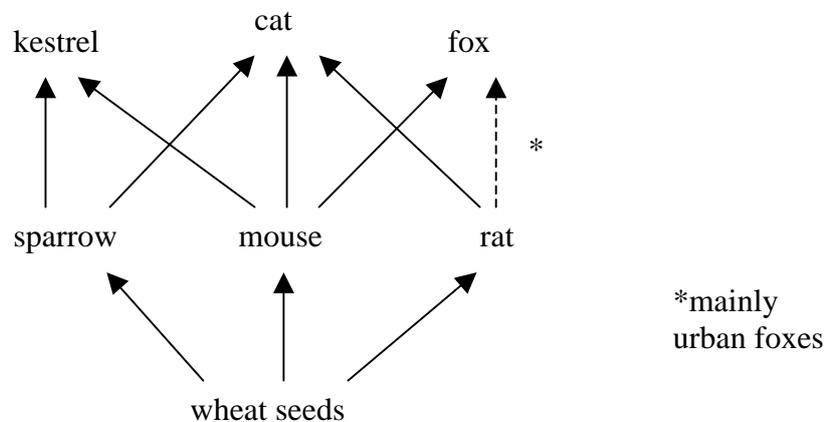


Section 5 Organisms and their environment

Chapter 25 The interdependence of living organisms

Page 228

1.



2. The tree and grass depend on the soil for anchorage, water and mineral nutrients.

The earthworm depends on the soil for making its burrows and for the humus it contains as a source of nutrients.

The soil depends upon the fall of leaves from the tree to renew its humus content and the earthworm uses leaves to pull into its tunnels. The soil also depends on the earthworms' tunnels for drainage and aeration as well as the improvement and mixing of soil structure from passing through the earthworm's alimentary canal. The blackbird depends on the earthworms as a source of nutrition and the tree as a place to perch or hide from predators.

3. Photosynthesis in vine leaves -- grapes -- grape juice fermented to wine.

Photosynthesis in grass -- eaten by cow -- milk from cow -- converted to butter.

Photosynthesis in wheat -- production of wheat grains -- eaten by chickens -- eggs.

Photosynthesis in leaves of bean plant -- seed production (beans).

4. Photosynthesis millions of years ago produced plants which became decomposed and fossilised to form petroleum or coal. Oil or coal burned to raise steam and drive generators.

Oil derived from fossilised plants (mainly algae or protista) becomes petroleum.

When this is distilled, one of the products is petrol.

Photosynthesis in oat plants results in the production of oat grains which are eaten by racehorses and provide energy from respiration.

Wind, waves and hydroelectric sources depend on energy from the sun but not specifically from sunlight. Tidal energy comes from the moon and the sun. Nuclear energy and geothermal energy (from the heat in the deep layers of the Earth) are independent of the sun. (not in text)

5. Long term observation will reveal what the fox and pigeon eat. This can be supported by evidence of their stomach contents at different times of the year.

Observation will also reveal which organisms eat the pigeons.

6. Domestic carnivores such as cats can catch and eat organisms to the point that the population is decimated. The animals above the victims in the food web will suffer or turn their attention to different prey.

Goats can eat the parts of plants that are usually unaffected by the indigenous herbivores. They may eat so much of the plants that they destroy the population altogether or reduce it so much that it cannot support its natural population of herbivores or insects.

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1. **a** Carbon atoms form the 'backbone' of the molecules needed by living organisms

(e.g. C - C - C - C - C - C carbon 'backbone' of glucose molecule $C_6H_{12}O_6$) for building all their body structures and supplying energy.

b glucose, sucrose, cellulose, amino acids, lipids.

c Animals get their carbon by eating plants or other animals.

2. **a** $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O$

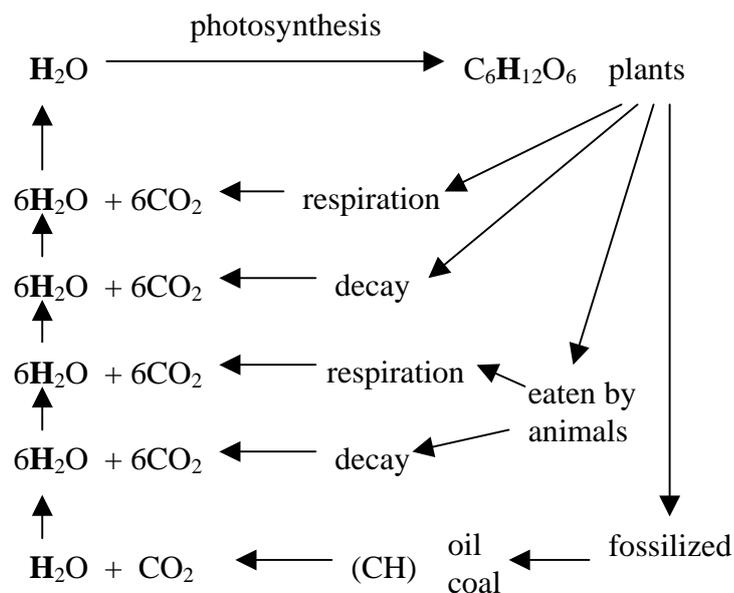
b $C + O_2 \longrightarrow CO_2$

c $6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6$

3. In the leaf, the carbon atom would be incorporated into a molecule of glucose by the process of photosynthesis. The glucose molecule would be carried in the phloem to the potato tuber which would combine the glucose molecules into starch.

When eaten, the starch molecules are converted to glucose molecules by the process of digestion. The glucose molecules are then oxidised by respiration and the carbon atom in a molecule of carbon dioxide is released.

4.



Page 230

1. The clover is a leguminous plant. These plants have root nodules which contain nitrogen-fixing bacteria. These bacteria can convert atmospheric nitrogen to nitrogenous compounds which are needed for healthy growth. Grass does not have root nodules and therefore suffers from nitrogen deficiency.

Page 231

1. To judge from the poor yield from plants deprived of nitrogen, this must be the mineral element which produces the most profound effect.

- | | |
|-----------------------------|----------------------------|
| 2. A (Nitrate added) | B (Nitrate removed) |
| nitrifying bacteria | denitrifying bacteria |
| nitrogen-fixing bacteria | leaching |
| manure | uptake by plants |
| chemical fertilizers | |
| lightning | |
| decomposition | |
| (of plants and animals) | |

3. **a** Advantages.

- (i) Manure. Freely available on mixed farms.
Contains organic material which improves soil structure.
Slow release of nutrients.
- (ii) Chemical fertilizer. Composition can be adjusted to meet needs of different soils.

b. Disadvantages

- (i) Manure. May not contain all essential elements e.g. trace elements, or the right balance of other minerals for a particular soil.
- (ii) Chemical fertilizers. Expensive. No organic matter to improve soil structure. More easily washed out.

Page 233

1. The energy for a muscle contraction in your arm comes from the respiration of glucose. The glucose is derived from carbohydrates in your food. These carbohydrates come from plants which have used the sun's energy to build them by photosynthesis. Photosynthesis depends on energy provided by sunlight.

2. The advantage would be that energy is not lost by the respiration of all the organisms in the food chain between the source and the final consumer e.g. eating plants instead of eating the animals which eat the plants. The disadvantage is that this would distort the food chain by depriving primary consumers of their food source, e.g. eating plankton would deprive fish of a food source.

Chapter 26 The human impact on the environment.

Page 239

1. It takes longer and therefore costs more to make up a quota of small fish. Removing small fish from the sea depletes the breeding stock.

2. All cereals, grass for silage, soya beans, and oil-seed rape may be grown as monocultures.

a Advantages: high yields per hectare; easy to harvest in bulk; the same treatment can be applied to the whole crop.

b Disadvantages: rapid spread of infestation, bacteria, fungi or insects; imbalance of minerals removed from the soil; bad news for bees and many other beneficial insects and the creatures which prey on them.

3. **a** Advantages: they keep weeds, fungi and harmful insects under control.

b Disadvantages: they kill harmless and beneficial insects as well as pests; they may get into the food chain.

4. In bad (cold) weather, the birds use their fat reserves as a source of energy. When the fat is metabolised it releases the DDT into the blood stream.

5. An excess of nitrate in river water allows microscopic algae to grow and reproduce rapidly. When this excess population of micro-organisms dies, the remains are oxidised to carbon dioxide and water, making excessive demands on the supply of dissolved oxygen in the water.

Page 241

1. Logging for timber, cutting down trees to make way for agriculture, destruction of trees for firewood.

Forest trees reduce erosion on sloping ground; their absorption of water and transpiration can affect local climate; on a global scale they help to slow down global warming by absorbing huge amounts of carbon dioxide; forests offer a habitat for a wide variety of animals not found elsewhere.

2. The trees intercept the rain and allow it to soak into the ground but not wash it away. Their roots also help to keep the soil together.

3. The furrows should run at right angle to the direction of slope, i.e. along contours. This helps to retain rain. If the furrows ran downhill, heavy rain could form channels and carry the soil away.

4. **a** On a hillside, the trees intercept heavy rain and allow it to soak into the soil. Removal of trees allows the rain-water to run off the slopes and flood the valley beneath.

b Clear felling the trees leaves huge swathes of ground totally unprotected. The transpiration from the trees previously created water vapour, clouds and local rainfall.

The bare soil heats up in the sunlight, disperses local cloud cover and reduces rainfall.

5. The insecticide kills the springtails. Their numbers diminish and so do the numbers of mites which depend on them for food. When the insecticide eventually goes, the springtail population increases once more, but now there are fewer mites to eat the springtails and so their numbers soar until the mite population recovers and starts to eat them again.

Page 242

1. If the poisonous chemicals are dumped, animals and plants in the vicinity may be harmed. If they are buried, the poisons may kill the plants growing above or may be leached out into ground water and find their way into public water supplies or rivers where they harm wildlife.
2. The water about to leave the waterworks may contain a small residue of bacteria. Exposure to chlorine kills any remaining bacteria and the chlorine eventually evaporates.
3. The mercury was taken up by and accumulated in fish until it reached poisonous levels.

Page 246

1. Tall chimneys deliver the pollutants into the air well above ground level, but the pollutants are still there and may eventually find their way back to the surface (See Figure 26.20).
2. Acid rain contains sulphur dioxide and oxides of nitrogen which come mainly from factories burning coal and oil, and from exhaust gases of vehicles.
3. Carbon dioxide and methane both absorb long wave radiation reflected from the Earth's surface and cause the atmosphere to warm up.

Chapter 27 Conservation

Page 249

1. Extinction can result from excessive hunting, destruction of habitats, introduction of alien species.
2. CITES concentrates on banning trade in endangered species by persuading countries to pass laws forbidding such trade. WWF adopts a variety of strategies for protecting endangered plants and animals. For example they may attempt to prevent excessive hunting, or the destruction of habitats. Both organisations may attempt to get laws passed to restrict human activities which threaten wildlife and both are dedicated to the preservation of biodiversity.
3. **a** The extinction of certain wild plants may deny us the chance to develop new drugs from their products.
 - b** If a plant becomes extinct its genes are lost for good. Some of these genes from drought-tolerant plants could have been introduced to crop plants.

Page 251

1. **a** Biodiversity means the mixture of plant and animal species which comprise a community.
 - b** Sustainable development means the development of any kind of industry, farming or technology which does not permanently destroy habitats or reduce biodiversity. Felling trees, for example is not sustainable unless new trees are planted at the same rate.
2. An Area of Special Scientific Interest is a naturally occurring environment on privately owned land but governed by rules concerning its maintenance.

A Nature Reserve is also a natural habitat but managed by an organisation to maintain and possibly improve its community of wildlife.

Page 252

1. Any renewable resource used to produce energy will have come ultimately from a plant source, e.g. firewood, sunflower oil for diesel, sugar cane for ethanol. The plant source will have depended on photosynthesis for making these products.
2. The energy used to recycle products will be less than the energy needed to produce them in the first place. For example, the energy needed to melt aluminium is less than the energy needed to mine the ore and extract the metal.