WJEC (Eduqas) Biology A-level

Topic 1.5 - Population size and ecosystems

Flashcards

Define ecology.

Define ecology.

The study of the relationships among organisms and their environment.

Define ecosystem.

Define ecosystem.

- The community of organisms (biotic) and non-living (abiotic) components of an area and their interactions
- Vary from very large, e.g. biome, to very small, e.g. microhabitat.

Describe biotic and abiotic factors, giving examples.

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- **Biotic** - living features of an ecosystem, e.g. predators, disease, breeding
- **Abiotic** - non-living features of an ecosystem, e.g. light, temperature, oxygen

Define community.

Define community.

All of the populations of different species living together in a habitat.

What is a habitat?

What is a habitat?

The region where an organism normally lives.

Define population.

Define population.

All organisms of the same species living with one another in a habitat at the same time.

Define niche.

Define niche.

Describes how an organism ‘fits’ into an ecosystem and its role in that environment.

What do population numbers depend on?

What do population numbers depend on?

- Birth rate
- Death rate
- Immigration
- Emigration

Define birth rate and death rate.

Define birth rate and death rate.

- **Birth rate** - the number of offspring born per thousand of population per year
- **Death rate** - the number of deaths per thousand of population per year

What is immigration?

What is immigration?

The number of individuals entering a region per thousand of population per year.

What is emigration?

What is emigration?

The number of individuals leaving a region per thousand of population per year.

When do population sizes increase?

When do population sizes increase?

When births and immigrants are greater than deaths and emigrants.

When do population sizes decrease?

When do population sizes decrease?

When deaths and emigrants are greater than births and immigrants.

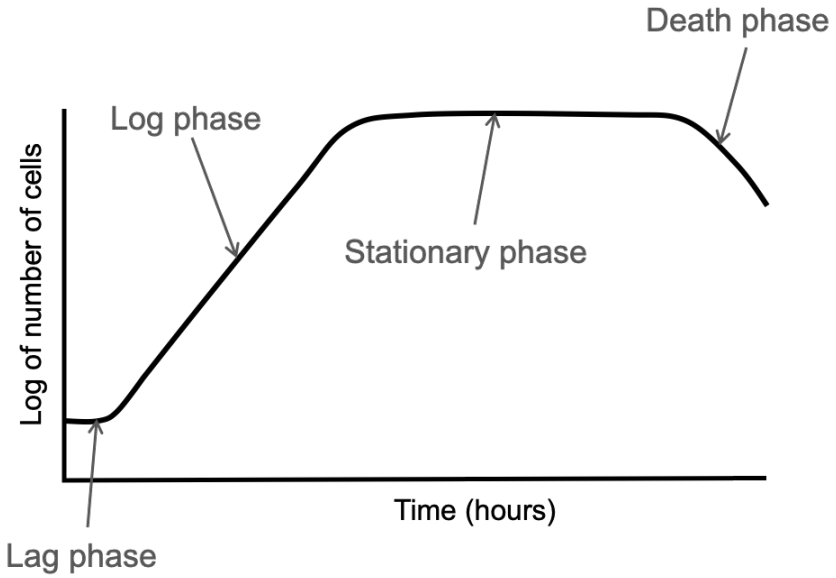
Describe the phases of population growth.

Describe the phases of population growth.

- **Lag phase** - period of slow population growth
- **Log phase** - period of rapid exponential population growth in which birth rate exceeds death rate
- **Stationary phase** - period of stability in which population numbers generally remain constant

Draw a generalised graph of population growth in a bacterial population.

Draw a generalised graph of population growth in a bacterial population.



What is carrying capacity?

What is carrying capacity?

- The maximum population size that can be supported by an ecosystem over extended periods of time
- Varies depending on biotic and abiotic factors

What is competition?

What is competition?

- When different organisms compete for the same resources (e.g. light, water, mates, territory) in an ecosystem
- Limits population sizes

Describe density-dependent and density-independent factors, giving examples.

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- **Density-dependent factors** - factors whose effects on population size differ with population density, e.g. competition, predation, disease
- **Density-independent factors** - factors that have an effect on the whole population regardless of population density, e.g. climate

What is abundance?

What is abundance?

The number of individuals per species in a specific area at any given time.

What is distribution?

What is distribution?

The spread of living organisms in an ecosystem.

What is sampling?

What is sampling?

Selecting a group of individuals that will represent the whole target population. Allows us to measure the distribution and abundance of organisms.

Suggest methods of assessing abundance and distribution of organisms.

Suggest methods of assessing abundance and distribution of organisms.

- **Quadrats** - square frames placed at random in area to be investigated
- **Transects** - line or belt that runs across the area to be investigated

Suggest different ways abundance can be quantified.

Suggest different ways abundance can be quantified.

- Percentage area cover
- Percentage frequency
- Density

What is random sampling?

What is random sampling?

A sampling technique used to avoid bias, e.g. creating a square grid and generating random coordinates.

What is systematic sampling?

What is systematic sampling?

- Sampling technique used to determine the abundance and distribution of organisms along an area at periodic intervals, e.g. along a belt transect
- Commonly used in ecosystems where some form of gradual change occurs

What is the source of energy for an ecosystem?

What is the source of energy for an ecosystem?

Light energy

(other than ecosystems that rely on chemosynthesis)

What is a trophic level?

What is a trophic level?

The position that an organism holds in a food chain, food web, pyramid of numbers or pyramid of biomass.

What is biomass and how is it transferred? How can we measure this?

What is biomass and how is it transferred? How can we measure this?

- The total weight of living matter in a certain area, transferred up trophic levels through consumption
- Measured in terms of mass of carbon, or dry mass of tissue

State the formula for efficiency of biomass transfer.

State the formula for efficiency of biomass transfer.

$$\text{Efficiency} = \frac{\text{biomass transferred}}{\text{biomass intake}} \times 100$$

Why is some energy never taken in at each trophic level?

Why is some energy never taken in at each trophic level?

- Some parts of food aren't consumed
- Some parts of food are indigestible
- Plants can't use all light energy as some is the wrong wavelength

Why is some energy lost at each trophic level?

Why is some energy lost at each trophic level?

Respiration, lost as heat.

What is a pyramid of biomass?

What is a pyramid of biomass?

A table of the dry mass of living material at each trophic level of a food chain. This forms the shape of a pyramid.

What is meant by net and gross primary productivity?

What is meant by net and gross primary productivity?

Gross primary productivity (GPP) - the rate of chemical energy fixture during photosynthesis by all producers in an ecosystem, measured in kJ m^{-2} $year^{-1}$

Net primary productivity (NPP) - the amount of chemical energy that is available to heterotrophs in an ecosystem

How is net primary productivity calculated?

How is net primary productivity calculated?

Calculated by subtracting chemical energy generated in respiration (R) from gross primary production:

net primary production (*NPP*) = gross primary production (*GPP*) − respiratory losses (*R*)

What is meant by primary succession?

What is meant by primary succession?

Where an area previously devoid of life is colonised by **pioneer species**.

What is a pioneer species?

What is a pioneer species?

Species that can survive in hostile environments and colonise bare rock or sand, e.g. lichens.

Summarise the process of primary succession.

Summarise the process of primary succession.

- **Pioneer species** colonise the area
- They die, decompose and add nutrients to the ground
- Over time, this allows more complex organisms to survive

What are seres?

What are seres?

Various intermediate stages in succession in an ecosystem progressing towards a climax community.

Define secondary succession.

Define secondary succession.

A type of succession in which a habitat is re-colonised after a disturbance.

What is the climax community and how is it reached?

What is the climax community and how is it reached?

- The final stage of succession, where the ecosystem is balanced and stable (shows very little change overtime)
- Reached when the soil is rich enough to support large trees or shrubs and the environment is no longer changing
- Only a few dominant plant and animal species present depending on the climate

How does succession affect species diversity and the stability of a community?

How does succession affect species diversity and the stability of a community?

Succession increases species diversity and the stability of the community.

Give some examples of organisms that play an important role in decay.

Give some examples of organisms that play an important role in decay.

- **Detritivores** - feed on dead organic matter
- **Saprotrophs** - feed by extracellular digestion

Describe extracellular digestion by saprotrophs.

Describe extracellular digestion by saprotrophs.

They release enzymes which catalyse the breakdown of dead plant and animal material into simpler organic matter.

What is the carbon cycle?

What is the carbon cycle?

The cycle through which carbon (in the form of carbon dioxide) moves between living organisms and the environment, involving respiration, photosynthesis and combustion.

Describe the stages of the carbon cycle.

Describe the stages of the carbon cycle.

1. Photosynthesising plants remove CO_2 from the atmosphere
2. Eating passes carbon compounds along a food chain
3. Respiration in plants and animals returns CO_2 to the atmosphere
4. Organisms die and decompose. Saprotrophs break down dead material and release CO_2 via respiration
5. Combustion of materials (e.g. wood, fossil fuels) releases CO_2

Describe global warming.

Describe global warming.

The gradual rise in the average temperature of the Earth due to increasing atmospheric levels of carbon dioxide and methane gas.

What is the greenhouse effect?

What is the greenhouse effect?

The increase of global temperatures caused by the trapping of solar heat by gases in the atmosphere.

How might global warming affect the natural world?

How might global warming affect the natural world?

- Temperature, rainfall, light levels etc. all affect survival
- Habitats may be destroyed by deforestation or flooding
- Species may need to change their habitat, or face **extinction**

What is the nitrogen cycle?

What is the nitrogen cycle?

The cycle through which nitrogen moves between living organisms and the environment, involving ammonification, nitrification, nitrogen fixation and denitrification.

How do plant roots take up nitrogen?

How do plant roots take up nitrogen?

Taken up via active transport and facilitated diffusion as ammonium (NH_4^+) and nitrate ions (NO_3^-).

Name the four types of bacteria involved in the nitrogen cycle.

Name the four types of bacteria involved in the nitrogen cycle.

- Nitrogen-fixing bacteria
- Nitrifying bacteria
- Denitrifying bacteria
- Decomposers

Describe ammonification.

Describe ammonification.

The production of ammonium compounds when decomposers feed on organic nitrogen-containing molecules.

Describe nitrification.

Describe nitrification.

The conversion of atmospheric nitrogen gas into ammonia by nitrogen-fixing bacteria in the soil or root nodules of legumes.

Give some examples of nitrifying bacteria.

Give some examples of nitrifying bacteria.

- ***Azotobacter*** - lives freely in the soil
- ***Rhizobium*** - lives inside the root nodules of leguminous plants

Describe nitrogen fixation.

Describe nitrogen fixation.

Conversion of ammonium ions to nitrate ions by nitrifying bacteria. Takes place in two stages:

- Ammonium ions oxidised to nitrite ions
- Nitrite ions oxidised to nitrate ions

Name the two types of nitrifying bacteria. State their functions.

Name the two types of nitrifying bacteria. State their functions.

- ***Nitrosomonas*** - oxidises ammonium compounds into nitrites
- ***Nitrobacter*** - oxidises nitrites into nitrates

Describe denitrification.

Describe denitrification.

The conversion of nitrate ions to nitrogen gas by denitrifying bacteria.

What are denitrifying bacteria?

What are denitrifying bacteria?

Anaerobic microorganisms, found in waterlogged soils, responsible for the reduction of nitrate ions to nitrogen gas.

Describe the economic importance of the nitrogen cycle.

Describe the economic importance of the nitrogen cycle.

Maximises plant growth and crop yield, increasing food production.

How can farmers increase the nitrate content of soil?

How can farmers increase the nitrate content of soil?

- Ploughing and drainage to aerate the soil
- Application of fertilisers
- Growing legumes

What are fertilisers?

What are fertilisers?

Natural or artificial materials that are added to soils to provide essential nutrients and improve plant growth.

Give some examples of natural fertilisers.

Give some examples of natural fertilisers.

- Manure
- Compost
- Treated sewage

Give an example of an artificial fertiliser.

Give an example of an artificial fertiliser.

Ammonium nitrate

What is eutrophication?

What is eutrophication?

The process by which pollution by nitrogen-containing fertilisers results in algal blooms and subsequent oxygen level reduction in bodies of water.

Describe how fertilisers can cause eutrophication.

Describe how fertilisers can cause eutrophication.

1. Fertiliser run-off into rivers and lakes
2. Nutrients build-up in water
3. Algal bloom blocks sunlight
4. Aquatic plants cannot photosynthesise ∴ less oxygen produced
5. They die and decompose
6. Decomposers further deplete oxygen levels
7. Animals can no longer respire aerobically so die

How does digging drainage ditches affect habitats?

How does digging drainage ditches affect habitats?

- Habitat loss
- Reduction in biodiversity
- May lead to eutrophication