

CAIE Biology IGCSE

20: Human Influences on Ecosystems

Notes

(Content in **bold** is for Extended students only)

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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.



Habitat destruction

Biodiversity is the number of different species that live in an area. 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 enter 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 the whole 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.

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**. Global warming occurs



when greenhouse gases rise into the atmosphere and form a layer around the Earth, **preventing heat from the Sun escaping from** the atmosphere. This means that the climate of Earth becomes **hotter**.

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**.

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, overhunting 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.



Artificial insemination and in vitro fertilisation are often used in captive breeding programmes for endangered species.

Artificial Insemination:

Artificial insemination is where sperm from a male animal is collected and is introduced manually into the female reproductive tract. This means controlled breeding can occur without direct contact between animals. This reduces the risk of disease transmission as there is no direct contact. This also increases the **genetic diversity** of the species, as the genetic material of individuals who are geographically separated can be combined.

In vitro fertilisation:

In vitro fertilisation involves the fertilisation of an egg and a sperm outside the body. The eggs and sperm are collected separately and fertilised in a lab. The embryo is then implanted into the female's uterus. This can be used when mating naturally is unsuccessful. In vitro fertilisation also allows the combination of genetic material from individuals that are geographically separated, increasing **genetic diversity**.

Methods of conservation of forests:

- **Replanting** - Replanting trees can restore deforested areas.
- **Quotas** - Implementing quotas on logging can improve sustainability and protect the biodiversity of tree species.
- **Protected areas** - Protecting endangered species and their habitats, conserving biodiversity.
- **Education** - Allows logging companies to be aware of sustainable practices. It also allows consumers to be informed of the importance of buying products made from sustainable practices.



Methods of conservation of fish:

- **Education** - Educating fishermen of local and international laws allows them to be more aware of sustainable practices. Educating consumers makes them aware of unsustainably produced fish, helping them avoid buying these types.
- **Quotas** - Controlling the number of fish caught in each region each year prevents overfishing.
- **Controlling net types and mesh size** - The size of the fish caught can be controlled: younger fish should be avoided to allow them to breed. A larger mesh size means younger fish can escape from being caught.
- **Protected areas** - These areas can help protect endangered species of fish, preserving marine biodiversity.
- **Closed seasons** - A certain period of time in the year where fisherman cannot fish for specific types of fish.
- **Monitoring** - Changes to populations of species can be monitored. Assessment of the marine ecosystem's health should be conducted to investigate the impact of human activities on the ecosystem.

Reasons for conservation programmes:

- **Maintaining and increasing biodiversity** - This is important for maintaining the balance and functioning of the ecosystem, for example by reducing damage to food chains.
- **Reducing extinction** - Conservation protects endangered species and their habitats and prevents them from going extinct.
- **Protecting vulnerable ecosystems** - Protecting and regenerating habitats will help protect species that live there.
- **Maintaining ecosystem functions** - Ecosystems provide essential services which are vital for human survival. For example, the supply of food, water, medicinal drugs and fuels comes from ecosystems. Ecosystems also have important functions such as nutrient cycling, which allows the recycling of nutrients that organisms need to live.

