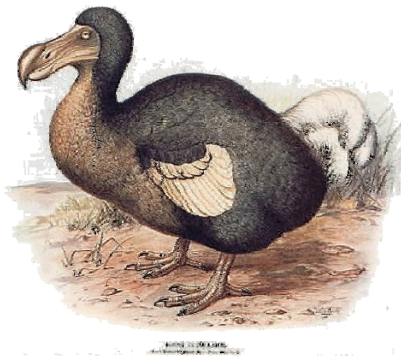
## Hazardous Materials

Toxic waste: danger is caused by chemicals, infectious materials, ... Radioactive waste: low-level: give off small amounts of radiation - hospitals, research facilities, nuclear power plants are the main sources of these minor contaminants. High-level: nuclear power plants & nuclear weapons facilities; may cause massive pollution and contamination. There is no satisfactory means of disposing high-level radioactive waste (e.g. salt effectively blocks some radiation).

## Biodiversity

There are between 10-100 million species in the world today (in other words - we know very little about the exact number of species on this planet). Only around 1.8 million species have been identified. Human travel has introduced new species worldwide, and has threatened many species (e.g. Columbian exchange).

The combination of human **population pressure**, technology & economic forces lead to species endangerment and



extinction. For example, the **Dodo** bird was hunted to extinction (1681) - Mauritius (in the Indian Ocean); destruction of the forests (cut off the Dodo's food supply); cats, rats, and pigs destroyed Dodo nests. The **American Buffalo** dominated the mid-west landscape; less than 300 of them remained in the U.S. and Canada by the turn of the 20<sup>th</sup> century out of the millions that once lived there; through massive protection efforts - today about 200,000 exist in herds today. The **Passenger Pigeon**: the last captive one died in the Cincinnati Zoo (1914).

## Trends in Human Consumption

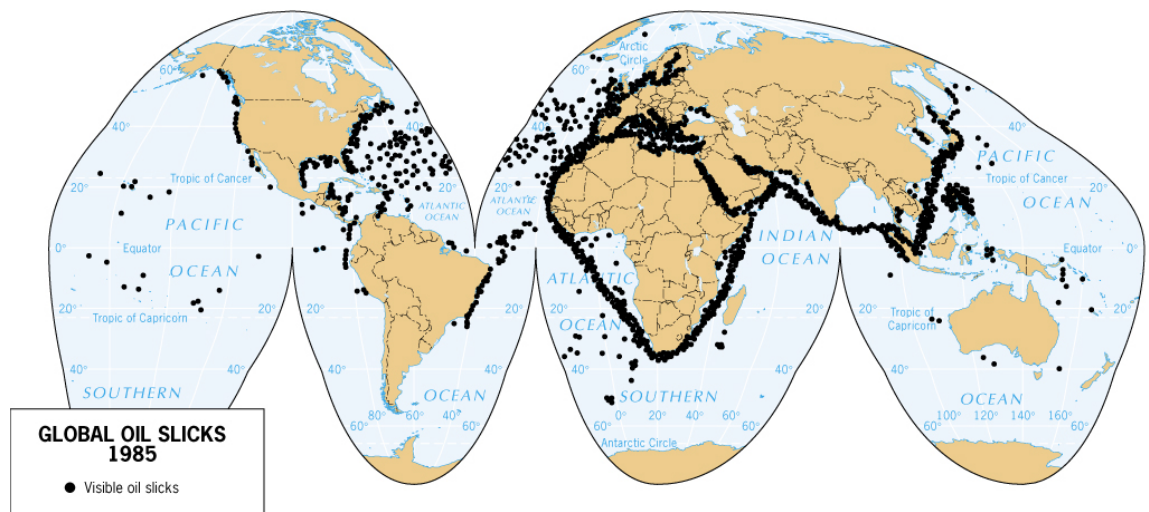
Improvements in the technology of transportation over time have required more energy at each level:

- 1) by foot or boat,
- 2) domesticated animals,
- 3) sail boats,
- 4) steam engine (invented toward the beginning of the industrial revolution),
- 5) internal combustion engine (invented toward the end of the industrial revolution).

Today's means of transportation causes more **pollution** (oil slicks) than ever before; moves species to new regions (e.g. Australian fir trees in West Palm Beach), diseases (SARS). Before the 1800s, humans relied on solar energy, mostly through the consumption of plants & animals = wood & meat). Global energy production was 75% greater in 1999 than in 1971; and this rate has

Crop	Liters/Kg Water
Potatoes	500
Wheat	900
Corn	1,400
Rice	1,900
Chicken	3,500
Beef	100,000

\* As you can see in the table, the production of meat requires much more water than for crops.



been steadily increasing. Nuclear power is largely reliable, but not 100% safe (e.g. [Three Mile Island](#), US ('79), [Chernobyl](#), USSR ('86)).



Chernobyl Reactor 4 After the Disaster

### Environmental Policies in Response to Environmental Change

Many environmental problems do not lie w/in a single **jurisdiction**, or state; often times these difficulties cross political boundaries.

Many international agreements have been spear-headed by **non-government**

**organizations** (NGOs) that operate outside the formal political arena. One example of an NGO is the **Global Environment Facility** (GEF) - a joint project of the United Nations and the World Bank; the GEF funds projects related to four issues (since 1992): 1) loss of biodiversity (plants & animals), 2) protection of the ozone layer, 3) global climate change (temperatures have been rising), and 4) protection of international waters. Although the GEF has been charged with protecting key elements of the world environment - it still functions in a **state-based world**.



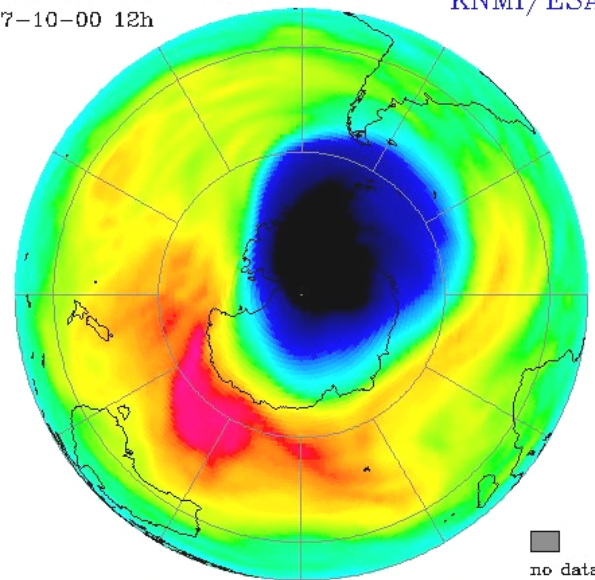
### Specific Policy Examples

Over 170 countries signed an agreement proposed by the **UN Environment Programme** dealing with biodiversity in 1993; the participating countries (168 today) work to establish a system to reduce activities that have a negative impact. It has been an ongoing struggle to find a balance between the need of LDCs to promote local economic diversity & preserve biodiversity, which is the richest in the global economic periphery; there has also been controversy over the MDCs sharing the costs for conservation.

A naturally occurring ozone layer exists in the upper levels of the stratosphere (when O<sub>3</sub> is too plentiful in the troposphere (0-16 kilometer altitude), smog can occur). The ozone layer protects the Earth from the Sun's harmful ultraviolet rays; **CFCs** (chlorofluorocarbons) found in refrigerants, fire extinguishers, and aerosol cans used since the 1950s were found to be harmful in the 1980s; the image to the left shows a "hole" in the ozone layer over Antarctica. The **Montreal Protocol** was signed in 1987 to deal with CFCs. The **Kyoto Protocol** was signed in 1997 by more than 80 countries; it laid out plans to reduce the emission of greenhouse gases; the U.S. has decided to go its own course - and has actually abandoned it unilaterally.

Assimilated GOME total ozone  
17-10-00 12h

KNMI/ESA



no data  
 <160 175 200 225 250 275 300 325 350 375 400 425 450 475 >500 DU

A "Hole" in the Ozone Layer Over Antarctica