1.4.9 Human Impact on an Ecosystem

Pollution

Pollution is any human addition (contamination) to a habitat or the environment that leaves it less able to sustain life.

Chemicals of human origin that harm the environment are called ***pollutants***.
CO_2 from respiration is not a pollutant – excess CO_2 from burning fossil fuels is.
SO_2 from marshes & volcanoes is not – SO_2 from factory chimney is.

Some pollutants are normally present in an environment, e.g. CO_2, but levels are increased by human activity. Other pollutants never exist in an environment e.g. oil slick, CFCs.

Need to know the effects of one pollutant from any of the following areas: domestic, agricultural, industrial." and give an example of one way in which pollution may be controlled in the selected area.

Area	Pollutant	Source	Effects
Agricultural	Slurry & Fertiliser	Washed or leached from land	Formation of *algal blooms* and *eutrophication*
Industrial	Sulphur dioxide	Burning fossil fuels	Forms 'acid rain' More detail later
Domestic	Plastic bags	Shopping	Non-biodegradable Suffocate small animals, Litter

Area	Pollutant	Control Measures
Agricultural	Slurry & Fertiliser	Avoid spreading these: • on wet, waterlogged, frozen or steeply sloping land • within 1.5m of any watercourse.
Industrial	Sulphur dioxide	Fit catalytic scrubbers in factory chimneys
Domestic	Plastic bags	Bag tax/levy. Reuse/Recycle bags

Ecological impact of one human activity

Burning Fossil Fuels

Acidic oxides and acid rain

All rain is acidic – but not the same pH
CO_2 in the air dissolves in rainwater to form carbonic acid – pH = 5.5 in unpolluted air
Acid rain refers to very acidic rain with a pH of 4.5 or less (Note: pH 4.5 is 10 times more acidic than pH 5.5)

Acid Rain

Burning of fossil fuels releases acidic oxides into the air, especially SO_2 and nitrogen oxides (NO_x).
SO_2 dissolves in rainwater to form sulphurous acid (H_2SO_3) or reacts with particles in the air to form sulphuric acid (H_2SO_4).
The resulting rain is very acidic and can be carried far by the wind.

Effects of acid rain

- Reduces soil pH
- Phosphorus (*P*) binds to soil particles and is unavailable to plant roots
- *Al* becomes soluble and poisonous and with *K*, *Ca* and *Mg* is washed (leached) from the soil into lakes and water supplies
- Soil is impoverished and fish die in highly mineralised water. Why?
- Erodes limestone buildings
- Causes breathing difficulties – irritates the delicate lining of the lungs
- Inhibits chlorophyll formation and burns the leaves of plants

Acid rain is a 'trans-boundary problem'.
Norway 'imported' its acid pollutions from the English Midlands and the Ruhr valley in Germany.

Dealing with acid rain

Reducing the quantity of fossil fuels burned
Using catalysts to treat chimney gases ('scrubbers' are fitted to the insides of chimneys)
Catalytic converters fitted to modern cars
Developing alternative 'clean' energy sources.

Conservation

Conservation is the protection and wise management of natural resources and the environment.
Benefits of Conservation

1. Existing environments are maintained
2. Endangered species are preserved for reproduction
3. The balance of nature is maintained
4. Pollution and its effects are reduced

Need to know One Conservation practice from one of the following areas

Area	Conservation Practice
Agriculture	Mixed farming, Crop rotation Biological controls, Gene banks
Fisheries	Fishing Net size, Quotas, Re-stocking
Forestry	Re-planting, Broadleaf/conifer mix

Waste Management

is the collection, transport, processing, recycling or disposal of waste materials, produced by human activity, in an effort to reduce their effect on human health or local aesthetics or amenity.
It also tries to reduce waste materials' effect on the natural world and the environment and to recover resources from them.

Urban rubbish is mostly dust, dirt, hair, paper, food scraps, metal, glass and plastic.
Traditional disposal has been to bury rubbish in landfill sites or incinerate.

Landfill operation

The area being filled has a rubberized landfill liner is in place.
This prevents leaching materials migrating downward through the underlying rock.

One of the following is necessary

Waste management in:
Agriculture **OR** Fisheries **OR** Forestry

1.4.9 Waste Disposal & Micro-organisms

Problems with Waste Disposal

- Lack of availability of suitable landfill sites
- The toxic or polluting content of fumes from incineration (CO_2, other acidic oxides and dioxins – produced from burning plastic)
- Decaying waste produces methane gas which contributes to the “greenhouse gases”
- Harmful substances may leak into groundwater supplies (wells, lakes, reservoirs)
- Plants and animals in rivers and lakes may be killed through direct poisoning or eutrophication

Possible solutions

- Alter attitudes to littering, waste minimisation and disposal through education programmes.
- Use micro-organisms to degrade the rubbish and produce fuel pellets.
- Reduce the use of paper and recycle more paper.
- Replace non-biodegradable materials with biodegradable ones, e.g. bags made of paper instead of plastic.
- Increase incineration temperatures to avoid dioxin production and fit catalytic scrubbers inside chimneys.

At Present

- Tax has been placed on plastic bags.
- Rubbish sorting at source makes disposal more efficient e.g. Householders separate metals, paper, plastic, glass for recycling and ‘vegetable’ waste for composting.

Micro-organisms in Waste Management – Composting

Bacteria & Fungi

Bacteria and fungi are both used in the decomposition of organic matter in the process of composting.

Compost recycles all the nutrients required for plant growth.

Fungi break down the ‘tougher’ materials in the waste such as lignin and cellulose.

Their filamentous structure penetrates the composting material and helps to improve aeration and drainage in the compost heap.

The Compost Heap

Since it is aerobic the organic waste mixture to be composted must be turned and loosened to allow air into it.

Temperatures within a compost heap can reach 70˚C as the bacteria and fungi work to breakdown the material.

Pathogens e.g. human viruses and infectious bacteria, are unable to survive at such high temperatures.

The temperature at the outside of the heap is cooler than in the centre, so it is important to mix the pile to ensure maximum pathogen and weed seed kill.

Keep the pile ventilated or it will become too hot for micro-organisms to survive.

Suggestions for Waste Minimisation

Reduce – use less, minimise waste.

Re-use – use again, without changing but maybe for a different purpose.

Recycle – change, recover some material and use again.

Vermicomposting

A method of producing compost by using worms to turn biodegradable waste into very high quality compost.

The compost consists mostly of worm casts and decayed organic matter.

Role of micro-organisms in Pollution Control

Bacteria and fungi break down organic matter into compost that recycles all the nutrients required for plant growth.

This reduces environmental pollution caused by disposal of organic wastes in landfills and streams or by incineration.

1.4.9 Waste Management

Agriculture

The main problems here are the waste products from farms i.e.

- slurry
- silage effluent
- overuse / incorrect use of chemical fertilisers and animal manures – excess of these may enter watercourses and cause *algal blooms* and *eutrophication*.

Agriculture solution

Spreading the slurry on the land as a fertiliser. This must be managed accurately in order to maximise the value of the nutrients for crop production and minimise their impact on the environment.

Soil Nutrient Programmes aim to ensure optimum crop yields and protect the quality of water resources by avoiding pollution from agriculture.

Soil Nutrient Programme

The amounts of fertiliser applied can be determined to ensure optimum yields without causing environmental damage.

When devising a fertiliser programme the soil fertility status must be known on foot of regular soil testing.

There must be full recognition of all sources of nutrients, both organic and inorganic.

Regular soil testing is very important to help maintain a balance of nutrients in the soil.

Plastics on the farm

Plastic bags from fertiliser and plastic silage wrap strewn all around a farm is becoming a thing of the past.

Legislation on *Producer Responsibility Obligations* ensures that the plastic must be collected by the producers and dealt with appropriately.

Fisheries

Fish waste from fish landing and cleaning is a major pollutant of marinas and harbours.

Accumulated fish waste leads to:

- Unpleasant odours
- Infestations of rats
- Maggots
- Low O_2 levels in the harbour water due to decomposition of waste by bacteria

Solid organic by-products of the fishing industry were going to landfill.

This has been greatly reduced by recent legislation and dumping at sea is not an option (EU regulation).

New projects are testing various methods of management of fish wastes e.g. composting, anaerobic digestion, recycling of protein/oil etc.

Animal feeds and Oils

Fish offal is converted to fish meal and this is sold on as **animal feed** for e.g. chickens, pigs.

Some **oil is extracted** from the waste during the process and this is exported for further refining and then used in health food supplements.

Ensiling (converting to silage)

The fish waste is chopped and liquefied, then formic acid is added to it.

The resulting liquid silage can be used for fertiliser.

Fish waste Composting

Composting of fish waste is becoming more popular now and it results in a soil enhancer/fertiliser that is odour free, stable and easily stored.

This will probably become the favoured option for the industry in the near future.

Forestry

- Leaves from coniferous trees should not be allowed fall into rivers – make the water acidic
- Chemicals and fertilisers should not be allowed run off into waterways - algal blooms and eutrophication
- When trees are harvested only bare poles are removed so a lot of tree debris (called brash) and the stumps are left behind

Forestry solutions

- Waste Management in the forestry sector is all based on recycling.
- When the trees are harvested brash and the stumps are left behind.
- The stumps are sprayed with a urea-type compound which speeds up the decomposition process
- The brash is either left to decompose on the forest floor or collected and sold as a fuel source.
- In some of the larger sites the sawdust and debris is sold on for conversion to fibreboard e.g. MDF