BIODIVERSITY
Factors affecting the variety of species in an ecosystem

UNIT 2: ENVIRONMENTAL BIOLOGY AND GENETICS
Learning Objectives

Biodiversity

Define the meaning of the words species, niche and adaptation

Describe how populations within a food web could be affected by disruption of the food web
Biodiversity

Species
  - group of similar living organisms that can interbreed to produce fertile offspring

Biodiversity – variation of life on Earth
  - Variation that exists between different species
  - Variation within the same species
Activity

Video – state of the planet episode 1 (with question sheet)

• Watch the DVD answering the questions
Biodiversity in an Ecosystem

Within an ecosystem, biodiversity can refer to the variety of species present in the community.

Habitat
- environment where an organism lives

Niche
- the role the organism plays within the community
  - What it eats
  - What use it makes of resources
  - When it is active
Activities

S3 Biodiversity in Scotland – Data Handling

• Read through all information provided – answer the questions
Learning Objectives
Adaptations to habitat and niche

Describe how adaptation to habitat and niche influences the distribution of a species
Adaptation

An adaptation is an inherited characteristic that makes an organism well suited to survival in its environment.

Adaptations

- can be structural and behavioural
- will influence the distribution of a species within an ecosystem
Rocky Shore

**Channel Wrack**
Adapted to the upper shore

**Bladder wrack and knotted wrack**
Adapted to the middle shore

**Serrated wrack**
Adapted to the lower shore
Adaptations of desert plants

To increase water uptake
- Large number of root hairs
- Deep roots
- Widespread shallow roots

To prevent water loss
- Reduced leaf surface area (rolled leaves or spines)
- Presence of thick waxy cuticle on leaves

Store water in leaves or stem
Darwin’s Finches

Galapagos finches

• have adaptations to allow them to exploit different ecological niches, increasing their chances of survival

• main adaptations are seen in their beaks and feeding habits
Darwin’s Finches
The beak shape of each finch is adapted to the food that it eats.
Learning Objectives
Factors affecting Biodiversity

Describe how human activity has lead to habitat destruction and the biodiversity crisis

Give pollution and grazing as examples of factors which affect the variety of species in an ecosystem.
In a Stable Ecosystem
Energy Flows and minerals are recycled

- Plants
- Sunlight
- Animals
- Minerals
- Energy
- Decomposers

P: Primary Producers
R: Recipients
Stable Ecosystem

In a stable ecosystem, all members of the community are interdependent.

The variety of species in an ecosystem can be affected by

- Grazing
- Pollution
- Human activities
Effects of grazing

Rabbits
- Unselective grazers - eat all types of plants
- Maintain high diversity of plant species

Sheep
- Selective grazers - eat competitive grass species
- Maintain species-rich community
Air Pollution

Sulphur Dioxide
- Sulphur dioxide can cause respiratory problems and causes damage to plants
- Lichens show sensitivity to sulphur dioxide and can be used as indicators of pollution

Acid Rain
- Sulphur dioxide and nitrogen oxides combine with water to form acids, which falls as acid rain
- Can lead to acidification of lakes and cause damage to conifers
Acid Rain
Acid Rain

SO$_2$ and NOx react with water to form acid rain clouds containing sulphuric acid and nitric acid.

Older trees die back

Acid rain in soil, surface run off

Acidification in lakes, fish die

Sulphur dioxide, nitrogen oxides

Power station, industry, houses, traffic
Water Pollution

Thermal pollution

- Warm water returned to a river from a power station causes a decrease in oxygen in the water
- Causing a decrease in fish species

Sewage

- Provides food for bacteria
- Use up dissolved oxygen in respiration
- Freshwater invertebrates and fish suffocate
- Freshwater invertebrates can be used as indicator species
Effect of pollution on the number of species
Effects of human activity

Habitat Destruction with the demands of an ever increasing human population, natural habitats are being destroyed

Desertification

- Grazing and cultivation of marginal areas causing the land to be lost to desert.

Deforestation

- Causes rapid run off rainwater
- Soil erosion
- Less evaporation and transpiration
- Increased levels of CO$_2$ in atmosphere
Biodiversity in crisis

Human activities are accelerating the rate of extinction. Species are being lost through:
  • Over hunting
  • Habitat destruction
Species lost include high profile species (tiger) and low profile species (medicinal leech)
Disruption to food chains

Loss of one species can have a **knock-on effect** on the rest of the organisms in a food web.

The more links a food web has, the more able it is to withstand disruption.
Importance of Biodiversity

Aesthetics
Economical
Medicinal
Storehouse of genetic variation
Other key ideas

Opportunists

- Species that will thrive as a result of habitat destruction

Earth Summit Rio de Janeiro 1992

- Sustainable development and conservation
- Rio plus 5 Earth Summit
  - Nations still fail to agree on policy for protecting biodiversity
Learning Objectives

Behavioural Adaptations

Give an example of an animals’ behavioural adaptation to an environmental stimulus and give its adaptive significance e.g. woodlice and light/humidity
Behavioural Adaptations

Animals need to be able to respond to an external stimulus

Environmental stimulus
Receptor
Nerve impulse transmitted
Central nervous system
Nerve impulse transmitted
Effector
Behavioural response
Behavioural Responses

Different species respond to stimuli in different ways

Each species behaviour shows an adaptive significance

- Increase chance of surviving by behaving in a particular way
Examples of behavioural responses

Blowfly larva
  • Move away from a high light intensity
  • Find food, avoid predators and avoid dessication

Flatworm
  • Move up a chemical concentration gradient
  • Increases chances of finding food
Learning Objectives

Competition

State that plants mainly compete for light and soil nutrients.
State that animals compete for food, water and shelter.
Plants compete for:
- Water
- Light
- Soil nutrients

Animals compete for:
- Water
- Food
- Shelter
Competition between plants within a species

Plants have the same growth requirements
  • Intense competition
  • As direct competition if a resource is limited
Competition between plants between different species

Different species have different structures e.g. leaf shape, root depth

- Less intense competition because
  - they differ from each other
  - have different ecological niches
In a habitat a species may become dominant at the expense of others

- bracken and pine trees block out light and prevent growth of other species
- Pine needles make the soil acidic which inhibits growth of other plants
Competition between animals within a species

Very intense competition if a resource is limited

Can lead to territorial behaviour
Territoriality

- Each territory contains enough food for male, his mate and his potential offspring
- Territory is defended by social signals
- E.g. Robin

**Diagram:**

- **Stimulus:** Arrival of intruder with red breast
- **Response:** High pitched song, display of red breast
- **This Stimulus triggers a response:** Departure of intruder
Advantages of territorial behaviour

Territory size will space out the population in relation to available food supply

Red grouse

- Territory size depends on available food
- When resources are limited the weaker birds will not breed

Plenty heather

poor heather
Competition between animals between different species

If two species occupy the same ecological niche

- Competition is intense
- One species will force the other out
North American Grey Squirrel
- competes aggressively for food
- Has wider variety food stuffs
Widespread decline of the timid red squirrel

Rainbow trout
- Aggressive
- Greedy
Decline in populations of brown trout
Decreasing competition - Cormorants

The common cormorant and the green cormorant both

- Next on cliffs
- Dive into the sea for fish

Minimise competition by feeding at different depths

- Green cormorant – mainly off sea bed
- Common cormorant – upper waters at sea