

Midterm Review

ENV

Lecture 2:

Easter Island

- most remote island in the world, that had a population less than 2000 when europeans found it
- It is now bare, no vegetation or wildlife exists, but huge stone statues are left, showing that their was once a sophisticated civilization
- Scientists determined that the land was once inhabited by lush forests and a prosperous society of 6000-30 000 ppl
- The island exceeded its carrying capacity of the island by overusing resources , destroying its self in downward spiral of starvation and conflict
- Trees gone= soil erosion= faster runoff water (less available drinking water) and degraded agricultural lands (less crops)
- Predator-prey model: people= predator, resources= prey ;"feast and famine" cycles of rising and falling population and resource stocks

Contemporary Human Stressors

1. Population Growth: go hand in hand w/ consumption (the more ppl, the more resources used)
2. Consumption of resources: due in part to our successful efforts to expand and intensify food production.
3. Production of wastes:
4. Alteration of global-scale biophysical processes: carbon dioxide and other chemicals in atmosphere absorb heat and warm earths surface; anthropogenic enhancement of this process responsible for glacier melting, sea levels, impacts on wildlife and crops and increased episode of destructive weather.
5. Introduction of alien chemicals & organisms into the environment : use of fertilizers and pesticides negatively affect organisms and alters natural systems

Tragedy of the commons

- resources that are open to unregulated exploitation inevitably become overused and, as a result, are damaged or depleted
- Tragedy of the commons = the scenario in which each individual withdraws whatever benefits are available from an unregulated or poorly regulated common property resource, as quickly as possible, until the resource becomes overused and depleted.
- in some situation, private ownership can improve this, as they tend to be more environmental friendly than tenants

Two Categories of Modern global environmental change:

1. Cumulative: impact through worldwide distribution of change; impact through magnitude of change (share of global resources)
 - Ex) deforestation, biodiversity loss, land degradation, freshwater quality and availability, toxicity
2. Systemic: Direct impact on globally functioning systems
 - Ex) atmospheric systems, ocean circulation

Complexity

- The earth functions as a set of complex, interconnected systems
- changes in one system can cause changes in other systems
- system: a network of relationships among parts, elements, or components that interact and influence one another through the exchange of energy, matter, or information.

Historical Contexts of Environmental Studies

- environmental/climatic determinism: human behaviour and activities are dictated by the physical environment (somewhat true)
- post war quantitative science= a revolution; new technologies= increased scientific measurement of environmental features
- move towards empiricism: a theory that states that knowledge comes only from or primarily from sensory experience

Lecture 3: Ecosystems

- Ecosystem: a distinctive biotic(living) community and the abiotic (non-living) that occur and interact in a particular area at the same time.
- abiotic factors: distinguish between —> conditions (temperature, pH, wind, salinity,etc) and resources (water, minerals, light, etc)
- organic compounds = a compound made up of carbon atoms joined by covalent bonding
- inorganic compounds = may contain carbon but are not organic because of the lack of the carbon-carbon bonds that are characteristic fo organic compounds

Biomes

- a major regional complex of similar plant communities; a large ecological unit defined by its dominant plant type and vegetation structure ex) boreal forest, tundra, rainforest
- biomes dictate species
- abiotic factors influence the placement of the biomes (such as temperature, precipitation which are the most important)

Evolution

- the gradual change in species over time —> biological evolution= genetic change in populations organisms across generations
- natural selection: process by which traits that enhance survival and reproduction are passed on more frequently to future generations than those that do not, altering the genetic makeup of the population over time
- directional selection: selection drives a feature in one direction rather than another - ex) snails with thick shells are better than ones with thin
- in contract—> stabilizing selection: produces intermediate traits, preserving status quo ex)shell isn't better bigger or better smaller
- distructive selection: trait diverge from their starting condition in two or more directions ex) very thin shells benefit, as well as very thick.
- divergent evolution: closely related species that live in different environments and thus experience different selective pressures tend to diverge in their traits as the differing pressures drive the evolution of different adaptions

Tuesday, October 18, 2016

- convergent evolution: sometimes very unrelated species may have similar traits as a result of adapting to selective pressures from similar environments.
- species: group of similar organisms that can mate with each other and produce fertile offspring
- soft inheritance: organisms can pass characteristics it acquired during lifetime (Jean Baptiste Lamarck)

Habitat

- particular physical and biological (or abiotic and biotic) conditions to which a species is adapted
- the availability and quality of habitat are crucial to an organism's well-being

Ecological Niche

- a species use of resources (habitat use, and consumption of certain foods), and its functional role in its community (its role in the flow of energy and matter, and its interactions with other organisms)
- fundamental niche= with no competitors, an organism can exploit its full fundamental niche and fulfill all its roles
- realized niche= when competitors restrict what an organism can use (limited in its role and uses only subset resources, the organism is limited to a realized niche
- some species are:
 1. specialists: have very specific requirements, so are only found in certain conditions
 2. generalists: have broad tolerance to different conditions, thus can survive in a range of habitats with different resources
- an organism's habitat, niche, and degree of specialization each reflect the adaptations of the species and are products of natural selection

Systems

- a network of relationships among component that interacts with and influence one another through the exchange of energy, matter, or information
- open systems= interact with elements outside with systems— energy and matter are freely exchanged with surroundings

Tuesday, October 18, 2016

- closed systems= energy is free to come and go but matter is contained. Lack material inputs and outputs.
- Biosphere : a cycle
- cycles are subject to feedback loops: a circular process in which a systems output serves as an input to that same system; they can be
 1. Positive feedback loops: reinforce or speeds up a change that is occurring
 - they drive it further to one extreme
 - ex) account balance grows, more interest earned (therefore, balance grows more)
 2. Negative feedback loops: counteracts or slows down a change that is occurring; stabilizes the system
 - ex) body is hot, body sweats, body cools (which does not cause the body to over heat more)

Levels of Ecological Organizations

- biosphere → ecosystem: within ecosystem → biome (groupings of similar ecosystems), landscape (group of interacting ecosystems), ecotone (transition area between ecosystems) → community → population → organism

Trophic levels (feeding ranks)

- who eats who
- energy passes between trophic levels: at each trophic level most of the energy that organisms use is lost through respiration, only a small amount of the energy is transferred tot he next trophic level.
- Levels:
 1. Autotrophics (Producers): organisms that create organic matter via photosynthesis(plus some chemosynthetic bacteria)
 - contains the most energy
 2. Heterotrophs (Primary Consumers): must consume organic material produced by other organisms
 - includes herbivores, carnivores, parasites, detritus feeders, decomposers
 - contains only the amount of energy gained from the producers

- 3. Heterotrophs (Secondary Consumers)
- 4. Heterotrophs (Tertiary consumers) or Higher order Consumers
- The amount of energy lessens as you get higher in the pyramid
- Typically, fewer organisms exist at higher trophic levels
- Trophic pyramid= level of energy or biomass (organic matter) at each trophic level in a given ecosystem

Limits of Ecosystems

- ecological limits exist for all species
- Factors that limit ecosystems:
 - climate (temperature, humidity, atmospheric pressure, humidity, wind, rainfall),
 - local or micro-climates (climates within a specific ecosystem),
 - geology: nutrients available from weathered rock/soil; is the physical surface conducive to growing plants (e.g soil vs rock)
 - water availability
 - altitude: vegetation changes with altitude and latitude in similar ways

Complexity

- while chaos deals with situation such as turbulence that rapidly become highly disordered and unmanageable, complexity deals with the situations of many interacting against that, while hard to predict, nevertheless have a good deal of structure

Role of Photosynthesis

- provides energy that may be utilized (metabolized) by other living organisms
- entropy= a state of disorder —when you stop adding energy to a system, entropy increases and eventually the system stops

Lecture 4

- epigenetics: the study of heritable changes in the gene expression (active versus inactive genes) that does not involve changes to the underlying DNA sequence

Mass extinctions

- earth is currently entering its sixth mass extinction event and humans are the cause
- change to earth's natural systems set in motion by human population growth, development, and resource depletion have driven many species extinction and threaten many more

Cycles

- The carbon Cycle: the routes that carbon atoms take through the environment
- producers (terrestrial and aquatic plants) pull carbon from the atmosphere and out of surface water in photosynthesis → photosynthesis breaks the bonds in carbon dioxide and water to produce oxygen and carbohydrates → autotrophs use some of the carbohydrates to fuel their own respiration, thereby releasing some of the carbon back into the atmosphere and oceans as CO₂ → when producers are eaten by primary consumers, which then get eaten by secondary con., more carbohydrates are broken down in respiration, producing carbon dioxide and water → the same process happens when decomposers consume waste and dead organic matter
- respiration from all these organisms release carbon back into the atmosphere and oceans
- a portion of the carbon an organism take in becomes incorporated into its tissues
- organisms die and bodies may settle in ocean basins and wetlands and as the layers accumulate, older layers are under more pressure → these conditions can convert soft tissue into fossil fuels and create sedimentary rock which is the largest comprise of carbon cycle (this can be released when we burn fossil fuels)
- our impact:
 1. mining fossil fuels= removing deposit of carbon from underground reservoir
 2. combustion from cars, homes, industry = greatly increase the flux of carbon from the geosphere to atmosphere
 3. cutting down forests= release of carbon in the air, and less vegetation to draw back carbon from atmosphere
- this causes more carbon absorbed into ocean making it more acidic (threatening marine life)

Phosphorous Cycle: a major nutrient cycle consisting of the routes that phosphorus atoms take through nested networks of the environmental systems

- key component of cell membranes and of several molecules vital for life
- majority is contained in rocks and mobilized only by weathering, which releases phosphate ions into water → then it participates into solid form, settles at the bottom, and re-enters the geosphere's phosphorous reservoir in the form of sediment
- plants take up phosph. thru roots when its dissolved in water → primary consumers get it from plants and water and pass it on to secondary con. → consumers release it through waste → decomposers breakdown phosph-rich organisms and waste and return it to soil
- How we affect phosphorus cycle:
 1. Mining rock for inorganic fertilizers= taking away phosph.
 2. wastewater discharge (through fertilizers, detergents, municipal sewage) is rich in it and phosph. that runs off waterways can booth algae growth (detergents have lots of phosph)
- eutrophication: excessive richness of nutrients in a lake or other body of water, frequently due to runoff from the land → leads to murkier waters and altering the structure and function of aquatic systems

Nitrogen Cycle

- nitrogen cannot cycle to out of the atmosphere and into living organisms without the help from lightning, highly specialized bacteria, or human assistance.
- nitrogen= limiting factor for plant growth because its scarcity
- to become available, nitrogen gas must be "fixed" or combined with hydrogen in the form of ammonium, that can be taken up by plants in water
- Nitrogen fixation accomplished in 2 ways: intense energy of lightning strikes, or by the action specialized bacteria.
- animals get it from eating plants or other animals, and decomposers get it from dead plants or animals and waste → then decomposers release ammonium atoms, making it available for bacteria to convert to nitrates (nitrification) → final step: bacteria convert nitrates in soil to gas nitrogen going back into thermosphere (denitrification)
- Our Influence:

Tuesday, October 18, 2016

1. Excessive amounts of nitrogen from agricultural fertilizers in lakes and water systems → aquatic plants and algae= boosted growth, outstripping source of other nutrients for other organisms, which then decompose and die
 2. Burning forests and fields and fossil fuels= release of nitrogen into the atmosphere and reacts to form nitrogen dioxide (leads to acid precipitation)
- short term gains in economic and agricultural productivity lead to long term risks for ecosystem health
 - we are externalizing costs (costs of production that someone else pays) to the environment

Population Change

- # of organisms of any given species is not stable
- fluctuation with environmental conditions; shifts may be dramatic
- exponential growth: increase by a fixed **percentage** each year
- linear growth: increase by a fixed **amount** each year
- J-curve= exponential growth —usually occurs in nature when pop. is small, competition is minimal, and env. conditions are ideal;
- s-curve= linear; population held in balance by environmental resistance
- biotic potential= the capacity for a given species to increase its number given optimum conditions, through reproduction, geographical expansion of habitat or both
- environmental resistance= the total sum of factors that limit the potential for a species to increase its numbers or geographical range
- limiting factors= physical, chemical, and biological characteristics of environment that restrain pop. growth
- logistic growth curve: rises sharply (exponential) then begins to level off as effects of limiting factors become stronger
- critical number- the lowest # of organisms required to ensure that a population may reproduce and continue

Lecture 5: Human Population Dynamics

- pop. has doubled since 1966
- it has grown so fast due to exponential growth— even if growth rate remains steady, pop size will increase
- Thomas Malthus (1798): Limits to human population growth
- human pop increases exponentially, food production increases arithmetically —> unless pop. is limited by laws or social control, ppl would outgrow the available food supply until starvation, war, or disease arose and reduced pop
- "**positive checks**", which lead to 'premature' death: disease, starvation, war,
- "preventive checks" which lead to lower birth rate: birth control, abstinence
- Karl Marx (1818): human social behaviour can be understood in the context of the capitalist economy, which creates social classes that compete with one another for resources
- real problem isn't too many ppl or too little food its: private capitalists owns the means of meeting human need
- Today's population science:
- Neo-Malthusians= believe we are approaching, or have already surpassed, the earth's carrying capacity
- Neo-Marxists= believe eliminating oppression and poverty through social change in key
- Cornucopians (boomsters)= believe all major economic, social, and environmental problems can be fixed with technology and innovation ex)improvements in food production technology
- green (agricultural) revolution: agriculture productivity increased across the globe

What has led to human population explosion?

1. Nutrition
2. Improvements in medicine
3. Sanitation

What influences population growth rate?

1. Fertility
2. Death rate of humans under 40
3. Human longevity
 - crude birth rate (CBR)= # of births per 1000 people living per year
 - crude death rate (CDR)= # of deaths per 1000/yr
 - total fertility rate (TFR)= # of children born to an average women in a population during her lifetime
 - replacement-level fertility= a fertility rate that will replace 1 women and her partner
 - Why are people choosing to have fewer kids? maternal health-care, reduction in childhood mortality, household economic security. female and male education, contraception availability
 - The demographic transition model: a model of economic and cultural change to explain the declining death and birth rates in industrializing nations

Lecture 6: Environmentalism

- environmentalism= a movement to preserve the health of earth and its ecosystem
- social movement dedicated to protecting the natural world— and by extension humans— from undesirable changes brought about by human choices (different from env. studies)
- science but also values and spirituality
- gained momentum in the 20th century —industrial revolution and its effects
- First ideology to be rooted in natural sciences— role of scientific findings
- IPATS model: Understanding population environment linkage
- IPAT model = our total impact (I) on the environment as the product of the population, affluences (A), and technology (T) $I = P \times A \times T$
- the extent of human impacts on ecosystem capital is a function of: the # of humans, their level of consumption, the technologies they use, and the sensitivity of the environment in question
- Stewardship= calls for responsible planning and management of resources

Environmentalism vs Ecology

- **Environmentalism** refers to all forms of collective behaviour that aim to correct **destructive forms of relationship** between **human action** and its **natural environment** —ecology in practice
- **Ecology** can be understood as a set of beliefs, theories, and projects that consider humankind as **a component of a broader ecosystem** and wish to maintain the **system's balance** in an evolutionary perspective. —environmentalism in theory

Basic Principles of Environmentalism

1. Ethical ecological stewardship
2. respect for other species
3. wilderness as spiritual haven