

## Biology

### Human Influences on the Environment

Every Humans influenced their environment, but the enormous size of the population today and the extent of our industries mean that we affect the environment much more ~~sight~~ significantly. We make increasing demands on the environment for:

- Food to sustain an even-increasing population.
- Materials to build homes, schools and industries.
- Fuel to heat homes and power vehicles.
- Space in which to build homes, schools and factories, as well as for leisure facilities.
- Space in which to dump out waste materials.

## Modern Agriculture:

A modern farm is a sort of managed ecosystem. Many of the interactions are the same as in natural ecosystem. Crop plants depend on light and mineral ions from the soil as well as other factors in the environment. Stock animals (sheep, cattle, and pigs) depend on crop plants for food.

## Improving yields from crop plants:

Ex. Glasshouses (otherwise known as 'greenhouse') and polytunnels can provide very controlled conditions for plants to grow. There are several reasons for this:

- The transparent walls of the glasshouse allow enough natural light for photosynthesis during the summer months, while additional lightings gives a 'longer day' during the winter.

(3)

- The 'greenhouse effect' doesn't just happen to the Earth, but also in greenhouse! Short wavelength infrared radiation entering the glasshouse is absorbed and re-radiated as longer wavelength infrared radiation. This radiation cannot escape through the glass, so the glasshouse heats up. The glasshouse also reduces convection currents that would cause cooling.
- The glasshouse can be heated to raise the temperature if the outside temperature is too low.
- If heaters use fossil fuels such as gas, this produces carbon dioxide and water vapour. The carbon dioxide is a raw material of photosynthesis. The water vapour maintains a moist atmosphere and reduces water loss by transpiration.



(4)

- If the plants are grown in a hydroponic culture this provides exactly the right balance of mineral ions for the particular crop.

#### ■ Cycling Nutrients on a Farm:

Nitrates from the soil supply nitrogen that is needed to make proteins in plants. Some of these plants are crops that will be sold; others are used as food for the stock animals (fodder). When the crops are sold, the nitrogen in the proteins goes with them and is lost from the farm ecosystem. Similarly, when livestock is sold, the nitrogen in their proteins (gained from the fodder) goes with them and is lost from the farm ecosystem. Similarly, when livestock is sold, the nitrogen in their proteins (gained from the fodder) goes with them and is lost from the farm ecosystem. To replace the lost nitrogen, a farmer usually adds some kind of fertiliser. The amount of fertiliser added must be carefully monitored to ensure the

maximum growth and yield of the crop using excess fertiliser wastes money.

Fertilisers increase crop yield:

There are two main types of fertilisers -

(i) Organic and

(ii) Inorganic.

Many organic fertilisers (such as farmyard manure) are made from the faeces of farm animals mixed with straw. Inorganic fertilisers are simply inorganic compounds such as potassium nitrate or ammonium nitrate, carefully formulated to provide a specific amount of nitrate (or some other ion) when applied according to the manufacturer's instructions.

### Pest control:

Pests are organisms that reduce the yield of crop plants or stock animals. The 'yield' of a crop is the amount produced for sale. A pest ~~animals~~ can harm this in two ways:

(i) Lowering the amount by reducing growth, e.g. by damaging leaves and reducing photosynthesis.

(ii) Affecting the appearance or quality of a crop, making it unsuitable for sale.

Any type of organism - plants, animals, bacteria, fungi or protoctists, as well as viruses - can be pest. Pests can be controlled in a number of ways.

Chemicals called pesticides can be used to kill them, or their numbers can be reduced by using biological control methods.



Pesticides are named according to the type of organism they kill:

(i) Herbicides kill plant pests (they are ~~weeds~~ weedkillers).

(ii) Insecticides kill insects.

(iii) Fungicides kill fungi.

(iv) Molluscicides kill snails and slugs.

A farmer uses pesticides to kill particular pests and improve the yield from the crops or livestock. Pests are only a problem when they are present in big enough numbers to cause economic damage - a few whiteflies in a tomato crop are not a problem. A farmer's use of pesticides is largely a decision based on cost. The increase in income due to higher yields must be set against the cost of the pesticides.

## Problems with Pesticides

One problem with using pesticides is that a pest may develop resistance to the chemical. This happens through natural selection. It makes the ~~exista~~ existing pesticides useless, so that another must be found. Other problems are to do with the fact that pesticides can cause environment damage.

There are several reasons for this:

- (i) They may be slow to decompose - they are persistent in the environment.
- (ii) They build up in the tissues of organisms - bioaccumulation.
- (iii) They build up and become more concentrated along food chains - biomagnification.
- (iv) They kill other insects that are harmless, as well as helpful species. such as bees.



An ideal pesticide should:

- ① Control the pest effectively.
- ② Be biodegradable, so that no toxic products are left in the soil or on crops.
- ③ Be specific, so that only the pest is killed.
- ④ Not accumulate in organisms.
- ⑤ Be safe to transport, store and apply.
- ⑥ Be easy to apply.

DDT (dichlorodiphenyltrichloroethane).

DDT was invented in 1874, and first discovered to be an insecticide in 1939. In World War II it was used with great success to kill malaria carrying mosquitoes and the lice that carried typhus. Its use increased up until the 1960s, when we began to understand its harmful effects. It was banned from general use in the USA in 1972, and worldwide in 2004. Limited use of DDT is still allowed for control of insects that transmit disease, although this is still regarded as controversial.

☐ DDT is a very effective insecticide, so why has it been banned?

① DDT is very persistent, remaining active in the environment for many years. If DDT is sprayed onto a field, around half will still be there ten years later. To make things worse, the missing half won't have degraded to harmless products - some will have broken down to form a similar compound called DDE, which will also be a potent insecticide, and some will have spread to other habitats. DDT is carried all around the world by wind, and has been identified in polar ice caps and deserts, thousands of kilometres away from where it was applied.

② By the 1950s, many types of insect began to appear that were resistant to DDT. These insects had developed a genetic mutation that prevented them from being killed by the insecticide. While DDT continued to be used, the resistant insects had an advantage over the non-resistant ones. Their numbers increased with every generation since they were able to survive exposure to the pesticide. They reproduced - passing on their resistance genes to their offspring. This is an example of natural selection. There are now hundreds of examples