Ch. 7 - Geographical Ecology, Climate & Biomes

Weather - the short term properties of the troposphere at a given place and time - is very changeable:

Climate - the average long-term weather of an area.

averaged over a long time - at least 30 years.

determined by two main factors: temperature and precipitation

masses of air are constantly moving

Weather Front: the boundary between two fronts

warm front - boundary between an advancing warm air mass and the cool air mass it replaces

high wispy clouds; release moisture as rainfall.

days of cloudy skies and drizzle

cold front - boundary between an advancing cold air mass and the warm air mass it replaces.

the advancing cold air stays close to the ground (more dense)

produces rapidly moving towering clouds (thunderheads)

high surface winds and thunderstorms

after the front, cooler temperatures and clear skies

Weather Extremes:

tornadoes - form over land
tropical cyclones - form over ocean waters
hurricanes - in the Atlantic
typhoons - in the Pacific

Computer models predicts the weather for several days by calculating the probabilities that air masses, winds and other factors will move and change in certain ways.

How does Global Circulation of Air Affect Regional Climates?

The two most important factors determining a region's climate: average temperature and average precipitation

Factors that determine global air circulation patterns

1. Uneven heating of the earth's surface

    air is hot at the equator and cold at the poles, and temperate in between

2. Seasonal changes occur because the axis is tilted

    This tilt causes the seasonal changes as the earth revolves around the sun

    creates opposite seasons in the northern and southern hemispheres

3. The earth rotates on its axis

    prevents air currents from moving due north and south from the equator

    forces caused by this rotation cause winds to be deflected to the right (northern hemisphere) or the left (southern hemisphere)

    Coriolis Effect - results in the formation of six huge convection cells

4. Long-term variations in the amount of solar energy striking the earth

    these variations are the result of occasional changes in solar output, slight planetary shifts: earth wobble (22,000-year cycle) and tilt (44,000-year cycle) and minute changes in the shape of the Earth's orbit (100,000-year cycle)

5. Properties of air and water

    ocean water heated by the sun evaporates, removing heat from the oceans.

moist hot air rises, expands, becomes less dense (area of low pressure)

rising hot air cools and releases moisture as condensation (cold air hold less water than hot air)

when vapor condenses (precipitation), heat is released (radiating into space)

cooler denser air sinks (area of high pressure)

air mass flows across the surface picking up heat and moisture

How do Ocean Currents Affect Regional Climates?

In addition to the factors we just mentioned concerning global circulation, other factors include warm and cold ocean currents. Ocean currents are driven by the wind and the earth's rotation redistributes heat received from the sun.

Ocean currents redistribute heat - therefore, influence climate and vegetation (esp. near coastal areas)

Gulf Stream

Upwelling of cold, nutrient rich bottom water

> bring nutrients from the deeper parts of the ocean to the surface to support phytoplankton, zooplankton, fish and fish-eating birds

El Nino - Southern Oscillation (ENSO)

> can trigger extreme weather changes over 2/3 of the globe (esp. along the Pacific and Indian Oceans)

How Does the Chemical Makeup of the Atmosphere Lead to the Greenhouse Effect?

Greenhouse gases: carbon dioxide, water vapor, ozone, methane, nitrous oxide and chlorofluorocarbons

Visible light, infrared and some UV from sun pass through the troposphere

Earth's surface absorbs this energy and degrades it to longer wavelength infrared.

Some of this IR escapes into space; some is absorbed by molecules of the greenhouse (warming the air)

Some radiates back to the earth's surface.

Amount of heat trapped depends primarily on the concentration of the greenhouse gases and the length of time they stay in the atmosphere.

Water vapor - 1-5%
Carbon dioxide: 0.036%

How Does the Chemical Makeup of the Atmosphere Lead to the Ozone Layer?

In stratosphere 17-26 km (11-16 miles): $3\ O_2 + UV = 2\ O_3$

Ozone concentration is 10 ppm

Ozone layer blocks out almost all UV-A (highest energy UV); one-half of UV-B and only a small part of UV-C

Ozone layer prevents at least 95% of sun's harmful rays, creates warm layers of air (thermal cap) that prevents the churning air masses of the troposphere from entering the stratosphere and determines the earth's average temperature and the earth's current climates.

How Do Topography and Other Features of the Earth's Surface Modify Climate to Form Microclimates?

Microclimates - differ from the general climate of the region

Mountains - interrupt the flow of air masses

Rain shadow effect

Vegetation- takes up and releases water, affects wind near the ground and casts shadows.

Cities - bricks, concrete, asphalt etc. absorb heat and buildings block wind flow.

Motor vehicles generate heat and pollutants; haze, smog, higher temperatures

Biomes, Climate and Life on Land

Why Are There Different Organisms in Different Places?

Climate determines the nature of the land surface - determined by average temperature and precipitation

Biome - a terrestrial region with characteristic types of natural, undisturbed ecological communities adapted to the climate of the region.

For plants, precipitation is generally the limiting factor that determines whether a land area is desert, grassland or forest.

Biomes blend into one another - ecotones - transitional zones; are not uniform

Climate and biomes vary with latitude and altitude

Why Do Plant Sizes, Forms, and Survival Strategies Differ?

Plant communities in different biomes have distinct physical appearances depending on the types, sizes and forms of their plant species - determined largely by climate and soil type. Size and form of a plant species tend to represent adaptations for gathering sunlight for photosynthesis and for maintaining the optimum temperature in a particular environment.

e.g., Plants exposed to cold air year round or during winter have traits that keep them from losing too much heat and water. Desert plants must be able to lose heat so they don't overheat and die. They must also conserve water (ability to store water, and synthesize food)

Trees of wet tropical rain forests tend to be broadleaf evergreen plants

In cold dry winters, broadleaf deciduous trees shed leaves and go dormant to conserve heat and water.

Coniferous evergreen plants: leaf shape slow down heat loss and evaporation. leaves that are kept in winter enable photosynthesis to occur during brief summer periods.

Desert Biomes

Evaporation exceeds precipitation (less than 25 cm/year)

30% or earth's land surface

situated mainly between tropical and subtropical regions north and south of the equator (± 30^{o})

Different average temperatures create tropical, temperate and cold deserts

Tropical Deserts – Sahara Desert

Temperate Deserts

Cold Deserts – Gobi Desert

Semidesert

How do Plants and Animals Survive?

"Beat the Heat" and "Every drop of water counts"

What Impacts Do Humans Have on Desert Ecosystems?

Grassland, Tundra and Chaparral Biomes

Forest Biomes

Mountain Biomes

New Perspectives on Geological Ecology

Rather than concentrating on the minute details of each biome, learn the trends as one progresses from one biome to the next. Refer to the diagrams handed out in class: