Food Production
Food production

- Food availability
- Intensive farming
- Sustainability
- Modifying food
- Summary activities
An increase in average **life expectancy** is largely responsible for the rapid increase in world population.

This is because of:
- better healthcare
- cleaner water
- better sanitation.

The biggest increase in population is in **economically developing nations** (i.e. Bangladesh), rather than **economically developed nations** (i.e. the US).

The current population growth is described as **exponential**, where the larger the population is, the faster it grows.
Growth rate and food security

The population growth rate has an impact on the global food security. With more people to feed, the likelihood of food shortages will increase.

In natural ecosystems, all of the energy in food (plants and animals) comes from the Sun.

Moving up each stage in the food chain, less material and less energy are contained in the biomass of the organisms.

One way to increase the efficiency of food production is to reduce the number of stages in food chains.
Energy transfer in a food chain

How is energy transferred in a food chain?

The Sun is the source of all energy. How is this energy transferred through a food chain?

Press "play" to find out more.
The length of food chains

This lion is a top predator – the final level in a food chain. However, most food chains have fewer than six species.

Why is this?

- Plants cannot absorb all of the energy from the Sun.
- Energy is lost at all levels in food chains. If a food chain was very long, animals at the top of it would not get enough energy to survive.
How energy efficient is it to eat meat?

Food chains can be used to understand why some foods cost more than others. This relates to the efficiency of food chains.

The first food chain is the most efficient because it contains fewest **trophic levels**, so less energy will be lost.
Is eating meat less energy efficient?

Cattle and other livestock are fed grain and cereals. Would it be more energy efficient if humans ate the plant crops instead?

If a one-acre field of corn is used to feed cows, it can support one person.

If the same area is used to feed humans directly, it can support 10 people.

Why is so much energy lost?
Energy loss in food chains

How is energy lost in food chains?

Organisms do not use all the energy from their food for growth.

Press on a trophic level below to find out how energy is lost.

- primary producer
- primary consumer
- secondary consumer
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Increasing efficiency

**Intensive farming** is an agricultural system by which farmers try to maximize production using the available land, plants and animals.

Intensive farming reduces the amount of energy lost in food chains and improves the efficiency of the food chain.

For example, animals are kept in warm conditions, and their movement is restricted so they transfer less energy as waste heat. The energy saved can be used to produce more meat, eggs or milk.
What are pesticides?

Pests are organisms that damage or compete with crops. **Pesticides** are used to destroy or repel pests.

The use of pesticides prevents pests from taking energy from crops. This allows the desired plants to produce more biomass.

Different types of pests require different types of pesticides.

- **insecticides** → kill insects
- **herbicides** → kill unwanted plants (i.e. weeds)
- **fungicides** → kill fungi (e.g. moulds and mildews)
Benefits of pesticides

How pesticides affect crop yield

Pesticides can increase crop yield by decreasing the amount of damage caused by pests.

Press on the plants below to learn how pesticides affect the production of each of them.
Intensive farming ethics

Do you agree with these opinions about intensive farming?

Mrs Jones (organic farmer)

"Intensive farmers use antibiotics to keep their animals healthy. I don't want antibiotics in my food. I think this is causing antibiotic resistance."

-5 -4 -3 -2 -1 0 1 2 3 4 5

disagree  not sure  agree
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Sustainability

Humans will always need resources. Our use of resources can be **sustainable** or **unsustainable**.

Sustainable practices can continue year after year without depleting the resources for future generations.

However, the unsustainable use of resources could lead to environmental degradation, where:

- resources are depleted
- habitats are destroyed
- the levels of pollution increase.
Unsustainable food production

Press on the unsustainable aspects of farming

The rising population means that more food must be grown, but much of modern farming is not sustainable. Press on each unsustainable farming practice in this image. There are three to find. Press "start" to begin.
Over-fishing has led to the stocks of some fish, such as cod, plaice and sole, becoming dangerously low in UK coastal waters.

**Fish stocks** are maintained by the EU Fisheries Council, who limit the net size and amount of fish that can be caught each year (a *quota*).

It is important to maintain fish stocks at a level where breeding continues, otherwise species may disappear.

This symbol shows that fish is from a sustainable source:
Deforestation destroys habitats, but wood can still be harvested in a sustainable way by:

- **replanting** – new trees are planted to replace those that are cut down

- **coppicing** – harvesting the stems of young trees and allowing them to regrow

Changing to more sustainable forestry requires education. In the UK, awareness campaigns mean more people now buy sustainable wood and paper.
Ecosystem vs. community

Decide what is favoured when feeding the growing population:

- The need to conserve the natural ecosystems
- The needs of the local human communities

Introducing a fishing quota
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GM crops

Crops can be given new genes for useful characteristics. They are known as **genetically modified (GM)** crops.

What characteristics might be useful in crops?

- pest resistance
- frost/drought resistance
- disease resistance
- herbicide resistance
- addition of nutrients
- longer shelf-life.
Pest- and frost-resistant crops

The gene for a powerful bacterial toxin is added to the potato plant so they are toxic to pests such as the Colorado beetle.

If the beetle tries to eat the potato plant, the beetle is killed by the toxin.

Crops can also be genetically modified to increase the yield, or so that they are resistant to adverse environmental conditions, such as lettuces that have been modified to resist frost.
The genetic modification of crop plants is one way to increase food production, particularly in developing countries.

Press on each tab to find out more about the GM crops and their implications.
Some people are concerned about the impact of genetically modified crops on the environment, and there have been many debates about whether we should eat GM foods.

Press "start" to read more.
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Glossary of keywords: food production

**biomass** – The organic material that makes up plants and animals.

**consumer** – An organism that feeds on plants or animals.

**coppicing** – A conservation technique whereby certain species of young tree and shrub are cut down to near ground level to encourage rapid shoot re-growth and enable sustainable harvesting.
Do you have enough energy to get through this quiz about food production?

Press "start" to begin.