Unit 1 Review

Chapters 1, 2, 20

Chapter 1

- Chapter 1 is the intro Chapter.
  - Duh, I know, but there is a lot of content introduced that later chapters build on.
  - Arguably the **most important** Chapter in the book.
  - Helps show how all Units/Chapters are connected.
  - **Very important** to have a solid understanding of this Chapter and these introductory principles/ definitions.

Chapter 1 Highlights

- **Environmental Science**
  - *Interdisciplinary* study of how humans interact with their living and nonliving environment.
  - Combines *natural sciences* (physics, biology, chemistry, geology), *social sciences* (political science, economics, geography), and
- **Natural service (aka ecosystem service)**
  - Human benefit provided by an ecosystem process. (***free of charge*** and ***ongoing***)
    - Formation of soil, photosynthesis, cycling of nutrients, cleansing of water, crop pollination, decomposition, etc.
- **Natural capital**
  - World's stock of natural resources. These natural resources carryout and provide the natural services above.
    - Air, water, all living organisms, geological processes, etc.

Chapter 1 Highlights

- **Biotic and abiotic factors**
  - *Biotic*: living and once living components – plants, animals, and microbes. Includes dead organisms and waste of organisms.
  - *Abiotic*: consists of nonliving components such as water, air, nutrients, rocks, heat, and solar energy.
- **Ecology**
  - Branch of science studying ***relationships and interactions*** between organisms and their environment.

Chapter 1 Highlights

- **Renewable and nonrenewable resources**
  - Renewable: resources that are perpetually available (solar) or ***replenished*** on a *human timescale* (hours to hundreds of years).
    - Important – Must be used at or below sustainable yield or else they will become depleted. ***Sustainable yield*** is maximum use without reducing supply.
  - Nonrenewable: resources that are of ***fixed quantity*** on a human timescale. *Note*, these resources will replenish on a *geologic timescale* (millions of years).

Chapter 1 Highlights

- **Tragedy of the Commons (Garrett Hardin)**
  - ***Private gain from use of public resource*** – unregulated use of *open-access resource* will lead to environmental degradation.
  - Develops from *rational* thought - "If I do not use this resource, someone else will. The little bit that I use or pollute is not enough to matter, and anyway, it's a renewable resource."
    - *Cumulative impact* of this thought process exhausts or ruins resource.
  - Solutions: 1. Establish laws and regulations reducing use of resource (permit system)

    2. Convert open-access resource to private or government ownership (State and NPS)
  - Common examples: ***Atmosphere, groundwater supplies, fishing in the ocean, traffic congestion, tropical rainforests, Hetch Hetchy***
- **Ecological footprint**
  - Amount of land, water, resources, and ecosystem services to support population
  - Often focused on carbon, i.e. ***carbon footprint*** – amount of carbon dioxide released to directly or indirectly support human activities.

Chapter 1 Highlights

- **Scientific Method and Experimental Design**
  1. **Observation –** senses, curiosity
  2. **Question –** testable investigation
  3. **Hypothesis –** If, then statement predicting relationship
  4. **Test hypothesis –** Collect data
  5. **Analyze results –** Data analysis
  6. **Conclusion –** accept or reject hypothesis (back to step 3)
  - If designing an experiment, be sure to state hypothesis as "If, then" statement that will identify a relationship between variables.
    - **Ex:** If the concentration of chemical X increases, then the size of plant Y will decrease.
  - *Independent variable*: what you are manipulating, what you dictate.
  - *Dependent variable*: what is responding or results from the experiment.
  - *Control*: what occurs without any interference, baseline to compare experiment data to.
  - *Constant* – variables kept consistent and unchanged to isolate independent variable.
- **Scientific Theory**
  - A ***well-tested and widely accepted*** scientific hypothesis or a group of related hypotheses. Not just a "theory".
- **Scientific Law**
  - A ***well-tested and widely accepted*** description of what we find happening over and over again in the same way in nature.

Chapter 1 Highlights (Old Book)

- **Point vs nonpoint source pollution**
  - Point: single, identifiable – ***"you can point to it"***
    - **Ex:** smokestack, drainpipe – think *single, concentrated and isolated*
    - **Easy and cheap** to regulate, control, and prevent
  - Nonpoint: dispersed and difficult to identify
    - **Ex:** all forms of erosion, all forms of runoff – think *dispersed, scattered, spread out*
    - **Difficult and expensive** to regulate, control, and prevent
- **5 basic causes of environmental problems**
  - Population growth
  - Unsustainable resource use
  - Poverty
  - Excluding environmental costs from market prices
  - Trying to manage nature without knowing enough about it

ADVICE: Be able to write a thorough FRQ on each of these – major themes and plenty of Multiple-Unit Connections

Chapter 2 Highlights

- **Matter**
  - *Element, molecules, compounds, atomic number, mass number, isotopes, radioactive decay, half-life, covalent bond, hydrogen bond, ionic bond, polar molecule*
    - ***Half-life***: time required for one-half (50%) of radioactive sample to decay.
- **Water**
  - *Unique properties of water*: surface tension, capillary action, high boiling point, expansion when freezing and heating, water as a solvent (dissolves substances).
- **Acids and Bases**
  - **pH** indicates the relative strength of acids and bases in a substance.
    - Scale ranges from 0 to 14 – **LOW** is *acidic*, **HIGH** is *basic*
    - *Logarithmic scale*: each number on the scale changes by a factor of 10

ADVICE: Be familiar with some pH examples (page 39)

Chapter 2 Highlights

- **System**
  - A set of components that function and interact in some regular way.
    - Respond to change through *feedback loops*:
      - ***Positive feedback loop***: causes a system to change further in the ***same*** direction. Accelerates or amplifies what we already observe.
        - » **Ex**: Interest in bank account, melting of polar ice caps
      - ***Negative feedback loop***: causes a system to change in the ***opposite*** direction from which it is moving. Regulates the system, slows down or reverses the trend.
        - » **Ex**: thermostat, homeostasis

    ADVICE: Look at the beginning and the end to determine positive or negative, ignore the other details. Temperature rose, blah, blah, blah, blah, temperature rose = positive feedback loop.
- **Synergistic interaction or synergy**
  - When two or more processes interact so that the combined effect is greater than the sum of their separate effects.
  - Variables can have complicated effects when combined together.

Chapter 2 Highlights

- **High-quality and low-quality matter/energy**
  - *High-quality*: highly concentrated, great potential to benefit us
  - *Low-quality*: not highly concentrated, dispersed, little potential to benefit us
- **Physical and chemical changes**
  - Matter can undergo a physical or chemical change, but no atoms are created or destroyed (***law of conservation of matter***)
    - *Physical change*: the arrangement of its atoms or ions within molecules does not change.
    - *Chemical change*: there is a change in the arrangement of atoms or ions within molecules.
- **Kinetic and potential energy**
  - *Kinetic energy*: moving energy, has mass and velocity. **Ex**: wind, electricity, flowing water, heat, electromagnetic radiation
  - *Potential energy*: stored and potentially available for use. **Ex**: unlit match, water behind dam, gasoline, glucose, carbohydrates
    - Energy can change from one form to another

Chapter 2 Highlights

- **Thermodynamics**
  - The study of energy transformations
  - ***First law of thermodynamics***: When energy is converted from one form to another in a physical or chemical change, ***no energy is created or destroyed***.
    - Also known as the *law of conservation of energy*.
    - Energy input = energy output
  - ***Second law of thermodynamics***: When energy changes from one form to another, we always end up with lower-quality or less usable energy than we started with. (*not 100% efficient*)
    - *Energy always goes from a more useful to a less useful form*, usually taking the form of **heat** at low temperature.
    - Another way of stating is that **entropy** (disorder) always increases.
    - Governs energy efficiency in all forms.

Chapter 20 Highlights

- **Economics and sustainability**
  - **GDP** (*Gross Domestic Product*)**:** value of all goods and services produced in a year.
    - Often used to compare nations, but inaccurately measures well-being of country.
    - Ignores environmental impacts and pollution (*externalities*).
  - **GPI** (*Genuine Progress Indicator*)**:** economic measure that includes resource depletion, pollution, and social statistics such as education, health, and income distribution.
    - More accurately portrays well-being of country.
  - **Government action**
    - **encourage** (*incentive-based approach* – tax breaks, subsidies, low cost loans, etc.)
    - **discourage** (*command-control approach* – fines, taxes, tariffs, etc.)
- **Precautionary Principle**
  - Reasonable evidence of significant harm from hazard, take action to prevent or reduce risk
    - Pollution prevention and risk avoidance (*at the cost of potential profits*)
  - *Risk analysis* (cost/benefit analysis)
    - Estimates risk with whatever statistics available.
    - Often uses inaccurate estimates or attempts to assign economic value to systems difficult to quantify.
      - How much is clean air worth? Peace of mind?

Unit 2 Review

Chapters 3, 4, 5

Chapter 3 Highlights

- **Organization of matter**
  - *Biosphere*: Ecosphere, Earth's air, water and soil where life is found.
  - *Ecosystem*: community of different species interacting with one another and with their nonliving environment
  - *Community*: populations of different species living in a particular place
  - *Population*: group of individuals in a particular place
  - *Organism*: an individual living being
- **Earth's four major components**
  - *Atmosphere*: thin spherical envelope of gases surrounding Earth's surface
  - *Hydrosphere*: all of the water on or near Earth's surface.
  - *Geosphere*: Earth's core, mantle, and thin outer crust.
  - *Biosphere*: Everywhere life exists – bottom of ocean to about 9km up.
    - **Ecology** studies the interactions in these spheres.

Chapter 3 Highlights

- **Biotic and abiotic factors**
  - *Biotic*: living and once living components – plants, animals, and microbes. Includes dead organisms and waste of organisms.
  - *Abiotic*: consists of nonliving components such as water, air, nutrients, rocks, heat, and solar energy.
- **Limiting factor (or nutrient)**
  - Important *abiotic factor* that acts to ***regulate population*** growth more than any other.
    - Too much or too little of any abiotic factor can limit or prevent growth of a population, even if all other factors are at or near the optimal range of tolerance.

Chapter 3 Highlights

- **Trophic level and ecological roles**
  - *Trophic level*: feeding level essentially, transfer of energy from one level to another.
  - *Producers*: also called **autotrophs**, producers make the nutrients they need.
    - Green plants (land), algae and aquatic plants (near shorelines), and phytoplankton (open ocean)
    - Most producers carry out *photosynthesis* to convert ***sunlight*** into stored ***glucose*** energy.
    - Specialized bacteria can carry out *chemosynthesis* – conversion of ***hydrogen sulfide*** into stored energy, *no solar energy required*.
  - *Consumers*: also called **heterotrophs**, consumers cannot produce the nutrients they need and must obtain their nutrients by feeding on other organisms.
      - Directly dependent on producers.
    - *Primary consumers*: herbivores (plant eaters), animals that eat producers. (rabbits, deer)
    - *Secondary consumers*: carnivores (meat eaters), animals that eat herbivores. (spiders, birds)
    - *Tertiary and higher-level consumers*: carnivores, animals that eat other carnivores. (tigers, hawks)
    - *Omnivores*: play dual roles by feeding on both plants and animals. (foxes, humans)
    - *Decomposers*: consumers that release nutrients from the dead bodies of plants and animals. (bacteria)
    - *Detritivores*: feed on the wastes or dead bodies of organisms (earthworms, vultures)

Chapter 3 Highlights

- **Energy flow through trophic levels**
  - *Food chain*: sequence of organisms, each serving as source of energy for the next. (*photosynthesis, feeding, decomposition*)
  - *Food web*: complex network of interconnected food chains.
  - *Ecological efficiency*: percentage of usable chemical energy transferred as biomass from one trophic level to the next.
    - Ranges from 2-40%, but 10% is typical - dictated by ***second law of thermodynamics*** (10% passes on, 90% lost as heat).
    - Explains why food chains rarely have more than four or five trophic levels.
    - Explains why pyramid of energy is always shaped like a pyramid.
- **Net Primary Productivity (NPP)**
  - *NPP = Gross Primary Productivity – Respiration*
  - Measures how fast producers can provide the chemical energy stored in their tissue that is potentially available to other organisms (consumers).
    - **Swamps/marshes**, **tropical rain forests**, and **estuaries** have highest NPP.

Chapter 3 Highlights

- **Biogeochemical cycles (CHONPS)**
  - Life-earth-chemical cycles or *nutrient cycles*
  - Driven directly or indirectly by incoming *solar energy* and *gravity*.
  - ***Reservoirs*** are temporary storage sites where nutrients may accumulate in one portion of the cycle and remain there for different lengths of time.
    - Atmosphere, oceans, underground deposits are common examples.

  ADVICE: Review diagrams of all biogeochemical cycles (pg 79)
- **Hydrologic cycle (water cycle)**
  - *Precipitation, infiltration, percolation, surface runoff, evaporation, transpiration, condensation*
  - Cycle of natural renewal of water quality (ecosystem service)
  - **0.024%** of water is available as accessible liquid freshwater

Chapter 3 Highlights

- **Carbon Cycle**
  - Makes up only 0.038% of the atmosphere.
    - Key component of nature's thermostat.
  - *Photosynthesis* and *respiration* cycles carbon in the biosphere.
  - *Fossil fuels*: coal, oil, and natural gas – buried deposits of dead plant matter and bacteria subjected to high pressure and heat.
    - Fossil fuels are a reservoir, Earth's largest store of carbon.

  ADVICE: Probably the most tested biogeochemical cycle. Make sure to understand thoroughly.
- **Nitrogen Cycle**
  - 78% of atmosphere is nitrogen, major reservoir.
  - Necessary for complex proteins, vitamins, and DNA.
  - Chemically unreactive, needs to be fixed by nitrogen-fixing bacteria.
    - Nitrogen fixation: $N_2 \rightarrow NH_3$ (ammonia), $NH_3 \rightarrow NH_4^+$ (ammonium ions) – pulled from atmosphere (*cyanobacteria*)
    - Assimilation: taken up by plants as nitrite, nitrate, ammonia or ammonium
    - Ammonification: complex proteins $\rightarrow NH_3$ or NH_4^+
    - Nitrification: $NH_3 \rightarrow NO_2^-$ (nitrite ions), $NH_4^+ \rightarrow NO_3^-$ (nitrate ions)
    - Denitrification: $NO_3^- \rightarrow N_2$ or N_2O – returned to atmosphere

Chapter 3 Highlights

- **Phosphorus cycle**
  - *Does not include the atmosphere*, only cycles through geosphere, biosphere, hydrosphere.
    - Makes this a very slow cycle.
  - Major reservoir is phosphate ions (PO_4^{3-}) in *rock formations* and *ocean sediments*.
  - Component of nucleic acids and major component of bones and teeth.
  - Very often ***limiting factor*** for plant growth – key component in *inorganic fertilizers*.
- **Sulfur cycle**
  - Most sulfur is buried in *rocks, minerals, and in ocean sediments*.
  - Sulfur is essential component of many proteins.
  - H_2S is released by ***active volcanoes*** and ***decomposing organic matter.***
  - SO_2 also comes from volcanoes and can form ***sulfuric acid*** (H_2SO_4) which leads to *acid deposition*.
  - *Burning coal and oil* adds SO_2 to the atmosphere.

Chapter 3 Highlights

- **Responses to Disturbances**
  - Event resulting in changes in population or community.
  - *Resistance*: measure of how much a disturbance affects flows of energy and matter in ecosystem.
  - *Resilience*: the rate at which an ecosystem returns to its original state.
  - *Restoration ecology*: study and implementation of restoring damaged ecosystems.
  - ***Intermediate disturbance hypothesis***: ecosystems experiencing intermediate levels of disturbance are **more diverse** than those with high or low levels of disturbance.
    - *Goldilocks – "not too hard, not too soft – just right"*
    - **High biodiversity** leads to **high resistance** and **high resilience**.

Chapter 4 Highlights

- **Meteorology and climate basics**
  - **Atmosphere** - **78%** Nitrogen, **21%** Oxygen, **< 1%** everything else
  - Layers from bottom to top: *Troposphere, Stratosphere, Mesosphere, Thermosphere, Exosphere* (**TSMTE**)
  - ***weather*** is current atmospheric conditions, ***climate*** is average conditions over long-term.
    - *Temperature* and *precipitation* are the two most important factors determining climate.
  - Spherical shape of Earth: responsible for *unequal distribution of heat*, ocean and wind currents help distribute.
  - *Albedo:* percentage of incoming sunlight reflected from a surface.
  - Tilted axis of Earth: responsible for **seasons**.

ADVICE: Know approximate ranges of layers and temperature trends (pg 106) and some albedo examples (pg 108).

Chapter 4 Highlights

- **Meteorology and climate basics**
  - *Convection*: circular air movement initiated by unequal heating of Earth.
    - Warm air rises and experiences lower pressure, spreads out and cools (*adiabatic cooling*).
    - When this air cools and begins to sink it experiences high pressure, condenses and warms (*adiabatic heating*).
    - *Hadley cells, ITCZ, Polar cells, Ferrell cells*
  - *Coriolis effect*: **apparent** deflection of object's path due to rotation of Earth. (air is not attached to Earth, we are – appears that wind is deflected)
    - *Prevailing winds* – normal behavior of wind in a region
      - *Trade winds* – east to west across equator
      - *Westerlies* – west to east across United States
    - *Rain Shadow* – Dry conditions found on **leeward** (protected side) of mountain range, often heavy precipitation on **windward** side.

Chapter 4 Highlights

- **Oceanography**
  - Thermohaline circulation
    - Ocean circulation pattern crucial for moving heat and nutrients around the world.
    - Driven by dense, salty water sinking in North Atlantic.
  - El Nino Southern Oscillation (**ENSO**)
    - regional shift in wind causing widespread weather changes, more wet/tropical weather for most of USA due to warm water off Peruvian coast.
      - Caused by weakening of trade winds, every 3-7 years.
- ***Biome***: regions characterized by similar climate, soil, plants, and animals.
    - Most important factor determining where a biome is found is *latitude* (←→ E/W, measure how N or S of the equator you are, directly determines amount of solar radiation received).

Chapter 4 Highlights

- **Biomes (pg 123, Study Book pg 29 & 44-46)**
  - *Deserts*: evaporation > precipitation, succulent plants, deep/wide root systems, adaptations focused on water conservation, low NPP.
  - *Tundra*: permafrost, short growing season, cold and windy, dominated by small producers, low NPP.
  - *Grasslands*: 4 seasons, fire dependent, thick/productive soil, 98% destroyed in US (agriculture), savanna, prairie, steppes, grazing animals.
  - *Chaparral*: Mediterranean climate, fire dependent, humans like to live here (Southern California, Southern Europe).
  - *Tropical Rainforest*: no seasons, evergreen broadleaf, strongest sunlight in emergent layer, nutrient-poor soil, fast decomposition, nutrients held in biomass, slash & burn agriculture, high biodiversity, high NPP.
  - *Deciduous*: 4 seasons, loses leaves to conserve energy for winter, most disturbed biome in the world, thick/productive soil, slow decomposition.
  - *Coniferous*: aka taiga or boreal, cone-bearing, evergreen trees, slow decomposition, acidic soil.

  ADVICE: No need to memorize every detail, just be familiar with what is unique, what sets the biome apart from the others.

Chapter 4 Highlights

- **Aquatic Ecosystems**
  - *Phytoplankton*: responsible for roughly 60% of atmospheric oxygen, reason for dissolved oxygen
  - *Nekton*: swimmers, capable of open-water travel
  - *Benthos*: bottom-dwellers
  - *Saltwater life zones*: intertidal, photic, aphotic, abyssal or benthic (**IPPA/B**)
  - *Freshwater life zones*: littoral, limnetic, profundal, benthic (**LLPB**)
    - *Eutrophic* (high in nutrients) & *oligotrophic* (low in nutrients) lakes.
  - *Rivers*: Source zone, transition zone, floodplain zone
  - *Estuaries/wetlands*: high NPP, high biodiversity, numerous abiotic factors, reduce flooding, treat water, nursery and stops for migratory birds, disturbed for marinas, agriculture, and urban development.
    - Colorado Lagoon is an example.

Chapter 5 Highlights

- **Biological Diversity or biodiversity**
  - *Species richness* (number of species) vs *species evenness* (proportions of species)
    - Biodiversity is a balance between *speciation* (+) and *extinction* (-).
  - *Genotype* (set of genes of individual) vs *phenotype* (traits expressed by individual)
  - New species created through *evolution* and ***natural selection*** is the method of selecting which survive.
    - ***"survival of the fittest"*** is misleading because fitness refers to biological fitness (*reproductive success*), not physical performance.
  - *Mutations* are natural and random and lead to genetic diversity (large gene pool) which is required for *adaptation* and evolution to occur.
    - **Five random processes drive evolution**: *mutation, gene flow, genetic drift, bottleneck effect, founder effect*
    - *Geographical isolation*: two populations that are split by a *physical barrier* may develop into separate species (**allopatric speciation**).
    - *Reproductive isolation*: two populations can no longer interbreed and produce viable offspring (**sympatric speciation**).
    - *Fundamental niche* (can survive) vs *realized niche* (where actually live)
    - *Generalist* (wide range of abiotic conditions) vs *specialist* (needs specific conditions)
    - 5 great mass extinctions in Earth's history, humans are currently causing the 6th.

ADVICE: Brush up on terminology, vocab driven Chapter

Unit 3 Review

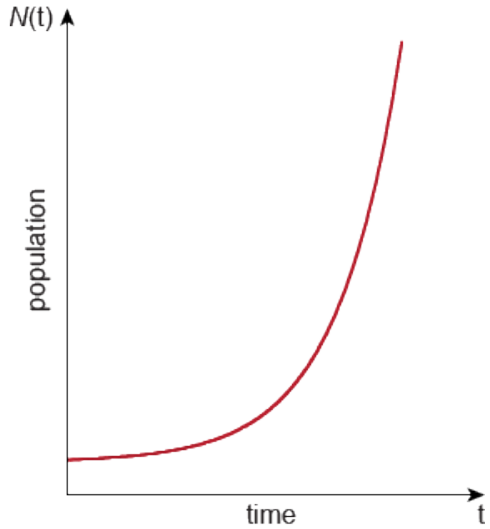
Chapters 6, 7

Chapter 6 Highlights

- **Population and Community Ecology**
  - *Population density* = population / area
  - *Density-dependent factor*: influences probability of survival and reproduction, but **depends on the size** of the population.
    - food, reproductive mates, disease, water
    - *Limiting resource*: resource a population cannot live without and occurs in quantities lower than required by the population to grow.
    - *Carrying capacity* (*K*): theoretical limit of how many individuals the environment can sustain.
  - *Density-independent factor*: factor that has the **same effect** on probability of survival and reproduction at **any population size.**
    - Natural disasters are great examples: floods, drought, fires, etc

Chapter 6 Highlights

- **Exponential Growth**
  - When quantity increases by a ***fixed percentage*** of the whole
  - When graphed shows a ***J-shaped curve***
  - Any population left unrestricted will experience exponential growth
  - 4, 8, 16, 32, 64, 128… → increasing by 100%
  - 1, 2, 3, 4, 5, 6, 7 → arithmetic increase (percent changes each time)
  - ***Rule of 70*** can be used to determine ***doubling time***



$$T_d = 70 / \%\ \text{growth}$$

ADVICE: Compute doubling time *ANY* time you have % growth

Chapter 6 Highlights

- **Population growth**
  - *Carrying capacity*: maximum number of individuals environment can support without damage.
    - Balance of **biotic potential** and **environmental resistance**.
      - *Density-dependent* and *density-independent* factors
  - Populations without restrictions grow at exponential growth (***J-curve***) – **Rule of 70** to find to **doubling time**.
    - restrictions cause slowing near carrying capacity (***S-curve*** or logistic growth) – example of *negative feedback loop*.
- **r-selected and K-selected (pg 201)**
  - ***r-selected***: high rate of growth, many offspring, no parenting, most offspring die off, opportunists/generalists, J-curve growth, early-loss species.
  - ***K-selected***: slow growth rate, few offspring, diligent parenting, specialists, S-curve growth, late-loss species.

Chapter 6 Highlights

- **Symbiosis**
  - How species interact: *mutualism, commensalism, intraspecific/ interspecific competition, parasitism*
    - *Predator/prey* techniques – food chain is easiest example of interspecific competition.
    - *Keystone species*: integral part of ecosystem, numbers do not reflect importance – ecosystem services performed.
    - **ADVICE: Know examples of symbiosis and keystone species (pg 206-211)**
- **Succession**
  - *Primary*: no existing biomass, life, ecosystem (all land starts as primary succession). Ex: cooled lava, glacier receding
  - *Secondary*: **soil is present**, has already gone through primary succession, structure of ecosystem already in place. Ex: fire, abandoned field.
- **Theory of island biogeography**
  - Higher immigration rates on close islands, less on far.
  - Higher extinction rates on small islands, less on large.
  - Combined, **large/close** islands expected to have higher biodiversity than small/far islands.

Chapter 7 Highlights

- **Human population**
  - **BIDE**: (*Births* + *Immigrants*) – (*Deaths* + *Emigrants*) = population growth (**Rule of 70** for doubling time)
  - Population increased because death rate has declined due to medicine and health care improvements.
  - *Crude birth rate*: births per 1000 (**CBR**).
  - *Crude death rate*: deaths per 1000 (**CDR**).
  - *Total fertility rate*: average number of children a woman will have in her reproductive years, 15-45 (**TFR**).
  - *Replacement level fertility*: number of children a woman needs to have to replace parents, **2.1 global average**.
    - Population decrease if TFR < Replacement level fertility.
  - **Age structure graphs**
    - Show percent of population at each age grouping, split by male and female.
    - Wide base means rapid future growth, narrow base indicates slow or negative population growth (**ZPG**)
- **Demographic transition (pg 238)**
  - Population change as a country becomes industrialized
    - ***Preindustrial***
    - ***Transitional***
    - ***Industrial***
    - ***Postindustrial***
  - Death rates fall first, population rises, birth rates start to fall, population levels off.

Chapter 7 Highlights

- **Developing vs Developed countries**
  - Be very familiar with differences between these
    - Population statistics (TFR, Infant Mortality, Life Expectancy, Demographic Transition stage, etc.)
    - Economies (GDP, per capita income)
    - Levels of education
    - Levels of technology
    - Sources of energy
    - Worldviews
  - Know several examples of each
    - *Developing*, or Less Developed, or 3rd World – Kenya, Chile, Honduras, Pakistan, Ethiopia, etc. (***nearly every country in Latin America, South America, Africa, most of Asia***)
    - *Developed*, or More Developed, or 1st World – USA, Canada, Japan, Germany, Spain, Australia, etc. (***Europe & NA***)
    - *Moderately Developed*, or 2nd World – China, Brazil, India, Mexico, South Africa, Turkey, Indonesia

Chapter 7 Highlights

- **Affluenza (affluence + influenza)**
  - Cultural addiction to consumption & economic growth.
  - Emotional health depends on materialistic consumption, placing inordinate value on "keeping up with the Joneses".
    - Afflicts wealthy developed countries – "planned obsolescence"
- **I=PAT**
  - Human Impact = Population x Affluence x Technology
    - Simplified expression demonstrating human impact is connected to population, resource use and consumption, and available technology to obtain and use resources.
- **5 basic causes of environmental problems**
  - Population growth
  - Unsustainable resource use
  - Poverty
  - Excluding environmental costs from market prices
  - Trying to manage nature without knowing enough about it

ADVICE: Be able to write a thorough FRQ on each of these – major themes and plenty of Multiple-Unit Connections