

CIE Biology GCSE

21: Human influences on ecosystems

Notes

Food supply

Improvements in farming:

With the advancement of technology, new methods of farming have been introduced in order to **maximise yield**:

- **Use of machinery** - agricultural machinery can be used in the place of people. This is quicker and more efficient, thus larger amounts of land can be farmed at once.
- **Chemical fertilisers** - fertilisers increase the amount of nutrients in the soil for plants, meaning that they can grow larger and produce more fruit, increasing the yield.
- **Insecticides and herbicides** - these chemicals kill off unwanted insects and weed species. This means that there is less damage done to plants and fruit lost to insects, as well as reducing competition from other plant species.
- **Selective breeding** - animals and crops which produce a large yield are selectively bred to produce a large number of organisms with a high yield.

Farmers also grow crops in a **monoculture**, which means that only **one species of crop is grown** at once. This is done to **maximise efficiency and simplicity**. It does, however, have a negative impact on the surrounding ecosystems. This is because there is a **loss of biodiversity** as only one species is grown. This can **harm food chains** and **reduce the population** of some species.

Intensive farming:

Animals and crops can both be farmed intensively. With crops, this means farming in a **monoculture** using high amounts of **pesticides, herbicides and fertilisers** to maximise production. Animals are kept in **high densities** and **energy loss is limited** by restricting movement and keeping a constant optimum temperature so that the organisms do not waste energy to thermoregulate. High amounts of **antibiotics** are also used to prevent diseases.

Intensive farming is not sustainable, however, and damages the environment: livestock produce large amounts of **methane gas**, which is a main contributor to **global warming**, whilst crops take up huge amounts of space, meaning that **forests and other habitats must be destroyed** to make space for farming.

Food shortage:

When people do not receive enough food, **famine** occurs. This can be caused by a variety of factors, including **natural disasters**, such as drought and flooding, **increasing population**, **poverty**, and **unequal food distribution**.

As the world human population increases, food production must also be increased to sustain the population. This is a problem as more land is required to grow crops and animals, meaning that **deforestation** is happening at an increasing rate, and there is also an increasing amount of **greenhouse gases** emitted from animal production. Greenhouse gases cause **global warming**, which is a worldwide issue that leads to **increased natural disasters**, such as tropical storms and drought, as well as **rising sea levels**, which floods homes and decreases the amount of habitable land.

Habitat destruction

Many habitats are destroyed by humans to **make space for other economic activities**, or by **pollution** from these activities. Consequently, the **biodiversity** of many places is decreasing. This **interrupts food chains and webs** and means that more species may die because their prey is gone.

Main causes of habitat destruction:

- **Clearing land for farming and housing** - crops, livestock and homes all take up a large amount of space. As there is an increasing population and demand for food, the amount of land available for these things must be increased by clearing habitats such as forests (deforestation).
- **Natural resource extraction** - natural resources such as wood and stone must be gathered to make different products. Therefore many trees are cut down, destroying forest habitats. In addition, some resource extraction takes up a large amount of space, for example mining, which means that the land must be cleared first.
- **Marine pollution** - human activities lead to the pollution of marine habitats. In many places, oil spills and other waste pollutes the oceans, killing sea life. In addition, eutrophication can occur when fertilisers from intensively farmed fields enters waterways. This causes a huge decrease in biodiversity as most species die.

Deforestation:

Deforestation involves cutting down large amounts of trees to gather as resources for manufacturing or to clear space for other economic activities. This has a large amount of undesirable effects:

- **Extinction** - habitat destruction can lead to the extinction of species that lived there.
- **Soil erosion** - without roots to anchor the soil, it is carried away by the wind and heavy rains. This decreases the fertility of these areas.

- **Flooding** - forests prevent flash flooding by slowing the time that water takes to reach the ground. They also allow the water to be absorbed into the soil.
- **Increased carbon dioxide in the atmosphere** - Trees absorb carbon dioxide from the atmosphere during photosynthesis. If there are fewer trees, less carbon dioxide is absorbed, thus there is more in the atmosphere. This increases global warming.

Pollution

Human activities have led to the pollution of **land, water and air**. This has a variety of negative outcomes, including **global warming and habitat destruction**. Pollution comes from a variety of sources, including industry and manufacturing processes, waste and discarded rubbish, chemicals from farming practices, nuclear fall-out, and untreated sewage. Plastics have a large negative impact on both land and water habitats due to their **non-biodegradability**. Animals often try to eat plastic or become caught in it, leading to injuries and death, which can affect whole the food chain. As plastics take a long time to break down, they accumulate in habitats which causes an increasing problem.

Eutrophication and water pollution:

Bodies of water, such as lakes, rivers and oceans, become polluted in a variety of ways, such as **oil spills, discarded rubbish, and chemicals**. One of the major pollutants to lakes and rivers is chemicals from **fertilisers**. When fertilisers are washed off fields into waterways, **eutrophication** occurs:

1. **Fertilisers** are washed from fields into the waterways by rain. This brings an **excess of nutrients** into the habitat.
2. The nutrients cause plants to **grow rapidly**, and there is an **algae bloom** across the surface.
3. **Algae covers the surface** of the water, **preventing sunlight** from passing through. This means that **plants cannot photosynthesise** to produce energy so they begin to die.
4. As there are less plants to photosynthesise, **less oxygen** is released into the water. The dead plants are broken down by **decomposers**, which use up the remaining oxygen from the water.
5. The lack of oxygen causes organisms such as fish to die, **reducing the biodiversity** of the habitat.

Another cause of water pollution is **female contraceptive hormones**. These hormones are excreted from the body in **urine** and then make their way into the water supply, as they are not filtered out by sewage treatment plants. When they reach male aquatic organisms, such as fish and frogs, which are very sensitive to the hormones, it causes **feminisation**. This is where male organisms begin to **produce eggs** and **lose the ability to reproduce**. Consequently, a **small amount of offspring** is produced which can harm the species survival and also **disrupts the food chain** for animals that usually feed off these organisms. In addition, these hormones can **reduce the sperm count** in men, which causes fertility problems.

Air pollution:

The main pollutants of air are **methane and carbon dioxide**. These are released into the atmosphere due to farming practices and manufacturing, especially during the burning of **fossil fuels**. Although these gases are released in small quantities naturally, human activity has greatly increased the rate of their emission.

Air pollution leads to a number of environmental problems: carbon dioxide and methane contribute to the increasing rate of **global warming and climate change**, as well as causing **acid rain**. Global warming occurs when greenhouse gases rise into the atmosphere and form a layer around the Earth, **preventing heat from the Sun escaping** the atmosphere. This means that the climate of Earth becomes **hotter**. **Acid rain** is caused by carbon dioxide dissolving in rain water to form **carbonic acid**, and sulphur dioxide dissolving to make **sulphuric acid**. Acid rain then falls and accumulates in bodies of water and soils, causing a **change in pH** which may harm organisms living there. The acid also **corrodes** infrastructure and damages tree bark and leaves.

To reduce acid rain, **sulphur dioxide is removed from gases** before they are released into the atmosphere. Sulphur can also be **removed from fossil fuels** before burning, although this process is expensive. Soils and water can be made less acidic by adding **powdered limestone or slaked lime**.

Conservation

It is important to reduce the negative impacts that humans have on the environment to **conserve the biodiversity of ecosystems**. This means increasing the **sustainability** of resources and manufacturing. **Sustainable resources** are those which can be taken from the environment without the risk of them running out, i.e. they can be produced naturally as quickly as they are harvested. Resources such as coal and oil are not sustainable as **fossil fuels are non-renewable**. Others, such as wood and fish, can be harvested sustainably with the help of **quotas, education and re-stocking**.

Development should also happen sustainably. **Sustainable development** is defined as development which meets the needs of people today, as well as providing for an increasing population **without damaging the environment**. Development must be managed carefully to maintain sustainability. This involves cooperation between different players, from local councils and companies, to governments and NGOs, each of whom may have differing demands. For example, some companies may want to continue harvesting resources to protect jobs and profits, whereas other people may disagree as it could damage habitats.

Reducing waste:

Unsustainable practices can lead to **large amounts of waste**. This waste can be reduced by introducing **recycling** programmes. **Paper, glass, plastic and metals** can all be **reused and recycled**, which greatly reduces the amount of these materials polluting the environment or in landfills. It also reduces the demand on sourcing raw materials, which in turn reduces the amount of habitat destruction.

Sewage treatment:

Water treatment happens in three stages: **sedimentation, filtration and chlorination**. In sedimentation, **larger solids separate out** from the water to form sludge, whilst water and lighter particles which float on top are drained into another tank. This liquid is then passed through **gravel and sand filters** in **filtration** to remove any particles still left in the water. Finally, **chlorine** is added to the water to **kill microorganisms** such as bacteria which makes the water safe to consume.

Conservation of endangered species:

When the number of surviving organisms in a species becomes very low, the species is classed as **endangered**. This is harmful to a species as it greatly **reduces the gene pool** by decreasing the number of **alleles** available. This makes the species more **susceptible to disease** and less able to **adapt** to changes. Species can become endangered for a variety of reasons, such as **habitat destruction, climate change, hunting, pollution, and competition from introduced species**.

If an endangered species is not protected, it can become **extinct**. There are many measures that can be used to protect a species from extinction:

- **Monitoring** - endangered animals can be monitored. This allows the number of organisms left to be tracked over time and can also highlight their preferred habitats and migration patterns, allowing important habitats to be protected.
- **Education** - this allows people to understand why a species is becoming extinct so that protective measures can be implemented.

- **Captive breeding programmes** - endangered animals can be bred in captivity where their chance of survival is greater. They can later be reintroduced to habitats in the wild.
- **Seed banks** - seeds from endangered plant species can be preserved so that the plants may be grown in the future.

Conservation is important to **prevent the extinction** of species and to **protect the environment**. It is important to protect these things to **improve sustainability** and to make sure that there are **resources available in the future**.