

Human Ecology Notes

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Human activities have more impact today than at any other time in the history of our species. Humans have wiped out entire species, laid waste to landscapes and polluted water ways to the point where even microbial life is near impossible. That is our power, the power to change nature to suit our needs. But with immense power comes immense responsibility! We can destroy but we can also create 😊

Biodiversity: the variety of living organisms in an area or habitat.

Life on earth is dependent on the interactions between billions of living things. The grazers are dependent on the growth of grasses. Predators are dependent on their prey. Decomposers are dependent on breaking down dead organisms & plants depend on these nutrients to grow. The circle of life as Mufasa would say 😊

How do humans cause the loss of biodiversity?

1. **Agriculture:** intensive farming reduces biodiversity by:
 - Using herbicide (chemicals that kill all plants) to reduce the competition between crops and weeds.
 - Using pesticides (chemicals that kill insects) to reduce insect damage to the crops. This leaves fewer insects for birds to eat, therefore there would be fewer birds.
2. **Deforestation:** the permanent removal of large areas of forest. This reduces biodiversity by:
 - Reducing the habitats available to animals and plants.
 - Reducing the food available to animals that rely on the rainforest for food.
3. **Overfishing:** continually fishing on populations of fish. This reduces their population.
 - Fewer fish means fewer predators can survive. This affects the entire food chain.
4. **Pollution:** this can poison an environment or make the animals very sick. This reduces biodiversity by:
 - Killing or reducing the number of animals in a habitat.
 - Reducing the fertility of organisms in a habitat. Lower fertility means fewer healthy offspring are produced.
 - Decreasing the microbial flora of the habitat.

What can humans do to maintain/increase biodiversity?

Do less intensive agriculture, stop deforestation, stop over fishing and reduce pollution.

Fish Farming

What is it? Large numbers of fish are kept in underwater tanks or large nets. They are fed and they grow, when they reach the correct size/ maturity they are collected.

What do we need to know?

The benefits	The negatives
• <u>Less energy is needed</u> as the fish farmer knows where the fish are so he/she doesn't have to go looking for them. • <u>Wild fish stocks are preserved.</u> • <u>The fish are protected from predators.</u> • <u>Fish can grow faster</u> than in the wild.	• As the fish are in an enclosed space, <u>any diseases can spread rapidly.</u> • Fish <u>waste can cause eutrophication.</u> • <u>Cost of feeding the fish adds to the overall costs.</u> • <u>Cages can be damaged by weather this could kill or free the fish.</u>

Eutrophication

Eutrophication: a process in which nutrients, particularly phosphorus and nitrogen, become concentrated in a body of water, leading to growth of algae.

This is usually caused excess fertilisers or sewage getting into the body of water.

Questions on eutrophication can appear in anything from a 1-mark multiple choice questions to a 6-mark long answer question. Below I have given an ideal 6-mark answer on Eutrophication, it includes all details and key phrases that you will need for full marks 😊 I hope it helps.

Take the following example as a typical question:

Example 1: *A large amount of untreated sewage entered the river. Many fish died. Untreated sewage contains organic matter and bacteria. Explain why many fish died.*

Ideal answer

Stage 1: Excess nitrates are washed into a body of water. This is usually due to heavy rain.

Stage 2: These excess nitrates cause all plants in the water to grow and reproduce.

Stage 3: Algae, microscopic plants, in the water grow rapidly. This is called an algae bloom. It grows so much that it covers the surface of the body of water.

Step 4: This blocks sunlight to the underwater plants. These plants then die.

Step 5: Decomposing microorganisms increase in number with all of the dead material around. As they break down the dead matter, they respire aerobically, which uses up all of the oxygen in the water. No new oxygen is being produced as the aquatic plants are dead. The body of water is now in an anoxic condition.

Step 6: There is not enough oxygen left to support much animal life and animals die in large numbers. If fish die in large numbers it is called a "fish kill".

Conservation

Conservation: protecting the natural environment to ensure that habitats and organisms are not lost.

What can humans do to help in conservation?

1. Establish wildlife preserves or national parks – these will preserve habitats and food sources for many species.
2. Captive breeding and release programs – this will increase the number of endangered animals and if they are released this could increase the numbers of the animals in an area. The reintroduction on red kites to England has been a huge success 😊 Recently they have reintroduced beavers to the UK. Many reintroduction programs are working very hard to bring all of these incredible animals back.
3. Reforestation – replanting large areas of woodland to provide a valuable habitat for thousands of animal and plant species.

What do I need to know about conservation?

The benefits	The negatives
• <u>Maintaining biodiversity</u> – this allows the largest number of <u>species to survive and thrive.</u> • <u>Ecotourism</u> – people travel all over the world to see animals in their natural habitat. <u>This creates a lot of jobs and opportunities for some countries.</u> • <u>Further discovery</u> – we do not know everything about the habitats that we study, <u>there is so much more to learn.</u> This may allow us to develop <u>new medicines in future.</u>	• <u>Conservation work costs money</u> – it can cost money to set up and get going and maintain. • <u>Monitoring</u> – conservation work requires constant monitoring to <u>see if it is working.</u> • <u>Lack of understanding</u> – local people in one area might wish to get rid of the animals if they are disrupting their way of life. <u>Education programs would be required to help the local people.</u> If the local people are not on board with conservation then nothing will change.

Food Security

Food security: the ability of human populations to access food of sufficient quality and quantity.

Food security is very important! This has been highlighted with Brexit and panic buying in supermarkets at the beginning of the COVID19 pandemic.

Food security is **reduced** by the following:

1. **The increase in human population** – as birth rates are increasing and many people have better access to medical care. This means there are simply more people that need food.
2. **Increasing consumption of meat and fish** – more land must be cleared for herds to graze and more bays and inlets given over to fish farming.
3. **New pests and pathogens that attack crops and farm animals** – this could reduce farm output or lead to localised famine in some areas.
4. **Environmental changes such as global warming** – this can cause more extreme weather, more droughts or floods which will reduce crop yields.
5. **Increased costs of farming** – this could reduce the number of people farming. This could reduce the amount of land being used to produce food again resulting in less food being produced.
6. **Armed conflicts** – peace is vital for trade and safe transport of food. If an area is not safe people are not likely to bring food into it. Also armed conflict reduces how many people are able to work on farms.
7. **Sustainability** – more land is used for infrastructure, housing, and growing crops for biofuels each year. This reduces the amount of land available for food farming

How can we increase food production?

To meet the demands of a growing population, farmers use modern agricultural methods to maximise their yield. However, these methods often come with ethical or environmental costs!

1. **Intensive animal farming (factory farming):** animals are kept indoors in temperature-controlled, restricted spaces. Because they cannot move around much or lose heat, less energy is wasted on respiration, so more energy goes into producing meat or eggs.

The negative: this raises massive ethical and animal welfare concerns. Keeping animals packed closely together also drastically increases the risk of infectious diseases spreading.

2. **Chemicals (fertilisers and pesticides):** adding nutrients to the soil and killing pests increases crop yields.

The negative: as we saw earlier, fertilisers can wash into rivers and cause eutrophication. Pesticides can kill harmless insects (like bees) or build up in the food chain, reducing biodiversity.

Since the 1990's the world's population has increased by 50%. Let that sink in for a sec...

Biotechnology

Biotechnology: the use of biological processes or organisms to produce products.

A lot of food products that we eat are made using a biotech approach. Many medical treatments also use biotech to produce their products or to improve a type of treatment. Many biotech processes involve genetic engineering.

Genetic modification: a technique to change the characteristics of a plant, animal or micro-organism by transferring a piece of DNA from one organism to a different organism.

Genetically Modified (GM) Crops

We have already covered the process of genetic engineering. We won't be going through the stages for that here but we will look at the advantages and disadvantages of genetically modify crops 😊

What are genetically modifying crops? These are crop plants that have had their DNA altered by having a gene from another species inserted into their genome. This is done to give the plant a new desirable characteristic.

What sort of characteristics are we talking about here? Check out the list of possible ones below 😊

- **Herbicide resistance:** The plant survives weedkiller, so farmers can spray the whole field, killing only the weeds and reducing competition.
- **Pest/insect resistance:** The plant produces its own mild toxin that kills insects trying to eat it, protecting the yield.
- **Disease resistance:** The plant is resistance to certain viruses or fungi.
- **Improved nutritional value:** The plant is engineered to have extra vitamins like Golden Rice producing vitamin A.
- **Drought resistance:** The plant can survive and grow with very little water.

Advantages of GM crops:

1. **Increased crop yields** – we can engineer crops to be resistant to insects (so pests don't eat them) or resistant to herbicides (so farmers can kill weeds without harming the crop). This means more food is successfully grown and harvested.
2. **Improved nutritional value** – crops can be engineered to contain extra vitamins. For example, Golden Rice has been genetically modified to produce a chemical that turns into Vitamin A in the body, helping to prevent blindness in developing countries.
3. **Growing in harsh conditions** – crops can be modified to survive in extreme environments, such as droughts or flooding.

Disadvantages and concerns:

1. **Impact on wild populations** – there are concerns that GM crops could cross-breed with wild plants to create "superweeds", or that pest-resistant toxins could harm innocent insects (like bees), reducing biodiversity.
2. **Human health concerns** – some people are worried about eating GM foods because the long-term effects on human health have not been fully explored yet.

Exam note: If a question asks you to "**evaluate the use of GM crops**", make sure you give at least one advantage and one disadvantage to get the marks 😊