Human Impact, Conservation, and Pollution

Matthew Williams • Biology • May 8, 2026

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This page covers the part of Section A where ecology meets real life: how human activity affects ecosystems and how careful management can reduce damage.

Natural Resources

Natural resources are materials or energy sources obtained from the environment.

Renewable Resources

Renewable resources can be reused or replenished quickly if managed properly. Examples include solar, wind, tidal, and geothermal energy.

Non-renewable Resources

Non-renewable resources exist in limited amounts and cannot be replaced quickly. Examples include coal, oil, natural gas, and minerals such as bauxite. Fossil fuels take millions of years to form, so they are effectively lost once used.

Bauxite is the ore from which aluminium is obtained. Mining bauxite can support industry and exports, but it can also damage habitats, remove vegetation, and disturb soil if not managed carefully.

Human Impact on Ecosystems

Human activities can change ecosystems faster than many organisms can adapt.

Major human impacts include:

- deforestation
- pollution
- burning fossil fuels
- mining
- overfishing

- poor waste disposal
- habitat destruction
- introduction of invasive species
- overpopulation
- heavy use of agricultural chemicals
- poorly planned tourism development

Deforestation

Deforestation is the removal of forests.

Effects include:

- habitat destruction
- reduced biodiversity
- soil erosion
- increased carbon dioxide in the atmosphere
- reduced photosynthesis
- global warming
- flooding
- extinction of species

Climate Change

Greenhouse gases trap heat near the Earth's surface. Carbon dioxide and water vapour are examples of greenhouse gases.

Human activities such as burning fossil fuels and deforestation increase carbon dioxide levels.

Possible effects include higher global temperatures, melting ice caps, rising sea levels, ocean acidification, flooding of low-lying areas, changes in rainfall patterns, and stress on crops and ecosystems. Small island states are especially vulnerable because many communities, roads, hotels, beaches, wetlands, and coral reefs are close to sea level.

A clear climate-change answer follows the chain: more greenhouse gases ’more heat trapped ’ global warming ’environmental effects.

Invasive Species

An invasive species is a species introduced into an area where it is not native and where it causes harm.

Invasive species may outcompete native species, have few natural predators, spread disease, damage crops, alter food webs, and reduce biodiversity.

Pollution

Pollution is the addition of harmful substances to the environment. These harmful substances are called pollutants.

Air Pollution

Pollutant	Common Source	Effects
Sulphur dioxide	burning fossil fuels, industry	irritates lungs, forms acid rain
Nitrogen oxides	vehicle exhausts, industry	respiratory problems, acid rain
Carbon monoxide	motor vehicle exhaust	combines with haemoglobin and reduces oxygen transport
Carbon dioxide	combustion, deforestation	contributes to global warming

Acid Rain

Sulphur dioxide and nitrogen oxides can react with rainwater to form acids.

Effects of acid rain:

- damages forests
- damages crops
- acidifies lakes and streams
- harms aquatic organisms
- can make water unsuitable for fish

Water and Land Pollution

Water and land pollution can come from:

- sewage
- fertilisers
- pesticides
- oil spills
- plastics
- industrial waste
- household garbage

Effects include:

- death of aquatic organisms
- spread of disease
- eutrophication
- blocked waterways
- contaminated food chains
- reduced habitat quality

Agricultural pollution may come from chemical fertilisers and pesticides. Fertilisers can be washed into rivers and seas, where they may encourage excessive algal growth and reduce oxygen availability for aquatic organisms.

Pollution answers are clearest when they connect source ’pollutant ’effect. For example: vehicle exhaust releases carbon monoxide, which combines with haemoglobin and reduces oxygen transport in the blood.

Marine and Wetland Pollution

Marine and wetland ecosystems are especially important in the Caribbean. They support fisheries, tourism, coastal protection, biodiversity, and recreation.

Pollution of marine and wetland environments can:

- reduce fish and shellfish populations
- damage coral reefs and seagrass beds
- lower the aesthetic value of beaches and coastal areas
- reduce tourism income
- harm human health through contaminated seafood or water

- weaken natural coastal protection

Polluted runoff entering a coral reef can reduce water quality, encourage algal growth, and make the reef less attractive for tourism while also damaging the habitat of many marine organisms.

Waste Management and the 3Rs

Waste may be biodegradable or non-biodegradable.

Biodegradable waste can be broken down by microorganisms.

Non-biodegradable waste cannot be broken down easily and may remain in the environment for a long time.

The 3Rs are:

Strategy	Meaning	Example
Reduce	use less material in the first place	avoid disposable cutlery
Reuse	use an item again instead of throwing it away	reuse a bottle as a container
Recycle	process waste material to make new products	recycling paper, glass, or plastic

Recycling conserves land, reduces pollution, saves energy, saves raw materials, and reduces the amount of waste sent to landfills.

Recycling may be difficult because people must sort garbage correctly, collection systems must be organised, and recycling may cost more than using raw materials.

Conservation

Conservation is the careful management and protection of natural resources and ecosystems.

Conservation methods include:

- recycling
- reducing pollution
- using renewable energy
- proper waste disposal
- protecting forests

- replanting trees
- sustainable fishing and farming
- organic agriculture
- using more natural materials in agriculture where suitable
- reducing harmful emissions
- public education
- monitoring environmental conditions
- protecting endangered species
- managing national parks and reserves

> **Conservation and preservation**
> Conservation means using resources carefully so they remain available. Preservation means protecting an area or species from use or disturbance as much as possible.

Sustainable Use

Sustainable use means using resources at a rate that allows them to be replaced naturally or managed for future use.

Examples:

- catching fish only above a certain size
- replanting trees after logging
- rotating crops to protect soil
- using renewable energy where possible

Practical and Data Skills

Human impact questions may use graphs, tables, maps, or field investigations.

You may be asked to:

- interpret changes in pollution levels
- compare biodiversity in two habitats
- explain changes in population size
- design a field investigation
- identify variables and controls
- suggest improvements to an ecological investigation
- estimate density of organisms in a habitat

Field Investigation Example

Aim: To compare the number of plant species in a shaded area and an open area.

Possible method:

- 1. Place a quadrat randomly in the shaded area.
- 2. Count the number of different plant species inside the quadrat.
- 3. Repeat several times in different positions.
- 4. Repeat the same method in the open area.
- 5. Calculate and compare the mean number of species.

Variable Type	Example
Independent variable	habitat type: shaded or open
Dependent variable	number of plant species
Controlled variables	quadrat size, number of samples, sampling method

Useful precautions:

- use random sampling to reduce bias
- use the same quadrat size each time
- take several samples, not just one
- record results in a clear table

Sampling Methods

The best sampling method depends on the habitat and organism.

Method or Equipment	Best Used For
Quadrat	estimating plant or slow-moving organism distribution in a measured area
Line transect	studying how organisms change along a line across a habitat
Belt transect	sampling a strip of habitat, useful where conditions change across an area
Pooter	collecting small insects safely
Net	collecting flying insects or aquatic organisms
Sieve	separating small organisms from soil or leaf litter

Bottle or jar	temporary collection and observation
Mark, release, recapture	estimating population size of mobile animals

Density can be estimated as:

$$\text{Density} = \frac{\text{total number of organisms}}{\text{area sampled}}$$

For ecological sampling, the method should match the organism. A quadrat suits plants better than flying insects; a net suits flying or aquatic organisms better than rooted plants.

> **Core idea**
> Human activity can damage ecosystems, but conservation, sustainable use, pollution control, and better waste management can reduce the impact.

[Code: flashcard[Human Impact and Conservation]]

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Renewable resource === A resource that can be reused or replenished quickly if managed properly.
Non-renewable resource === A limited resource that cannot be replaced quickly once used.
Pollution === The addition of harmful substances to the environment.
Acid rain === Rain made more acidic by pollutants such as sulphur dioxide and nitrogen oxides.
Conservation === Careful management and protection of natural resources and ecosystems.
Sustainable use === Using resources at a rate that allows them to remain available for the future.
Biodegradable waste === Waste that can be broken down by microorganisms.
Density === The number of organisms per unit area.
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