

GEOG 1125 EXAM #2 REVIEW

Material Cycles

- basics of each cycle: water, carbon, nitrogen, phosphorus, sulfur
 - **Water:**
 - Steps - Evaporation, Condensation, Precipitation, Run-Off
 - caused by sunlight and gravity
 - causes soil erosion & moves weathered rock fragment
 - transports nutrients throughout the environment
 - **Carbon:**
 - flow of carbon through the atmosphere, hydrosphere, lithosphere, and biosphere
 - controls earth temperatures, one of the greenhouse gases
 - key element in formation of organic molecules and compounds
 - stored as fossil fuels
 - **Nitrogen**
 - Steps: nitrogen fixation, nitrification, ammonification, denitrification
 - Nitrogen fixation - bacteria converts nitrogen gas (N_2) into ammonia (NH_3) that plants can use.
 - Nitrification - ammonia in the soil is turned into nitrite ions by aerobic bacteria & nitrate ions
 - Ammonification - converts nitrogen locked in organic compounds in N_2 gas
 - Denitrification - converts ammonia and ammonium ions back into nitrite & nitrate
 - adds nitric oxide (NO) to the air and makes acid rain
 - **Phosphorus:**
 - cycles through water, lithosphere, and living organisms and is commonly found as phosphate salts.
 - must be mined and processed. used in clothes detergents and household products. if released in that form they become a pollutant.
 - **Sulfur:**
 - It is added as hydrogen sulfide (H_2S) from active volcanoes & the decay of organic matter by anaerobic bacteria. It is also in the environment as sulfate salts (SO_4^{2-}) from sea spray.
 - humans burning fossil fuels and factory processes releases sulfur compounds into the atmosphere.

Ecological Concepts

- definition of terms:
 - **Environment** encompasses the sum total or aggregate of the conditions, surrounding things, or influences of a given organism(s). All the things, both biotic and abiotic, which interact with or influence that organism(s).
 - **Ecosystem** refers to a subset of the total Earth environment and encompasses all the interactions within that subset.
 - **Habitat** usually refers to the subset of an ecosystem in which that organism/species lives. Sometimes interchanged with ecosystem.
 - **Evolution** or biological evolution is the change in a population's genetic makeup, or gene pool, through successive generations by the processes of mutation, natural selection, genetic drift, etc.
 - **Macroevolution** is the long-term, large-scale changes that lead to new species and taxa (speciation), and the loss of other species.

- **Microevolution** refers to the small genetic changes that occur in a population/species which lead to new varieties within the species. It is the development of genetic variability through mutations, the random changes of the DNA in a cell, brought about by exposure to external agents (radiation, chemicals, etc.), random mistakes during DNA replication, etc.
 - **Mutations** are random & unpredictable and the only source of totally new genetic raw material (without human help), and relatively rare events.
 - **Natural selection** is a process by which a particular beneficial gene, or set of genes, is reproduced in succeeding generations more than other genes due to influences within the environment which make those genes and its resulting phenotype more beneficial. This leads to a population of organisms with a greater proportion of individuals better adapted to certain environmental conditions.
 - **Adaptation** or adaptive trait refers to any genetically controlled structural, physiological, or behavioral characteristic that helps an organism survive & reproduce under a given set of environmental conditions.
 - **Speciation** is the process of forming new species from a previous species as a result of divergent natural selection in response to changes in environmental conditions. The new population(s) cannot interbreed with the original population(s)/species because of geographical, physiological, anatomical, or behavioral factors.
 - **Reproductive isolation** results from changes/mutations causing one portion of a species no longer being able to reproduce with other members of the species. This may occur within the same geographical area.
- types of species:
 - **Generalists** are those species with a broad ecological niche
 - **Specialists** are those species with a narrow ecological niche
 - **Native species** are those species that normally live & thrive in the ecosystem within which they evolved
 - **Indicator species** are those species which serve as an "early warning" that a habitat or ecosystem may be undergoing detrimental change.
 - **Keystone species** are those species which play roles affecting many other species within an ecosystem. These are often top-level predators and plant pollinators.
 - types of extinction:
 - **Background extinction** is the normal extinction of a few species as a result of changes in local environmental conditions.
 - **Mass extinction** is a catastrophic, widespread extinction event in which organisms at various taxa levels are wiped out over a geologically short time span.
 - **Mass depletion** is a widespread, often global, period during which extinction rates are higher than normal but not high enough to classify as a mass extinction.
 - types of species interactions:
 - ** **Types:** interspecific competition, predation, parasitism, mutualism, commensalism, amensalism
 - **Interspecific Competition** occurs when members of two or more species try to use the same resource in an ecosystem.
 - **Predation** is the situation in which an organism of one species (the predator) captures, kills, & feeds on parts or all of an organism of another species (the prey).
 - **Parasitism** is an interaction between species in which one organism (the parasite) preys on another organism (the host) by living on or in the host, but where the host is usually not killed.

- **Mutualism** is a species interaction in which the presence of one species is often essential to the survival of another species, and usually both species benefit from the interaction.
- **Commensalism** is an interaction between organisms of different species in which one organism benefits & the other is neither helped nor harmed.
- **Amensalism** is a process by which one species tries to exclude other species from an area by the use of chemicals.

- Biodiversity & Biomes
- types of diversity:

Genetic diversity refers to the variety in the genetic makeup among individuals within a species.

Species diversity is the variety of species in an area. The distinct types of organisms/species found in different habitats/ecosystems of the planet.

**approx. 1,750,000 known species

Ecological diversity refers to the variety of ecosystems (forests, deserts, grasslands, streams, lakes, oceans, coral reefs, wetlands, etc.) across a given area (usually a continent or country).

Functional diversity refers to the biological & chemical processes or functions such as energy flow & matter cycling needed for the survival of species & biological communities.

- physical factors to biodiversity: Temperature, Water, Light availability, Soils, and Landforms (elevation).
- terrestrial biomes & aquatic zones; characteristics of each, examples
- succession; types, primary vs secondary
- zoogeographic realms; location, examples

- Human Population Dynamics

World is ~ 7.2 billion, U.S.A. is ~ 320 million

- terms: arithmetic population density vs physiologic density
- population concentrations, historical trends
- types of growth
 - exponential: compounded growth, percentage added each year
 - linear: uniform increase each year
 - doubling time
 - Malthus: **Population Explosion**: rapid growth attended by ever-shorter doubling times & accelerating rates of increase. **Neo-Malthusians** still believe the basic premise, but admit that technology can forestall the outcomes, but not erase them forever, these ideas were revived in the 1960's & early 1970's by Paul Ehrlich & others in an idea known as the Population Bomb
- population pyramids:
 - **Population Pyramid**: the graphical representation of a populations structure or arrangement
 - shows the % of the total population for each 5-yr age group with males on the left & females on the right;