Chapter 1 Vocab

Environment: the sum of all the conditions surrounding us that influence life

Environmental science: the field that looks at interactions among human systems and those found in nature

System: any set of interacting components that influence one another by exchanging energy or materials

Ecosystem: a particular location on Earth whose interacting components include living and nonliving components

Biotic: living

Abiotic: nonliving

Environmentalist: a person who participates in environmentalism (a social movement that seeks to protect the environment through lobbying, activism, and education)

Environmental studies: a broader field that includes additional subjects such as environmental policy, economics, literature, and ethics

Ecosystem services: the processes by which life-supporting resources such as clean water, timber, fisheries, and agricultural crops are produced.

Environmental indicators: factors that describe the current state of an environmental system (biological diversity, food production, average global surface temperature, CO_2 concentrations in the atmosphere, human population, resource depletion)

Sustainability: living on Earth in a way that allows us to use its resource without depriving future generations of those resources

Biodiversity: the diversity of life forms in an environment (3 scales: genetic, species, ecosystem)

Species: A group of organisms that is distinct from other groups in its morphology, behavior, or biochemical properties

Speciation: the evolution of new species

Background extinction rate: the average rate at which species go extinct over the long term

Greenhouse gases: heat-trapping gases, such as CO_2

Anthropogenic: derived from human activities

Development: improvement in human well-being through economic advancement; influences personal and collective human lifestyles

Sustainable development: development that balances current human well-being and economic advancement with resource management for the benefit of future generations

Biophilia: love of life; a need to make "the connections that humans subconsciously seek with the rest of life"

Ecological footprint: a measure of how much an individual consumes, expressed in area of land

Scientific method: an objective way to explore the natural world, draw inferences from it, and predict the outcome of certain events, processes, or changes.

Hypothesis: a testable conjecture about how something works

Null hypothesis: a statement or idea that can be falsified, or proven wrong

Replication: the procedure of taking several sets of measurements

Sample size: the number of times a measurement is replicated

Accuracy: how close a measured value is to the actual or true value

Precision: how close to one another the repeated measurements of the same sample are

Uncertainty: an estimate of how much a measured or calculated value differs from a true value

Inductive reasoning: the process of making general statements from specific facts or examples

Deductive reasoning: the process of applying a general statement to specific facts or situations

Critical thinking: the process of questioning the source of the information, considering the methods or processes that were used to obtain the information, and drawing your own conclusions

Theory: a hypothesis that has been repeatedly tested and confirmed by multiple groups of researchers and has reached wide acceptance

Natural law: a theory to which there are no known exceptions and which has withstood rigorous testing

Control group: a group that experiences exactly the same conditions as the experimental group, except for the single variable under study

Natural experiment: when a natural event acts as an experimental treatment in an ecosystem

Environmental justice: a social movement and field of study that works toward equal enforcement of environmental laws and the elimination of disparities, whether intended or unintended, in how pollutants and other environmental harms are distributed among the various ethnic and socioeconomic groups within a society

9-14-18

Chapter 1 Notes: Studying the State of Our Earth

- Environmental studies is a field that encompasses many other branches: law, economics, politics, earth sciences, etc.

- Humans manipulate their environment more than any other species

* Global env. indicators:
  - Biodiversity
  - Food production
  - Avg global surface temp. + CO_2 concentration
  - Human population
  - Resource depletion

→ With global warming, permafrost (frozen ground) is melting, releasing vast amounts of methane.

→ Resources like coal, oil, and uranium cannot be renewed, while resources like aluminum and copper are finite but can be recycled. China controls the global rare metal market.

- Basic human needs: air, water, food, shelter

Chapter 2 Notes: Env. Systems 9-25-18

- Water is a significant component of many environmental systems.
  - Surface tension
  - Capillary action
  - Boils at 100°C, freezes at 0°C
  - Universal solvent

- Acids + Bases
  - Acids contribute H^+ ($pH < 7$)
  - Bases contribute OH^- ($pH > 7$)
  - pH of 7 is neutral

- Chemical v. Biological Reactions
  - Chemical: Law of Conservation of Matter
  - Biological:
    - Inorganic: doesn't contain carbon or doesn't contain C bonded to H
    - Organic: contains C-C and C-H bonds
      - Good for soil; smaller grain size than inorganic

- Energy = power × time

- Laws of Thermodynamics:
  1. Energy can neither be created nor destroyed, but can change from one form to another.
  2. When energy is transformed, the quantity of energy remains the same, but its ability to do work is diminished

- Open v. Closed Systems
  - Energy on Earth is an open system
  - Matter on Earth is a largely closed system

- Feedback loops in system dynamics

Chapter 2 Vocab

- Matter: anything that occupies space and has mass
- Atom: the smallest particle that can contain the chemical properties of an element
- Element: a substance composed of atoms that cannot be broken down into smaller, simple components.
- Periodic table: a table that lists all of the currently known elements
- Molecules: particles containing more than one atom
- Compounds: molecules that contain more than one element
- Atomic number: the # of protons in the nucleus of a particular element
- Mass number: the total # of protons and neutrons in an element
- Isotopes: atoms that differ only because of different #s of neutrons

- Radioactive decay: the spontaneous release of material from the nucleus

- Half-life: the time it takes for one-half of the original radioactive parent atoms to decay

- Covalent bonds: bonds formed by sharing electrons; created between atoms that don't readily gain or lose electrons

- Ionic bond: a chemical bond that forms between oppositely charged ions

- Hydrogen bond: a weak chemical bond that forms when hydrogen atoms that are covalently bonded to one atom are attracted to another atom on another molecule

- Polar molecule: a molecule that is more positive on one side and more negative on the other

- Surface tension: results from the cohesion of water molecules at the surface of a body of water

- Capillary action: when adhesion of water molecules to a surface is stronger than the cohesion between the molecules

- Acid: a substance that contributes hydrogen ions to a solution

- Base: a substance that contributes hydroxide ions to a solution

- pH: a scale used to determine the strength of acids and bases [1 to 14; 7 is neutral]

- Chemical reaction: when atoms separate from the molecules they are a part of or recombine with other molecules

- Law of conservation of matter: matter cannot be created or destroyed, only transformed

- Inorganic compounds: compounds that either don't contain carbon at all or only contain carbon bonded to hydrogen

- Organic compounds: compounds that have C-C or C-H bonds

- Carbohydrates: compounds composed of carbon, hydrogen, and oxygen atoms

- Proteins: organic compounds made up of long chains of nitrogen-containing organic molecules (amino acids)

- Nucleic acids: organic compound found in all living cells, form DNA + RNA

- DNA: the genetic material organisms pass on to their offspring that contains the code for reproducing the components of the next generation

- RNA: translates the code stored in the DNA and allows for protein synthesis

- Lipids: smaller biological molecules that do not mix with water (fats, waxes, etc.)

- Cell: a highly organized living entity that consists of the four types of macromolecules and other substances in a watery solution, surrounded by a membrane

- Energy: the ability to do work, or transfer heat

- Electromagnetic radiation: a form of energy that includes visible light, UV light, and infrared energy, which we perceive as heat.

- Photons: massless packets of energy that travel at the speed of light and can move through a vacuum.

- Joule: the amount of energy used when a 1-watt light bulb is turned on for one second.

- Power: the rate at which work is done

- Potential energy: energy that is stored but has not yet been released

- Kinetic energy: the energy of motion

- Chemical energy: potential energy stored in chemical bonds

- Temperature: the measure of the average kinetic energy of a substance
- 1st Law of Thermodynamics: Energy is neither created nor destroyed
- 2nd Law of Thermodynamics: when energy is transformed,
- Energy efficiency: the ratio of the amount of work that is done to the total amount of energy that is introduced into the system in the first place
- Energy quality: the ease with which an energy source can be used for work
- Entropy: randomness
- Open system: a system in which exchanges of matter/energy occur across system boundaries
- Closed systems: matter/energy exchanges across system boundaries do not occur

- Inputs: additions to a given system
- Outputs: losses from the system
- Systems analysis: when scientists determine inputs, outputs, and changes in the system under various conditions
- Steady state: inputs equal outputs
- Feedback: the results of a process feed back into the system to change the rate of that process
- Negative feedback loops: a system responds to a change by returning to its original state, or at least by decreasing the rate at which the change is occurring
- Positive feedback loops: amplifies changes
- Adaptive management plan: a strategy that provides flexibility so that managers can modify it as future changes occur

Chapter 3 Vocab

Ecosystem: a particular location on Earth distinguished by its particular mix of interacting biotic and abiotic components

Producers: organisms (such as plants and algae) that use the Sun's energy to produce usable forms of energy

Autotrophs: producers

Photosynthesis: the process by which producers use solar energy to convert CO_2 and water into glucose

Cellular respiration: a process that unlocks the chemical energy stored in the cells of organisms

Consumers: organisms that are incapable of photosynthesis and must obtain their energy by consuming other organisms

Heterotrophs: consumers

Primary consumers: herbivores; heterotrophs that consume producers

Secondary consumers: carnivores that eat primary consumers

Tertiary consumers: carnivores that eat secondary consumers

Trophic levels: successive levels of organisms consuming one another

Food chain: the sequence of consumption from producers through tertiary consumers

Food web: a model that shows that all species in an ecosystem are connected to one another

Scavengers: carnivores that consume dead animals

Detritivores: organisms that specialize in breaking down dead tissues and waste products (detritus) into smaller particles

Gross primary productivity (GPP): the total amount of solar energy that the producers in an ecosystem captured by producers

Net primary productivity (NPP): energy captured − energy respired

Biomass: the total mass of all living matter in a specific area

Standing crop: the amount of biomass present in an ecosystem at a particular time

Ecological efficiency: the proportion of consumed energy that can be passed from one trophic level to another

Trophic pyramid: a model showing the distribution of biomass among trophic levels

Biogeochemical cycles: the movements of matter within and between ecosystems

Hydrologic cycle: the movement of water through the biosphere

Transpiration: the process in which plants release water from their leaves into the atmosphere

Evapotranspiration: the combined amount of evaporation and transpiration; used as a measure of water moving through an ecosystem

Runoff: movement of water across the land surface and into streams and rivers

Macronutrients: key elements that organisms need in relatively large amounts: N, P, K, Ca, Mg, S

Limiting nutrient: nitrogen; a lack of N constrains the growth of an organism

Nitrogen fixation: the process by which organisms convert N_2 to NH_3; first step in the nitrogen cycle

Leaching: the process in which nitrate is readily transported through the soil with water

Disturbance: an event caused by physical, chemical, or biological agents that results in changes in population size or community composition

Watershed: all of the land in a given landscape that drains into a particular stream, river, lake, or wetland

Resistance: a measure of how much a disturbance can affect the flows of energy and matter

Resilience: the rate at which an ecosystem returns to its original state after a disturbance

Restoration ecology: a scientific discipline dealing with restoring damaged ecosystems

Intermediate disturbance hypothesis: ecosystems experiencing intermediate levels of disturbance are more diverse than those with high or low disturbance levels

Instrumental value: a species's worth as an instrument, or tool, that can be used to accomplish a goal

Intrinsic value: a species's worth independent of any benefit it may provide to humans

Provisions: goods that humans can use directly

Chapter 3 Notes

- Hydrologic Cycle
  - Transpiration
  - Evapotranspiration
  - Runoff
  - Condensation
  - Precipitation

- Carbon Cycle
  - Photosynthesis
  - Respiration
  - Exchange (between atmosphere & ocean)
  - Sedimentation
  - Extraction
  - Combustion

- Nitrogen Cycle
  - Nitrogen fixation [alfalfa]
  - assimilation
  - Ammonification
  - Nitrification
  - Denetrification

- Phosphorous Cycle
  - Weathering of rocks
  - Phosphate fertilizer
  - Excretion / decomposition
  - Precipitation / sedimentation
  - formation of mountains
  - No gaseous component
  - Ions bind to minerals

Chapter 4 Vocabulary: Global Chains & Biomes

Climate: the average weather that occurs in a given region over a long period [several decades]

Troposphere: the layer closest to the Earth's surface; extends roughly 16 km above Earth

Stratosphere: Extends 16 to 50 km above earth's surface

Albedo: the percentage of incoming sunlight that is reflected from a surface

Saturation point: the max amount of water vapor that can be in the air at a given temperature

Adiabatic cooling: a process in which air rises → pressure ↓ → air ↑ in volume → ↓ temperature

Adiabatic heating: air sinks → pressure ↑ → air ↓ in volume → ↑ temperature

Latent heat release: when energy is released as water vapor condenses into liquid water

Hadley cells: Convection currents that cycle between the equator and 30° N and S

Intertropical convergence zone (ITCZ): the area of Earth that receives the most intense sunlight, where the ascending branches of the two Hadley cells converge

Polar cells: convection currents formed by air that rises at 60° N and S and sinks at the poles (90° N and S)

Coriolis Effect: the deflection of an object's path due to Earth's rotation

Gyres: large-scale patterns of water circulation

Upwelling: the upward movement of water toward the surface

Thermohaline circulation: an oceanic circulation pattern that drives the mixing of surface water and deep water; crucial for moving heat and nutrients around the globe

El Niño-Southern Oscillation (ENSO): the periodic changes in winds and ocean currents caused by: trade winds near S. Am. weaken → warm equatorial water from W Pacific moves E to W coast of S Am → suppresses upwelling off the coast of Peru → ↓ productivity → ↓ fish pop. near coast

Rain shadow: warm, dry air produces arid conditions on the leeward side of the range → forms a region called a rain shadow

Biomes: terrestrial geographic regions that have a particular combo of avg annual temp. and annual precip. and contain distinctive plant growth forms

Tundra: cold & treeless w/ low-growing vegetation; soil is completely frozen in winter; arctic, antarctic, and alpine

Permafrost: underlying subsoil - an impermeable, permanently frozen layer that prevents water from draining and roots from penetrating

Boreal forests: forests made up primarily of coniferous evergreen trees that can tolerate cold winters and short growing seasons

Temperate rainforests: moderate temp. & high precip.

Temperate seasonal forest: receive over 1 m of precip annually; experience warmer summers + colder winters than temperate rainforests; dominated by broadleaf deciduous trees

Woodland/shrubland: characterized by hot, dry summers + mild, rainy winters

Temperate grassland/cold dessert: cold, harsh winters + hot, dry summers; plant growth constrained by insufficient precip. in summer + cold temps in winter

Tropical rainforests: lie within about 20° N and S of equator; warm + wet w/ little seasonal temp. variation; high productivity + rapid decomposition

Tropical seasonal forests/savannas: marked by warm temps. + distinct wet and dry seasons

Subtropical deserts (hot deserts): particular plants have adapted to lack of precip.; when rain falls, it transforms the landscape

Littoral zone: the shallow area of soil and water near the shore where algae and emergent plants such as cattails grow

Limnetic zone: open water

Phytoplankton: floating algae; the only photosynthetic organisms in open water

Profundal zone: the region of water bellow the limnetic zone in very deep lakes

Benthic zone: the muddy bottom of a lake/pond beneath the limnetic and profundal zones

Freshwater wetlands: aquatic biomes that are submerged or saturated by water for at least part of each year, but shallow enough to support emergent vegetation throughout

Salt marshes: found along the coast in temperate climates; contain nonwoody emergent vegetation

Mangrove swamps: occur along tropical/subtropical coasts; contain trees whose roots are submerged in water; trees are salt-tolerant

Intertidal zone: the narrow band of coastline that exists between the levels of high + low tide

Coral reefs: found in warm, shallow waters beyond the shoreline; Earth's most diverse marine biome

Coral bleaching: a phenomenon in which the algae inside the corals die

Photic zone: the upper layer of water that receives enough sunlight to allow photosynthesis

Aphotic zone: the deeper layer of water that lacks sufficient sunlight for photosynthesis

Chemosynthesis: the process by which certain bacteria can generate energy by using the energy contained within the bonds of methane and hydrogen sulfide

Chapter 4 Notes

Atmospheric composition:

SPACE
thermosphere
Mesosphere
stratosphere — OZONE — O_3, a pale blue gas
troposphere

- Temperature changes as you go up into the atmosphere- rather than measuring the air itself, you measure the temp. of the objects there

Unequal heating of Earth:

1. Insolation (angle)
2. Variation in the amt of surface area over which the Sun's rays are distributed
3. Some areas of Earth reflect more solar energy than others (Albedo)

Properties of air that determine its movement:

1. Density
2. Water vapor capacity [saturation point]
3. Adiabatic heating/cooling
4. Latent heat release

Three Rules of Winds:

1. Air moves from high to low pressure
2. Fluids curve to the right in the N. Hem, left in the S. Hem
3. Named by where they originate

Chapter 5 Vocabulary

Ecosystem diversity: the variety of ecosystems within a given region

Species diversity: the variety of species within a given ecosystem

Genetic diversity: the variety of genes within a given species

Species richness: the # of species in a given area

Species evenness: whether an ecosystem is numerically dominated by one species or all its species have similar abundances

Phylogenies: branching patterns of evolutionary relationships

Evolution: a change in the genetic composition of a population over time

Microevolution: evolution below the species level

Macroevolution: when genetic changes give rise to new species, genera, families, classes, or phyla

Genes: physical locations on chromosomes within each cell of an organism

Genotype: the complete set of genes in an individual

Mutation: a random change in the genetic code

Recombination: occurs (in plants/animals) when chromosomes are duplicated during reproductive cell division and a piece of one chromosome breaks off and attaches to another

Phenotype: the actual set of traits seen in that individual

Evolution by artificial selection: when humans determine which individuals breed, typically with a preconceived set of traits in mind

Evolution by natural selection: when the environment determines which individuals survive and reproduce

Fitness: an individual's ability to survive and reproduce

Adaptations: traits that improve an individual's fitness

Genetic drift: a change in the genetic composition of a population over time as a result of random mating

Bottleneck effect: a reduction in the genetic diversity of a population caused by a reduction in its size

Founder effect: a change in population descended from a small number of colonizing individuals

Geographic isolation: a way for evolution to create new species - when a subset of a larger population colonizes a new area of habitat that is physically separated from the rest of the population

Reproductive isolation: if the physical barrier were removed, two populations could no longer interbreed and produce viable offspring due to their genetic differences

Allopatric speciation: geo. isolation → 2 distinct species

Sympatric speciation: the evolution of one species into two species in the absence of geo. isolation

Genetic engineering: techniques used by scientists to modify genes

Genetically modified organisms: organisms w/ artificially altered genes

Range of tolerance: limits to the abiotic conditions a species can tolerate

Fundamental niche: a species's suite of ideal abiotic conditions

Realized niche: the range of abiotic and biotic conditions under which a species actually lives

Distribution: the areas of the world in which the species lives

Niche generalists: organisms that can live in a variety of habitats or feed on a variety of species

Niche specialists: organisms that are specialized to live in a specific habitat or feed on a small group of species

fossils: the remains of organisms that have been preserved in rock

Mass extinction: when large numbers of species went extinct over relatively short periods of time

Chapter 5 Notes

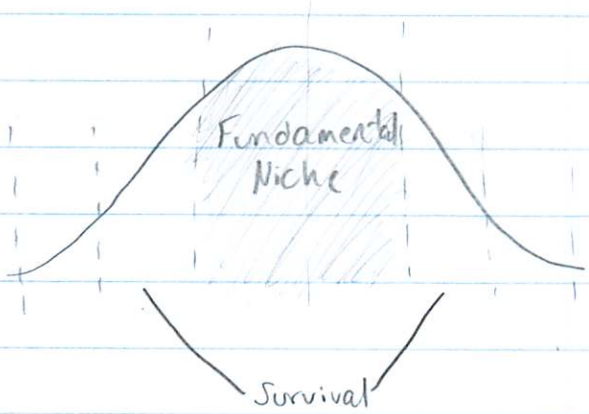
- Diversity - three levels
  1. Ecosystem
  2. Species
  3. Genetic

★ Functional diversity: biological/chemical processes needed for survival

- 1.9 million species identified on earth

- Evolution: artificial vs. natural selection
  - Charles Darwin: the father of evolutionary theory

- Fundamental niches



Characteristics of Endangered Species

- Extremely small range
- Requiring a large territory

Chapter 6 Vocabulary

Population: the second level of complexity (after an organism); composed of all the individuals that belong to the same species and live in a given area at a particular time

Community: the third level of complexity; incorporates all of the populations of organisms within a given area

Population ecology: the study of factors that cause populations to increase or decrease

Population size (N): the total # of individuals within a defined area at a given time

Population density: the # of individuals per unit area (volume for aquatic) at a given time

Population distribution: a description of how individuals are distributed with respect to one another

Sex ratio: the ratio of males to females

Age structure: a description of how many individuals fit into particular age categories

Density-dependent factors: factors that influence an individual's probability of survival and reproduction in a manner that depends on the size of the population

Limiting resource: a resource that a population cannot live without and which occurs in quantities lower than the population would require to increase in size.

Carrying capacity (K): the limit to how many individuals the food supply could sustain

Density-independent factors: factors that have the same effect on an individual's probability of survival and amount of reproduction at any population size

Growth rate: the # of offspring an individual can produce in a given period minus the deaths of the individual or its offspring during the same period

(r) Intrinsic growth rate: a population's particular maximum potential for growth

Exponential growth model: $N_t = N_0 e^{rt}$

- N_t = population's future size
- N_0 = current pop. size
- r = growth rate
- e = natural base

J-shaped curve: describes the exponential growth model

Logistic growth model: describes a population whose growth is initially exponential, but slows as the population approaches the carrying capacity

S-Shaped curve: describes the logistic growth model

Overshoot: when a population becomes larger than its [spring] carrying capacity

Die-off: population crash

K-selected species: species w/ low intrinsic growth rates that cause their populations to ↑ slowly until they reach the carrying capacity → small fluctuations in pop.

r-selected species: species that have high intrinsic growth rates bc they reproduce often and produce large #s of offspring

Survivorship curves: patterns of survival, of which there are 3 basic types

Corridors: strips of habitat that connect separated populations

Metapopulation: a group of spatially distinct populations that are connected by occasional movements of individuals

Community ecology: the study of the interactions between species in a habitat

Competition: the struggle of individuals to obtain a limiting resource

Competitive exclusion principle: "two species competing for the same limiting resource cannot coexist"

Resource partitioning: when two species divide a resource based on differences in the species' behavior or morphology

Predation: the use of one species as a resource by another species

True predators: kill their prey + consume most of what they kill

Herbivores: consume plants

Parasites: live on/in the organisms (hosts) they consume

Pathogens: parasites that cause disease in their hosts

Parasitoids: organisms that lay eggs inside other organism

Mutualism: an interaction in which two species benefit by increasing both species' chance of survival and/or reproduction

Commensalism: a relationship in which one species benefits but the other is neither harmed nor helped

Symbiotic: describes the relationship of two species that live in close association w/ each other

Keystone species: a species that plays a role in its community that is far more important than its relative abundance might suggest

Predator-mediated competition: when a predator that is small in number plays a key role in reducing the abundance of a superior competitor, allowing inferior competitors to persist

Ecosystem engineers: a keystone species that creates/maintains habitat for other species

Ecological succession: the predictable replacement of one group of species by another group of species over time

Primary succession: occurs on surfaces initially devoid of soil; bare rock is colonized by organisms that excrete acids that allow them to take nutrients directly from the rock → makes rock more susceptible to erosion → organisms die + mix w/ minerals from rock to create new soil

Secondary succession: occurs in areas that have been disturbed but have not lost their soil; follows an event that removes vegetation but leaves the soil mostly intact

Pioneer species: species that have the ability to colonize new areas rapidly and grow well in full sonshine

Theory of island biogeography: demonstrates the dual importance of habitat size and distance in determining species richness

Chapter 7 Vocab

Demography: the study of human populations and population trends

Demographers: scientists in the field of demography

Immigration: people moving into a country

Emigration: people moving out of a country

Crude birth rate (CBR): the # of births per 1000 individuals per year

Crude death rate: the # of deaths per 1000 individuals per year

Doubling time: the # of years it takes a pop. to double

Total fertility rate: an estimate of the avg. # of children that each woman in a pop. will bear throughout her childbearing years

Replacement-level fertility: the TFR required to offset the avg # of deaths in a pop. so that the current pop. size remains stable

Developed countries: countries with relatively high levels of industrialization and income

Developing countries: countries where relatively low levels of industrialization and incomes < $3 / person / day are the norm

Life expectancy: the avg # of years that an infant born in a particular year in a particular country can be expected to live, given the current avg. life span and death rate in that country

Infant mortality rate: the # of deaths of children under 1 yr of age per 1000 live births

Child mortality rate: the # of deaths of children under age 5 per 1000 live births

Age structure diagrams: visual representations of age structure within a country for males and females

Population pyramid: an age structure diagram that is widest at the bottom and smallest at the top; typical of developing countries

Population momentum: the phenomenon that it takes time for actions that attempt to reduce birth to catch up with a growing population

Net migration rate: the difference between immigration and emigration in a yr per 1000 people

Theory of demographic transition: as a country moves from a subsistence economy to industrialization and increased affluence, it undergoes a predictable shift in pop. growth

Family planning: regulation of the # or spacing of offspring thru the use of birth control

Affluence: level/amount of money, goods, or property

IPAT Equation: Impact = Population × Affluence × Technology

Urban area: A space that contains >386 people/sq. km.

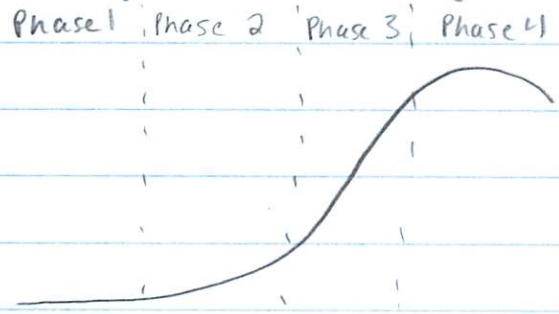
Gross Domestic Product (GDP): the value of all products and services produced in a yr in a particular country

Chapter 7 Notes

Factors that Drive Human Pop. Growth

- Demography
  - Changes in pop. size
  - Fertility
  - Life expectancy
  - Age structure
  - Migration

Stages of Demographic Transition



Impact of Human Lifestyles:

Impact = Population × Affluence × Technology

Chapter 8 Vocab

Core: the innermost zone of the planet

Mantle: the layer above the core; filled w/ magma

Magma: molten rock

Asthenosphere: the outer part of the mantle; composed of semi-molten, ductile rock

Lithosphere: brittle, outermost layer of the planet

Crust: the chemically distinct outermost layer of the lithosphere

Hot spots: places where molten material from the mantle reaches the lithosphere

Plate tectonics: Earth's lithosphere is divided into plates, most of which are in constant motion

Tectonic cycle: the sum of the processes that build up and break down the lithosphere

Subduction: the process of one plate passing under another

Volcano: a vent in Earth's surface that emits ash, gases, and molten lava

Divergent plate boundaries: where plates move away from each other

Seafloor spreading: at divergent boundaries, oceanic plates move away from each other and magma pushes upward and out, forming new rock

Convergent plate boundaries: where plates move towards each other and collide

Transform fault boundaries: where plates move sideways past each other

Fault: a fracture in rock across which there is movement

Fault zones: large expanses of rock where movement has occurred

- Earthquakes: when the rocks of the lithosphere rupture unexpectedly along a fault

Seismic activity: found in fault zones

Epicenter: the exact point on the surface of Earth directly above the location where the rock ruptures during an earthquake

Richter scale: a measure of the largest ground movement that occurs during an earthquake

Minerals: solid chemical substances w/ uniform, often crystalline structures

Rock cycle: the constant formation and destruction of rock

Igneous rocks: rocks that form directly from magma

Intrusive igneous rocks: form within Earth as magma rises up and cools in place underground

Extrusive igneous rocks: form when magma cools above Earth's surface

Fractures: cracks that occur when stresses cause cooled rock to break

Sedimentary rocks: form when sediments such as mud, sands, or gravels are compressed by overlying sediments

Metamorphic rocks: form when other rocks are subjected to high temperatures and pressures

Physical weathering: the mechanical breakdown of rocks and minerals

Chemical weathering: the breakdown of rocks and minerals by chemical reactions and/or the dissolving of chemical elements from rocks

Acid precipitation (acid rain): when SO_2 reacts w/ water vapor in the atmosphere to form sulfuric acid, and then falls to Earth as precipitation

Erosion: the physical removal of rock fragments from a landscape or ecosystem

Deposition: the accumulation or depositing of eroded material

Soil: a mix of geologic and organic components

Parent material: the rock material underlying a soil from which its inorganic components are derived.

Horizons: layers in soil

O Horizon (organic horizon): a layer of organic detritus at the surface of many soils

A Horizon (topsoil): a zone of organic material and minerals that have been mixed together

E Horizon: a zone of leaching (eluviation) that forms under the O Horizon in acidic soils

B Horizon (subsoil): composed primarily of mineral material

C Horizon: the least weathered horizon; similar to the parent material

Texture: determined by the percentages of sand, silt, and clay

Cation exchange capacity (CEC): the ability of a particular soil to adsorb and release cations

Base saturation: a measure of the proportion of soil bases to soil acids, expressed as a percentaje

Soil degradation: the loss of some or all of the ability of soils to support plant growth

Crustal abundance: the avg concentration of an element in the crust

Ores: concentrated accumulations of minerals from which economically valuable minerals can be extracted

Metals: elements w/ properties that allow them to conduct electricity and heat energy, and perform other important functions

Reserve: the known quantity of the resource that can be economically recovered

Strip mining: the removal of "strips" of soil and rock to expose ore

Mining spoils (tailings): unwanted waste materials generated during mining

Open-pit mining: the creation of a large pit or hole in the ground that is visible from Earth's surface

Mountaintop removal: when miners remove the entire top of a mountain w/ explosives

Placer mining: the process of looking for metals and precious stones in river sediments

Subsurface mining: vertical shafts drilled from a horizontal tunnel (think: coal, diamonds, gold)

Chapter 9 Vocabulary

Aquifers: permeable layers of rock and sediment

Unconfined aquifers: aquifers that water can easily flow in and out of

Confined aquifers: aquifers that water can't flow in and out of

Water table: the uppermost level at which the water in a given area fully saturates the rock and soil

Groundwater recharge: when water from precipitation percolates through the soil and works its way into an aquifer.

Springs: when water from aquifers naturally percolates up to the ground surface

Artesian wells: where drilling a hole into a confined aquifer releases the pressure on the water, allowing it to burst out of the aquifer and rise up in the well

Cone of depression: an area where there is no longer any groundwater

Saltwater intrusion: when drilling near a coastline leads to adjacent salt water infiltrating the area of rapid pumping, making the water in the wells salty

Floodplain: the land adjacent to a river

Oligotrophic: lakes that have low productivity due to low amounts of nutrients in the water (like P and N)

Mesotrophic: lakes w/ moderate levels of productivity

Eutrophic: lakes w/ high productivity

Impermeable surfaces: pavement or buildings that do not allow water penetration

Levee: an enlarged bank built up on each side of the river

Dikes: bandaries built to prevent ocean waters from flooding adjacent land

Dam: a barrier that runs across a river or stream to control the flow of water

Reservoir: behind a dam, where water is stored

Fish ladders: stairs w/ water flowing over them, meant to allow fish to move around more freely

Aqueducts: canals or ditches used to carry water from one location to another

Desalination: the process of removing salt from water

Hydroponic agriculture: the cultivation of crop plants under greenhouse conditions w/ their roots immersed in a nutrient-rich solution, but no soil

Gray water: the wastewater from baths, showers, bathroom sinks, and washing machines

Chapter 10 Vocab

Tragedy of the commons: the tendency of a shared, limited resource to become depleted because people act from self-interest for short-term gain

Externality: a cost/benefit of a good/service that is not included in its purchase price

Maximum sustainable yield: the max amount of a renewable resource that can be harvested w/o compromising its future availability

Resource conservation ethic: people should maximize resource use based on the greatest good for everyone

Multiple-use lands: public lands that may be used for recreation, grazing, timber harvesting, and mineral extraction

Rangelands: dry, open grasslands used primarily for cattle grazing

Forests: dominated by trees + other woody vegetation

Clear-cutting: removing all, or almost all, the trees within an area

Selective cutting: removing single trees or relatively small numbers of trees from among many in a forest

Ecologically sustainable forestry: removing trees from the forest in ways that do not unduly affect the viability of other, noncommercial tree species

Tree plantations: large areas typically planted with a single rapidly growing tree species

Prescribed burn: when a fire is deliberately set in a forest under controlled conditions

National wildlife refuges: the only federal public lands managed for the primary purpose of protecting wildlife

National wilderness areas: land set aside w/ the intent of preserving large tracts of intact ecosystems / landscapes

Natl Environmental Policy Act (1969): mandates an env. assessment of all projects involving federal money or fed. permits

Environmental impact statement: a document that outlines the scope + purpose of a project, describes the env. context, suggests alt. approaches to the project, and analyzes the env. impact of each alternative

Environmental mitigation plan: states how a project will address its environmental impact

Endangered Species Act (1973): a law designed to protect species from extinction

Suburban: areas surrounding metropolitan centers

Exurban: similar to suburbs, but unconnected to any central city

Urban sprawl: the creation of urbanized areas that spread into rural areas and remove clear boundaries between the two

Urban blight: the degradation of the built and social environments of the city that often accompanies and accelerates migration to the suburbs

Highway Trust Fund: pays for construction/maintenance of roads/highways

Induced demand: when ↑ in supply → ↑ in demand

Zoning: a planning tool developed in the 1920s to separate industry and business from residential neighborhoods and create quieter, safer communities

Multi-use zoning: allows retail and high-density residential development to coexist in the same area

Smart growth: focuses on strategies that encarage the development of sustainable, healthy communities

Stakeholders: people w/ an interest in a particular place or issue

Sense of place: the feeling that an area has a distinct + meaningful character

Transit-oriented development: attempts to focus residential and retail development around stops for public transportation

Infill: development that fills in vacant lots within existing communities, rather than expanding into new land outside the city

Urban growth bandaries: restrictions on development outside a designated area

Eminent domain: the gov't's power to acquire property at fair market value even if the owner does not wish to sell it

Chapter 11 Vocab

Undernutrition: not consuming enough calories to be healthy

Malnourished: when diets lack the correct balance of proteins, carbs, vitamins, and minerals

Food security: the condition in which people have access to sufficient, safe, and nutritious food that meets their dietary needs for an active and healthy life

Food insecurity: not having adequate access to food

Famine: when food insecurity is so extreme that large #s of deaths occur in a given area over a relatively short period

Anemia: Iron deficiency; the most widespread nutritional deficiency in the world

Overnutrition: the ingestion of too many calories + improper foods

Meat: livestock and poultry (2nd largest component of human diet)

Industrial agriculture (agribusiness): applies mechanization + standardization to the production of food

Energy subsidy: the energy input per calorie of food produced

Green Revolution: a shift in farming methods in the 20th century

Economies of scale: the avg. costs of production ↓ as output ↑

Waterlogging: when soil remains under water for prolonged periods, impairing root growth

Salinization: when the small amounts of salts in irrigation water become highly concentrated on the soil surface through evaporation

Organic fertilizers: composed of organic matter from plants / animals

Synthetic (inorganic) fertilizers: produced commercially (ex. nitrogen)

Monocropping: large plantings of a single species / variety

Pesticides: substances that kill / control organisms people consider pests

Insecticides: target insects / other invertebrates that consume crops

Herbicides: target plant species that compete w / crops

Broad-spectrum pesticides: kill many different types of pests

Selective pesticides: focus on a narrower range of organisms

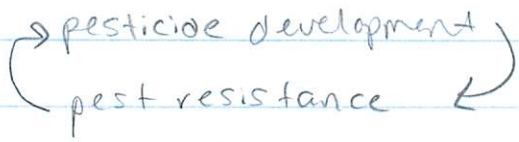
Persistent: pesticides that remain in the environment for a long time

Bioaccumulation: the process by which substances build up over time in the fatty tissues of predators

Nonpersistent: pesticides that break down relatively rapidly

Resistant: Individuals that survive pesticide

Pesticide treadmill: a positive feedback loop:



Conventional agriculture: industrial agriculture

Shifting agriculture: clearing land and using it for only a few years until the soil is depleted of nutrients

Desertification: agriculture → degradation of soil → infertility; Irrigation → salinization → topsoil erosion

Nomadic grazing: moving herds of animals [over large distances] to seasonally productive feeding grounds

Sustainable agriculture: fulfills the need for food/fiber while enhancing the quality of the soil, minimizing the use of nonrenewable resources, and allowing economic viability for the farmer

Intercropping: when 2 or more crop species are planted in the same field at the same time to promote a synergistic interaction between them

Crop rotation: rotating the crop species in a field season to season

Agroforestry: intercropping trees w vegetables

Contour plowing: plowing + harvesting parallel to the topographic contours of the land

No-till agriculture: leaving crop residues in the field between seasons

Integrated pest management: uses a variety of techniques designed to minimize pesticide input

Organic agriculture: production of crops w/o the use of synthetic pesticides or fertilizers

Concentrated animal feeding operations (CAFOs): large indoor or outdoor structures designed for maximum output

Fishery: a commercially harvestable population of fish within a particular ecological region

Fishery collapse: decline of a fish population by ≥ 90%.

Bycatch: unintentional catch of nontarget species

Individual transferable quotas (ITQs): established total allowable catch and distribute/sell quotas for individual fishers / fishing companies

Aquaculture: farming of aquatic organisms

Annual: plants that live only one season + must be replanted every year

Perennial: plants that live for multiple years

Chapter 12 Vocab

Nonrenewable: things that can't be replenished once they run out

Fossil fuels: derived from biological material that was fossilized millions of years ago

Nuclear fuels: derived from radioactive materials that give off energy

Commercial energy sources: bought + sold (coal, oil, etc)

Subsistence energy sources: gathered by individuals for their own immediate needs

Energy carrier: something that can move and deliver energy in a convenient, usable form to end users

Turbine: a large device used to generate electricity

Electrical grid: Connects power plants together + links them w/ end users of electricity

Combined cycle: a power plant in which natural gas combustion turns a gas turbine

Capacity: maximum electrical output

Capacity factor: the fraction of the time a plant is operating

Cogeneration: the use of a fuel to generate electricity and produce heat

Coal: a solid fuel formed primarily from the remains of trees, ferns, and other plant material 280 mill. to 360 mill. years ago

Petroleum: a fluid mixture of hydrocarbons, water, and sulfur that occurs in underground deposits

Crude oil: liquid petroleum removed from the ground

Oil sands: slow-flowing, viscous deposits of bitumen mixed with sand, water, and clay

Bitumen: a degraded type of petroleum that forms when a petroleum deposit is not capped w/ non-porous rock

CTL (coal-to-liquid): converts solid coal to liquid fuel

Energy intensity: energy use per unit of GDP

Hubbert curve: a bell-shaped curve representing oil use

Peak oil: the point at which half the oil supply had been used up

Fission: a nuclear reaction in which a neutron strikes a relatively large atomic nucleus, which splits and releases additional heat energy

Fuel rods: cylindrical tubes that contain nuclear fuels

Control rods: cylindrical devices that can be inserted between the fuel rods to absorb excess neutrons, slowing/stopping the fission reaction

Radioactive waste: after nuclear fuel stops producing useful energy

Becquerel (Bq): measures the rate at which a sample of radioactive material decays

Nuclear fusion: the reaction that powers stars, generating a great deal of heat

Chapter 12 Notes

- Patterns of nonrenewable energy use:
  - Wood until 1875, then coal, then natural gas and oil, then nuclear around 1958 and renewable in the 70s
  - ⚠ Nuclear is actually a nonrenewable energy source

- Over time, energy use has increased overall, with the most notable increases in oil and nuclear in recent years, and also natural gas

- Energy efficiency: $\frac{\text{output}}{\text{input}} \times 100$
  → Most fossil fuels are around 35% effective

- US is a net exporter of natural gas/oil, which is really good for our international relations! Go Trump!
  → Much of our own electricity comes from coal, followed by natural gas
  * Surface Mining Control and Reclamation Act (1977)
    - Expensive, but mitigates adverse environmental impact of coal mining

Chapter 13 Vocab

Nonrenewable: finite; depleted > replenished

Potentially renewable: can be regenerated rapidly as long as we don't consume them too quickly [biomass]

Nondepletable: will not run out

Renewable: can be quickly replenished

Energy conservation: finding ways to use less energy

Tiered rate system: paying higher rates the more energy you use

Peak demand: greatest quantity of energy used at any one time

Passive solar design: uses solar radiation to maintain a comfortable temperature in the building

Thermal inertia: the ability of a material to retain heat or cold

Biofuels: Biomass that is processed into liquid fuels (ethanol, etc.)

Modern carbon: carbon in biomass

Fossil carbon: carbon in fossil fuels

Carbon neutral: an activity that does NOT change atmospheric CO_2 levels

Net removal: removing more timber than is replaced by growth

Ethanol: an alcohol fuel, typically produced from corn

Biodiesel: a sub for regular petroleum derived from algae/plant oils

Flex-fuel vehicles: can run on gasoline or E-85

Hydroelectricity: generated by kinetic energy of moving water

Run-of-the-river: water is retained behind a low dam and runs through a channel before returning to the river

Water impoundment: storing water in a reservoir behind a dam

Tidal energy: comes from water movement driven by tides

Photovoltaic solar cells: capture solar light energy and convert it directly into electricity

Geothermal energy: heat that comes from the natural radioactive decay of deep Earth elements

Grand source heat pumps: take advantage of the high thermal inertia of the grand

Wind energy; energy generated from wind

Wind turbine: converts kinetic energy of moving air into electricity

Fuel cell: electricity generated by continually replenished reaction between two reactants

Electrolysis: electric current applied to water to split it into H and O

Smart grid: an efficient, self-regulating electricity distribution network that accepts any source of electricity and distributes it automatically to end users

Chapter 14 Vocab

Water pollution: the contamination of streams, rivers, lakes, oceans, or grandwater with substances produced through human activities and that negatively affect organisms

Point sources: distinct locations such as a particular factory that pumps its waste into a nearby stream or a sewage treatment plant that discharges its wastewater from a pipe into the ocean

Nonpoint sources: diffuse areas such as an entire farming region that give out pollution

Wastewater; water produced by human activities, including human sewage and gray water

Oxygen-demanding waste: organic matter that enters a body of water and feeds the growth of decomposing microbes

Biochemical oxygen demand (BOD): the amount of oxygen a quantity of water uses over a period of time at a specific temperature

Dead zones: areas w/ too little oxygen to support much life

Eutrophication: decomposition of wastewater → abundance of fertility

Cultural eutrophication: when a body of water experiences an increase in fertility due to anthropogenic inputs of nutrients

Indicator species: an organism that indicates whether or not disease-causing pathogens are likely to be present

Fecal coliform bacteria: a group of generally harmless microorganisms that live in the intestines of human beings and other animals

Septic system: sewage treatment systems for individual houses

Sludge: gross waste heavier than water

Septage: a fairly clear water layer in the middle

Leach field: combination of pipes and lawn

Manure lagoons: large, human-made ponds lined w/ rubber to prevent the manure from leaking into the groundwater

Acid deposition: when acids in the atmosphere return to the earth's surface

Polychlorinated biphenyls (PCBs): compounds used in manufacturing plastics and insulating electrical transformers until 1979, now causing many enviro. problems

Polybrominated diphenyl ethers (PBDEs): commonly used flame retardants that have been linked to brain damage

Thermal pollution: when human activities cause a substantial change in the temperature of water

Thermal shock: when a dramatic change in water temperature killing many habitant species

Maximum contaminant levels (MCL): the EPA-mandated max concentrations of 77 different substances

Chapter 15 Vocab

Air pollution: the intro of chemicals, particulate matter, or microorganisms into the atmosphere at concentrations high enough to harm plants, animals, and materials, or to alter ecosystems

Particulate matter (PM), particulates, particles: solid or liquid particles suspended in air

Photochemical oxidants: a class of air pollutants formed as a result of sunlight acting on compounds such as nitrogen oxides and sulfur dioxide

Smog: a mixture of oxidants and particulate matter that scatters light

Photochemical smog, Los Angeles-type smog, brown smog: dominated by oxidants like ozone

Sulfurous smog, London-type smog, gray smog: dominated by SO_2 and sulfate compounds

Volatile organic compounds (VOCs): organic compounds that become vapors at typical atmospheric temperatures

Primary pollutants: polluting compounds that come directly out of the smokestack, exhaust pipe, or natural emission source

Secondary pollutants: primary pollutants that have undergone transformation in the presence of sunlight, water, oxygen, or other compounds

Thermal inversion: when a relatively warm layer of air at mid-altitude covers a layer of cold, dense air below

Inversion layer: a warm layer that traps emissions

Chlorofluorocarbons (CFCs): a class of anthropogenic compounds used in refrigeration and propellants

Asbestos: a long, thin, fibrous silicate material w/ insulating properties

Sick building syndrome: when reduced energy use leads to the buildup of toxic compounds and pollutants in an airtight space

Chapter 16 Vocab

Waste: nonuseful or unconsumed outputs

Municipal solid waste (MSW): refuse collected by municipalities from households, small businesses, and institutions like schools, prisons, and hospitals

Waste stream: the flow of solid waste that is recycled, incinerated, put in a landfill, or otherwise disposed of

Reduce, Reuse, Recycle (three Rs): a solid waste management approach

Source reduction: reduces use of materials in the early stages of manufacturing to prevent it from becoming MSW

Reuse: using something multiple times, allowing it to cycle through a system longer before becoming an output

Recycling: the process by which materials destined to become MSW are collected and converted into raw materials that are then used to produce new objects

Closed-loop recycling: the recycling of a product into the same product

Open-loop recycling: one product is recycled into another

Compost: organic matter that has decomposed under controlled conditions to produce an organic-rich material that enhances soil structure, cation exchange capacity, and fertility

Sanitary landfills: repositories (engineered ground facilities) designed to hold MSW w/ as little contamination of the surrounding environment as possible

Leachate: the water that leaches through the solid waste and removes various chemical compounds it contacts

Tipping fee: a fee that covers the construction of a landfill

Siting: designation of a location [for a landfill]

Incineration: the process of burning waste materials to reduce their volume and mass + sometimes generate electricity/heat

Ash: residual nonorganic material that doesn't combust during incineration

Bottom ash: residue collected underneath the furnace

Fly ash: residue collected beyond the furnace

Waste-to-energy system: when heat generated by incineration is used rather than released

Hazardous waste: liquid, solid, or gaseous waste material that is harmful to humans or ecosystems

Superfund act (CERCLA): imposes tax on chemical + petroleum industries, funds cleanup of nonoperating hazardous waste sites, authorizes fed. govt to respond directly to to release of substances that threaten human health or enviro.

Brownfields: contaminated industrial or commercial sites that may require env. cleanup before being redeveloped

Life-cycle analysis: a systems tool that looks at the materials used and released during the lifetime of a product

Integrated Waste Management: employs several waste reduction, management, and disposal strategies in order to reduce env. impact of MSW

Chapter 17 Vocab

Disease: any impaired function of the body w/ a characteristic set of symptoms

Infectious diseases: caused by infectious agents (pathogens)

Chronic diseases: slowly impair the functioning of a person's body

Acute diseases: rapidly impair the functioning of a person's body

Epidemic: when a pathogen causes a rapid increase in disease

Pandemic: when an epidemic occurs over a large geographic region

Plague: a disease caused by a bacterium (Yersinia pestis) carried by fleas

Malaria: caused by an infection from a protist in the genus Plasmodium

Tuberculosis: a highly contagious bacterial disease affecting the lungs

Emergent infectious diseases: infectious diseases that were previously not described or have not been common for at least the prior 20 years

Acquired Immune Deficiency Syndrome (AIDS):

Human Immunodeficiency Virus (HIV):

Ebola hemorrhagic fever: disease caused by Ebola virus

Mad cow disease: a pathogen slowly damages a cow's nervous system

Prions: small, beneficial proteins that sometimes turn deadly

Bird flu: avian influenza, caused by H1N1 virus

West Nile virus. transmitted among birds by mosquitoes

Neurotoxins: chemicals that disrupt the nervous systems of animals

Carcinogens: chemicals that cause cancer

Mutagens: cause damage to the genetic material of a cell

Teratogens: chemicals that interfere with the normal development of embryos or fetuses

Allergens: chemicals that cause allergic reactions

Endocrine disruptors: chemicals that interfere w/ the normal functioning of hormones in an animal's body

Dose-response studies: exposing animals/plants to different amounts of a chemical and then observe a variety of possible responses

Acute studies: short dose-response studies

LD50: the lethal dose that kills 50% of the individuals