

## ENVIRONMENTAL MIDTERM REVIEW

### 1. What is a system?

An assemblage of parts and their relationship forming a function entirely or whole

- A system can be living or nonliving
  - Ex: bicycle; cell; car

### 2. What is the difference between transfer and transformation?

- Transfer: a change in location
- Transformation: change in the chemical nature, a change in state or energy

### 3. Know examples of transfer and transformation (In terms of ecology)

- Transfer: Energy gets transferred from plants to animals and animals to animals within different stages of trophic levels
  - The movement does not involve a change of form or state
    - Example: run off (the water's location is just changing)
- Transformation: Photosynthesis transforms solar energy into chemical energy

### 4. Know terms: open, closed and isolated systems (what enters/exits?)

- Open System: exchanges matter and energy with its surroundings
  - Energy in → energy out
  - Mass in → mass out
- Closed System: exchanges energy but not matter with its environment
  - Most examples are artificial: terrarium, aquarium (organisms don't survive on their own)
    - Energy in → energy out
- Isolated System: exchanges neither matter nor energy with its environment
  - Do not exist naturally

### 5. Difference between stable and unstable systems

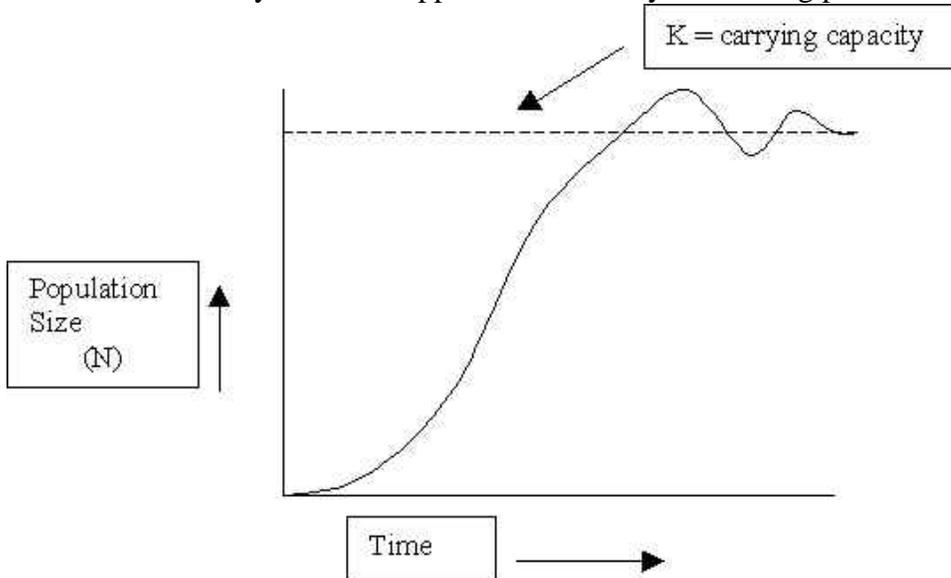
- Stable Systems: System returns to its original equilibrium following a disturbance.
- Unstable System: A system that does not return to the same equilibrium but forms new equilibrium

### 6. Know examples of positive and negative feedbacks (in terms of global warming)

- Positive Feedback: occurs when a change in the state of a system leads to additional and increased change (a continuous change, enhancing the system)
  - Increased temperature through global warming melts more of the ice in the polar ice caps and glaciers, leading to a decrease in the Earth's albedo. The Earth absorbs more of the sun's energy which makes the temperature increase even more, melting more ice
  - Exponential population growth
  - Human population - more people on the planet produce more children than at the rate people die. Human population grows exponentially
- Negative Feedback: Feedback that counteracts any change away from equilibrium, contributing to stability (prevents positive feedback)
  - Ecosystems normally exist in a stable equilibrium
  - Temperature control in the human body - an increase in body temperature results in sweating .
  - Predator prey relationships

7. **Identify a graph that shows when a population reaches carrying capacity**

- Carrying Capacity: refers to the number of organisms - or size of population - that an area or ecosystem can support sustainably over a long period of time.



8. **What is gross primary productivity?**

- Gross Primary Productivity (GPP): How much is produced by plants
  - Rate at which producers convert solar energy into chemical energy as biomass
  - Measured in terms of energy production per unit area

9. **In a food web, identify the producers, primary & secondary consumers**

- Producers (autotrophs): support the ecosystem by constant input of energy and new biological matter (an organism that makes its own food)
  - Ex: algae, plants
- Primary Consumer (herbivore): only eats primary producers
- Secondary Consumer (omnivore; carnivore): eats the primary consumers
- Food webs: many food webs together
  - 1st trophic levels → second trophic level → third trophic level → fourth trophic level → fifth trophic level
  - Pant → Grasshopper → Bird → Snake → Owl
  - Producer → Primary Consumer → Secondary Consumer → Tertiary Consumer → Quaternary consumer

10. **What are pioneer species?**

- Organisms that first come into an area that was destroyed
  - They are the first to colonize a previously disrupted or damaged ecosystem
    - Example: bacteria, fungi and lichens (mis of fungus and algae)

11. **What is a climax community?**

- The final stage of a succession
- More stable than earlier seral stages and in equilibrium

**12. In terms of productivity, how would you describe a pioneer community and a climax community?**

- Pioneer community
  - Low gross productivity because of the lack of producers but high net productivity is high because of the proportion of the energy lost through community respiration is low
  - Increases in its early stages
- Climax community
  - High gross productivity because there are more producers
  - Low net productivity

**13. Differentiate: cellular respiration and photosynthesis (know the species that undergo these processes)**

- Photosynthesis: converts light energy to chemical energy, which is stored in the biomass (Plants and algae go through photosynthesis)
  - Takes place in chloroplasts
  - $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$ 
    - Inputs - sunlight as an energy source, carbon dioxide and water
    - Outputs - glucose, used as an energy source for the plant and as the basic starting material for other organic molecules; oxygen released to the atmosphere through stomata
- Cellular Respiration: releases energy so that it can be used to support the life process of organisms (all living things go through cellular respiration; plants and humans)
  - Takes place in the mitochondria
  - $\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{ATP}$ 
    - Inputs - organic matter (glucose) and oxygen
    - Processes - oxidation process inside cells
    - Outputs - release of energy for work and heat

**14. How is a system able to self-regulate?**

- Through feedback mechanisms that return it to homeostasis (negative feedback loops)
  - Example: over population of foxes will cause decline in rabbit population and because of this, the fox population will eventually start to die out

**15. Understand the Nitrogen cycle.**

- Because Nitrogen is a triple bond it is very hard to break
  - Only a few things can break that triple bond
    - For example bacteria
      - Nitrogen gas can be broken down by lightning and bacteria,
- Storages include:
  - Organic: organisms
  - Inorganic:
    - Soil
    - Fossil Fuels
    - Atmospheres
    - Water bodies
- Transfers include:
  - Herbivore feeding on producers
  - Carnivores feeding on herbivores
  - Decomposers feeding on dead organic matter
  - Plants absorbing nitrates through their roots
  - Removal of metabolic waste products from an organism (excretion)
- Assimilation: is absorbing and taking in  $\text{NO}_3$  / ammonium.
  - Example: The cow dies or releases waste

- In the waste there is nitrogen
- Ammonification: This nitrogen is found from plants and dead bodies animals
  - Not the same nitrogen that's found in the atmosphere

**16. Know the process involved in: Nitrogen Fixation, Denitrification**

- Nitrogen Fixation:  $N_2$  is changed into something else
  - It is changed to a form plants can use
- Denitrification: getting  $NO_3$  back to  $N_2$ 
  - turn it back into the atmosphere

**17. What is Net Primary Productivity?**

- Net Primary Productivity (NPP): Rate at which producers use photosynthesis to store energy minus the rate at which they use this stored energy through aerobic respirations
- NPP measures how fast producers can provide the food needed by other organisms in an ecosystem
- $NPP = GPP - \text{Respiration}$

**18. Differentiate between r-strategist organisms and K-Strategist organisms**

- R-Strategist organisms
  - They have a fast rate of increase
  - Better adapted to pioneer communities
  - Small offsprings that mature rapidly-- species that reproduce through eggs
    - Many offspring are produced
  - Small size of organism
  - Energy used to make each individual is low
  - Early maturity
  - Short life expectancy - Type III survivorship pattern
  - Each individual only reproduces once
- K- Strategist organisms
  - Slow- growing organisms limited by the carrying capacity of an environment
  - Better adapted to climax communities
  - Very large offsprings that mature slowly and have loads of paternal support
    - Energy used to make each individual is high
      - Ex. Elephants and whales
  - Vulnerable to high death rates and extinction because of slow reproduction
  - Late maturity, often after a prolonged period of parental care
  - Long life expectancy - type I or II survivorship pattern in which individuals live near the maximum life span
  - Individuals can reproduce more than once in their lifetime

**19. What is the role of lichen in the process of succession?**

- Lichens are typically the first organisms to colonize bare rock-- they are therefore the pioneer species in primary succession
- Many organisms require soil before they can colonize an area. Lichens that colonize bare rock secrete acids that break down the rock and start the soil-production process
- Also, as lichens die, they provide some organic matter that also contributes to soil
- Mosses can then colonize the thin soil; as mosses die, the soil thickens more allowing other hardy species to colonize.

20. **Understand symbiotic relationships: parasitism, competition, mutualism, predation**
- Symbiosis: a relationship in which two organisms live together
  - Parasitism: one species (parasite) feeds on part of another organism (host) usually by living in or on the host. (one species benefits at the expense of another)
    - Ex: ticks
  - Competition: the demand by individuals for limited environmental resources
    - Intraspecific competition: competition between members of the same species (within)
    - Interspecific competition: competition that does not occur between individuals of the same species. Individuals of different species could be competing for the same resource (between)
  - Mutualism: both species benefit
    - Es: bacteria, viruses, fungi
  - Predation: an animal hunts and eats another animal
21. **What are the main factors that determine a type of biome**
- Biome: a community on a global scale, where habitats flank each other, and is usually defined by the temperature, **precipitation**, and types of plants and animals that inhabit it. The Earth's biomes are categorized into two major groups: terrestrial and aquatic.
  - Climate
    - Insolation
    - Precipitation
    - Temperature
22. **What process lowers the levels of CO<sub>2</sub> in the atmosphere?**
- Photosynthesis
    - a process where plants intake CO<sub>2</sub> and emit O<sub>2</sub>, thus lowering the CO<sub>2</sub> levels in the atmosphere.
23. **Compare, given reasons, for the differences in NPP between any two biomes**
- The more productive a biome is, the higher its NPP
  - Rainfall, temperature, and insolation determine rates of photosynthesis which affect productivity
  - Also, such factors affect the quality of life
    - Better quality of life, the more plants there are, the higher the NPP is
24. With the help of a diagram, describe the transfer and transformation of energy
25. **Compare the structure and distribution of the tropical rainforest and tundra**
- Tropical rainforest
    - High temperatures and high rainfall throughout year
    - High sunlight
    - All year growing season
    - High levels of photosynthesis and NPP
    - Many forests and high diversity of animals/ plants
    - Around the Equator (middle of the Earth)
  - Tundra
    - High latitudes (low temperatures)
    - Low insolation (not much sun)
    - Water is frozen and little rainfall
    - Rate of photosynthesis and productivity are low
    - Soil is frozen -- some plants/ no trees
    - Few animals-- big w/ thick fur
    - North pole region (Arctic)

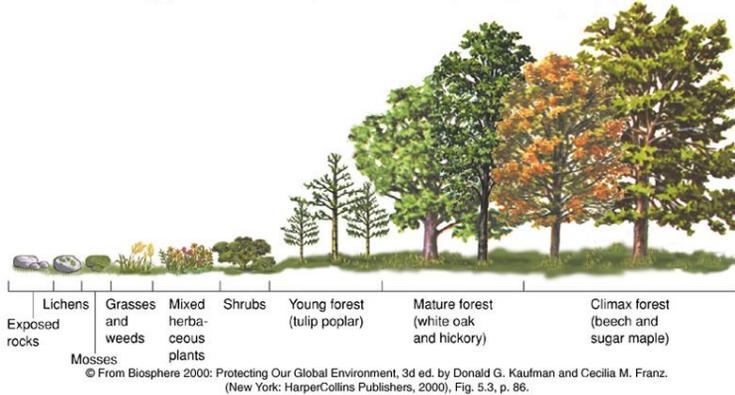
26. **What is a species?**

- Species: a group of organisms sharing common characteristics that can interbreed and produce offspring
  - ex: donkey + horse = mule (this is a hybrid offspring and can not reproduce)

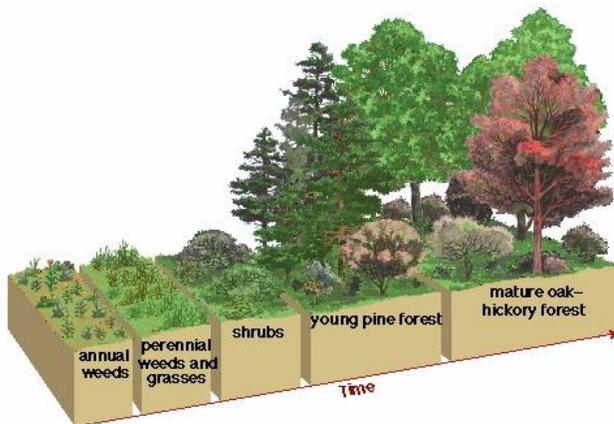
27. **Understand the process of succession using a diagram.**

- Primary succession

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- Secondary Succession



28. **Know where the pioneer community begins and know what the climax community is.**

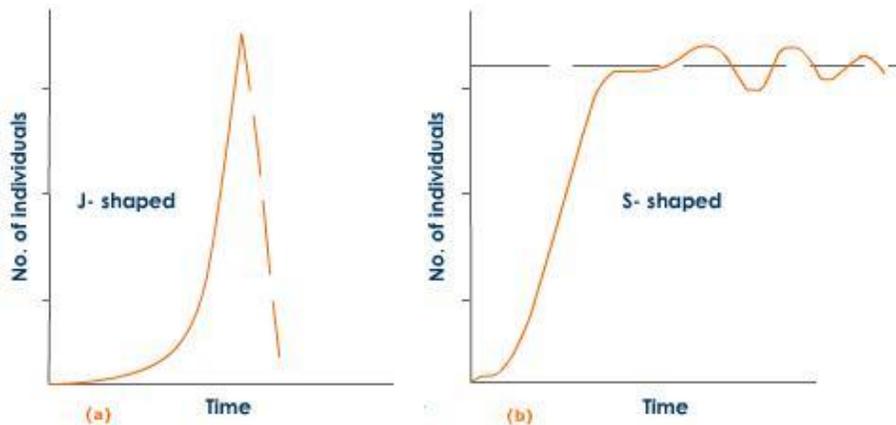
- Pioneer community starts in the rocks during primary succession
- Climax community is at the end of both graphs

29. **What activities alter a climax community?**

- Human activities which create disturbance and divert the succession so that a different stable state is reached rather than climax community
  - Hunting
  - Burning
  - Grazing
  - Forest clearance
- Interrupted succession
  - Plagioclimax

**30. Draw and label population growth curves – graph it.**

- Exponential growth: an increasing or accelerating rate of growth
  - J curves
  - No limiting factors
  - Growth is initially slow but becomes increasingly rapid and does not slow down as population increases
  - Occurs when:
    - Limiting factors are not restricting the the growth of the population
    - There are plentiful resources such as light, space and food
    - There are favorable abiotic components, such as temperature and rainfall



Population Growth Forms: (a) J-shaped (b) S-shaped  
K represents the carrying capacity

- Logistic Growth (sigmoid growth curve):
  - S curve
  - Shows initial rapid growth and then slows down as carrying capacity is reached
  - It won't keep growing because there are limiting factors like competition and resources
  - 4 Stages of the curve:
    - 1. Lag phase: population numbers are low leading to low birth rates - few individuals colonize a new area and because numbers of individuals are low birth rates are also low.
    - 2. Exponential growth phase: population grows at an increasingly rapid rate - limiting factors are not restricting the growth of the population; there are favorable abiotic components, such as temperature and rainfall, and lack of predators or disease; the numbers of individuals rapidly increases as does the rate of growth
    - 3. Transitional phase: Population growth slows down considerably although continues to grow - limiting factors begin to affect the population and restrict its growth; there is increased competition for resources; an increase in predators and an increase in disease and mortality due to increased numbers of individuals living in a small area also cause a slowdown in growth rate.
    - 4. Stationary phase: population growth stabilizes (the graph flattens) and then the population fluctuates around a level that represents the carrying capacity - limiting factors restrict the population to its carrying capacity; changes in limiting factors, predation, disease and abiotic factors cause populations to increase and decrease around carrying capacity.

**31. List the characteristics of K- strategist organisms**

Stable environment, density dependent interactions
large size of organism
energy used to make each individual is high
few offspring are produced
late maturity, often after a prolonged period of parental care
long life expectancy
individuals can reproduce more than once in their lifetime
type I or II survivorship pattern in which most individuals live to near the maximum life span

**32. List the characteristics of r-strategist organisms**

Unstable environment, density independent
small size of organism
energy used to make each individual is low
many offspring are produced
early maturity
short life expectancy
each individual reproduces only once
type III survivorship pattern in which most of the individuals die within a short time but a few live much longer

**38. Describe and explain the process by which carbon is added to, and lost from the atmospheric storage. Know examples of organisms involved in the process. **\*\*CARBON CYCLE\*\*****

- Organic Storage
  - Organisms (including forests)
- Inorganic Storages
  - Atmosphere
  - Soil
  - Fossil fuels
  - Oceans
- Photosynthesis
  - Converts inorganic materials into organic matter
    - Carbon dioxide and water into glucose

- Respiration
  - Converts organic material into inorganic matter
    - Glucose into carbon dioxide and water
- Combustion
  - Transforms biomass into carbon dioxide and water
- Fossilization
  - Transforms organic matter in dead organisms into fossil fuels through incomplete decay and pressure

**39. How has the balance of Carbon Dioxide changed throughout the years?**

- The balance has changed because now, carbon dioxide is released into the air in a faster pace than plants and trees can absorb
- So there is much more CO<sub>2</sub> gas in the air that there has been in the past years

**40. What effects do these changes have on the planet?**

- This affects the planet because the increase of CO<sub>2</sub> gas causes global warming and it propels climate change

**41. Describe what a Desert looks like and determine whether the productivity is high or low.**

- High temperatures
- Low precipitation-- rainfall may be unevenly distributed
- Vegetation is sparse
- Low decomposition levels because of dryness is air
- Cacti
- Snakes
- Reptiles
- Lack of water limits rate of photosynthesis
- Rates of NPP are every low

**OTHER STUFF TO KNOW**

42. First Law of Thermodynamics

- Energy can neither be created nor destroyed, it can only change form

43. Second Law of Thermodynamics

- Energy goes from a concentrated form into a dispersed form

44. Define a biome

- A large community of plants and animals that occupies a distinct region

45. Define a niche and the different types

- Where, when, and how an organism lives
- Fundamental niche: Full potential or where, when, and how a species can exist
- Realized niche: Where the species actually exist

46. Lightning fixation

- Transforms atmospheric nitrogen into ammonia