

CAIE Geography Pre-U

2B: The Provision of Food

Detailed Notes



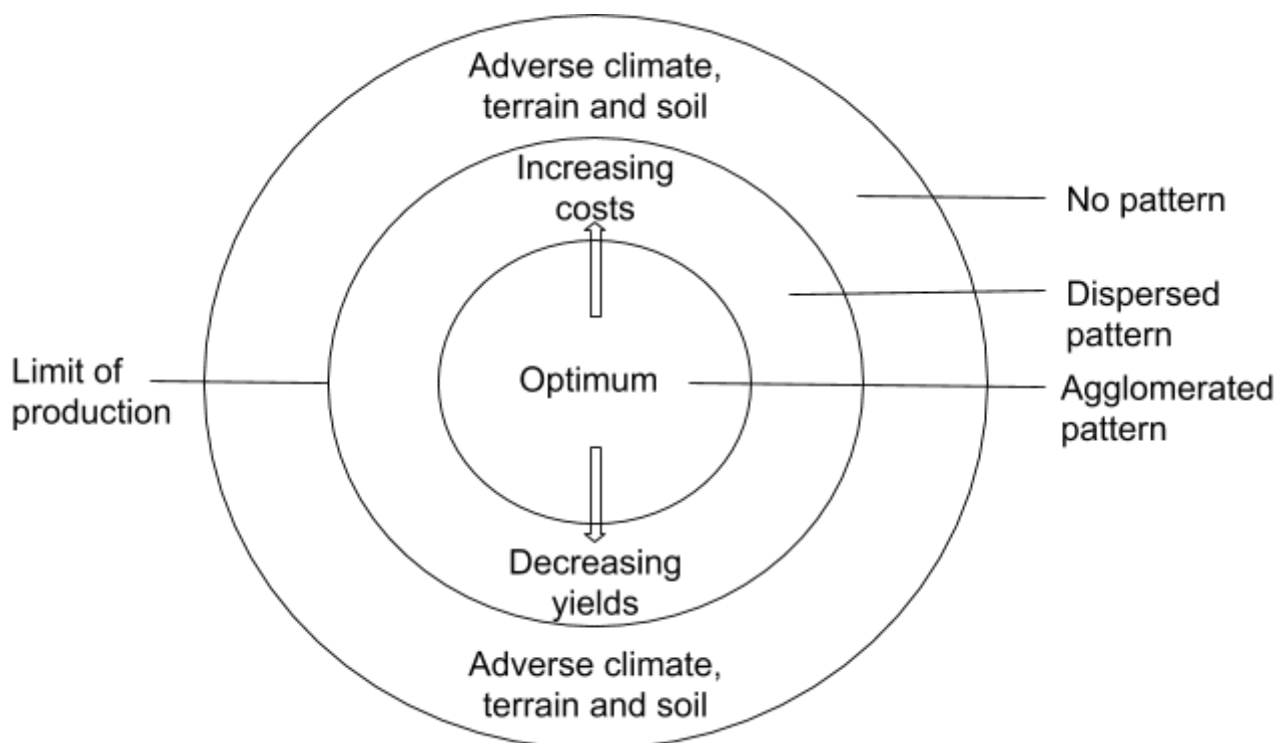
Classification and distribution

Physical constraints on food supply

There are many different **physical factors** which can affect food supply.

- **Insolation:** The amount, the number of daylight hours and how it changes seasonally.
- **Temperature:** The maximum and minimum temperatures both daily and annually and the length of the growing season.
- **Precipitation and water supply:** The amount of precipitation determines the crop type, levels of evapotranspiration and the seasonality of precipitation, which is more important than the total.
- **Wind** increases evapotranspiration which dries out the soil making it prone to erosion.
- **Relief:** Increases in altitude increases exposure to wind, cloud, snow and rain. The steepness of the slope affects the depth of the soil, the moisture content, pH and how easy access by machinery is. The aspect can affect the temperature and the levels of precipitation.
- **Soils:** Nutrient availability and soil structure.
- **Pests and diseases.**
- **Global warming and climate change.**

The optima limits model



The Optima-limits model of agricultural production shows that as the conditions of the environment move away from the optimum for that particular crop due to more adverse climate, terrain or soil, the resulting effect is decreased yields and increased costs. The patterns of farming of that crop becomes more dispersed as the distance from optimum conditions increases as less farmers plant the crop due to higher costs and lower yields.



Distribution of agriculture globally

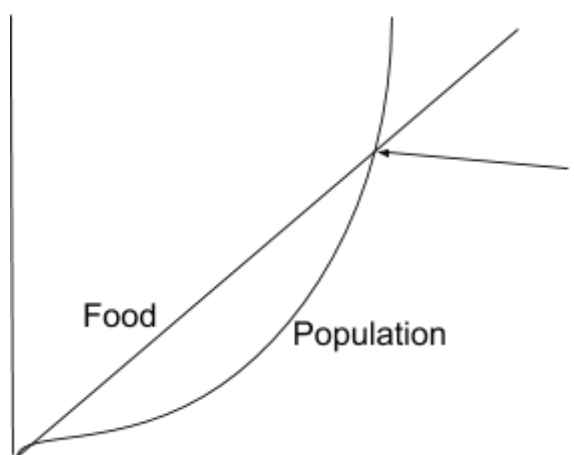
The **physical constraints** that act upon an environment will determine which **method of agriculture is used**. In arid and semi-arid areas like the Sahel in Africa, nomadic herding is mainly used to deal with the lack of rainfall. Areas with vast areas of grasslands might use extensive, pastoral farming methods compared with areas with smaller amounts of land which will farm intensively. Subsistence farming is mainly used in poorer countries where the majority of the population are involved in agriculture whereas in more developed countries commercial agriculture is used.

Carrying capacity

Carrying capacity is the number of people that a region can support with its basic **resources**. The people can enjoy a good quality of life without destroying the resources or the landscape.

Malthusian Theory of population growth

Malthus suggested that **famine was the inevitable result of population growth**. This is because the population increases **geometrically** (eg. doubles with each generation) whereas food



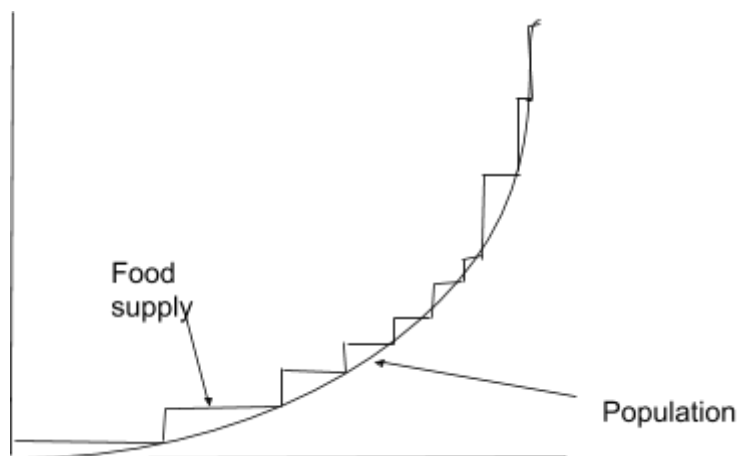
production can only increase **arithmetically** (eg. 2+2+2 etc.). When population outstripped food supply negative consequences would follow which would then decrease the population. Malthus' theory was disproved because humans invented new technologies which increased food supply significantly and regions are trading with each other.

The Club of Rome's limit to growth model

The Club of Rome's limit to growth model suggested that the human population would reach a point where the level of **food supply would determine the size of the human population** by decreasing birth rate and increasing death rate.

Ester Boserup

Boserup's hypothesis suggested that the **size of the population determines the agricultural methods used**. So if the population continued to rise then people would be more motivated to improve agricultural techniques. This is a very optimistic view and surely there would be a limit that humans could reach.



The Brundtland Report

The **Brundtland report** promoted sustainable economic development and highlighted the lack of regard for the environment and overconsumption of the human race. It also promoted the idea of a **sustainable carrying capacity** that would allow a decent standard of living for all humans without destroying the environment for future generations.

Commercial vs Sustainable

Commercial agriculture is concerned with producing crops or livestock in order to sell the product to **gain a profit**. Subsistence agriculture is producing crops or livestock to be **used by the family or community** with any excess being sold at a market or traded for other goods.

The benefits of commercial agriculture include:

- It's able to **feed the majority of people** in rapidly expanding populations.
- **Industrialisation** and **urbanisation** would not have been possible without the commercialisation of agriculture.
- The money made can be used to **buy fertilisers, pesticides and GM crops** which would improve yields.
- Not every member of the area has to be involved in agriculture which allows them to be **involved in other areas of society**.
- Workers receive a **constant wage** and it is not dependent on the level of crop production.

The benefits of subsistence farming are:

- People are **living in harmony with the environment** so there is little degradation of the environment.
- More **sustainable**.
- **Community-focused**.
- People are **self-employed** so are not at risk of being exploited.
- Mainly grow lots of different types of crops which means that the **soil is not damaged** and the crops have a lower risk of suffering from pests or diseases.

Location of major marine fish stocks

- **NW Pacific:** Salmon, Herring, Cod
- **NE Pacific:** Salmon and Cod
- **SE Pacific:** Anchovy due to the upwelling of cold currents
- **NW Atlantic:** Cod is the major fish where the Gulf stream and the Labrador current meet
- **Indian ocean:** Tuna and shrimp, other fish are limited due to the warmth
- **Southern Ocean:** The most productive in the world due to cold, oxygen-rich waters
- **Arctic Ocean:** Not much fish and hard to fish here due to ice cover, little plant life and a fragile ecosystem

Reasons for the locations of marine fish stocks

- **Abundance of plankton.**
- **Shallow coastal waters.**
- **Marine topography.**
- **Ocean currents:** Cold ocean currents are best as they are very nutrient-rich.
- **Ocean gyres** are circular ocean currents which help to transport nutrients.



- The **sublittoral zone** is where the water temperature and salt levels are stable and the waters are shallow.

Reasons for the locations of fish farming

Fish farming is the cultivation of freshwater and saltwater populations under controlled conditions.

- High levels of demand
- Shelter
- Allowed by the government

Supply of food in developed countries

Modernisation of food production after 1950

Involved the **intensification, concentration and specialisation** of agriculture with a focus on the **economics** of farming. It was a period of time where **agribusiness** became prominent, farmers were **increasing yields to the point of overproduction**, there were changes in **land tenure and farm size** and there were **significant landscape changes**.

Agribusiness' are those involved in any of the various parts of the food production chain from the production of machinery and agrichemical to marketing and retail sales. They normally own large, intensive farms aimed at **producing high yields at low costs**. They create a wide variety of food, allow the release of workers to non-agricultural endeavours and provide **better economic growth**. However, they can make it difficult for smaller farms to survive, **decrease biodiversity**, cause eutrophication due to the use of fertilisers, places **patents** on seeds and technology which increases the gap between the rich and the poor, and cause **land degradation**. Watch [this video](#) about the growth of agribusinesses in the UK.

Modernisation of food production has **increased agricultural yields to the point of overproduction**. This is due to higher levels of inputs, **high yield varieties** and the use of **fertilisers and pesticides**. This form of farming is often driven by **government incentives**. Although it means that the majority of people have access to all the food they require this form of farming can cause **land degradation** and water pollution for food that was not required, causes **small farms to collapse**, floods developing countries with surplus food and can **destabilise world markets**.

Farms have tended to **increase in size and more land is now owned by companies rather than families and communities**. Between 1950 and 1960 in the USA the **number of farms decreased by half** whilst between 1950 and 1965 the average farm size went from 205 to 400 acres. Although this lowers prices for farmers and consumers by allowing increased mechanisation and yields it also has many negative consequences. It causes **unemployment**, increases the consequences experienced by agribusinesses and **removes boundaries** to farms which are important for biodiversity.



The influence of agribusinesses and the increased size of farms have caused **significant landscape changes**. Hedgerows and trees have been removed, the fields have been made regular in shape, monocultures have been introduced and roads have been improved. This has caused the **destruction of habitats**, **decreased biodiversity**, lack of natural pest control and increased **soil erosion**.

The post-productionist phase of food production

Represented by the **extensification, dispersion and diversification** of agriculture and an increased focus on **conservation**. **Farm diversification schemes, stewardship schemes** and **bottom-up approaches** were all characteristics of this phase of food production.

Farm diversification schemes were aimed at adding different business activities to traditional farming such as alternative livestock, non-food crops or tourist accommodation. **More than half of England's 57,000 farms have diversified with a total income of £580 million between 2015 and 2016**. These diversification schemes allow a **greater income** for farmers and it protects farmers income if their crops fail.

Stewardship schemes include **milk quotas, set aside policies** where farmers are made to set aside areas of land which is not to be farmed, and the **Countryside Stewardship** which brings together all environmental schemes. Stewardship schemes **reduce overproduction, increase biodiversity** and are better for the environment.

Bottom-up approaches are **organic** and **low-impact techniques** aimed at maintaining the quality of the soil. Bottom-up approaches produce **food of high nutrient quality**, there are **no agrochemical inputs** so it is better for the environment and using techniques that do not disrupt the soils as much release **less CO₂** into the atmosphere.

However, there are some negatives to the post-productionist phase of food production:

- On average **organic yields are 25% lower** than that of conventional yields. This could lead to food insecurity or it might not be able to support a growing population.
- On average **organic food is 47% more expensive**.
- Set aside policies might **encourage more intensive farming** on the land that is being used which could have a more detrimental effect.

The neo-productionist phase of food production

The neo-productionist phase of food production involves the use of **subsidies, further intensification** of agriculture, the use of **GM crops** and **food insecurity**.

Governments are giving **subsidies** to farmers so that they are able to make a livable wage whilst still providing the consumers with cheaper produce. They also encourage increased production. The EU has an agricultural subsidy policy known as the **Common Agricultural Policy (CAP)**. The main subsidy is known as the **Basic Farm Payment** which gives money based on the **amount of land owned**. This means that richer farmers get large amounts of money and small farmers do not. **80% of CAP goes to 20% of farmers**. Subsidies can also cause **overproduction**, this can lead to waste or can flood developing countries with surplus food. Subsidies also divert trade away from more efficient farmers.



Further **intensification** of agriculture has occurred mainly in the form of mega-livestock farming which keeps animals inside with all food and water being supplied to them directly. It is very **efficient** and uses the least amount of input for the greatest amount of output. This type of agriculture has **risen by a quarter since 2011**. It **increases yields**, **lowers loss of energy** between the crops and livestock and is able to **feed a growing population**. However, it is **cruel** to the animals, **diseases** are more likely to spread and the large scale use of **antibiotics** can cause resistance and also has health effects of humans.

Genetically modified (GM) crops are where a plant or animal has had its genes altered or selectively bred to encourage favourable characteristics. They **increase the yields**, need **fewer fertilisers and pesticides** and are better at coping with **adverse conditions**. However, there are **possible health effects** and are often **patented** and so small farmers may lose out.

The neo-productionist phase of food production is also characterised by **increased food insecurity**. This is due to **increased food prices**, **pestilence**, **climate change** and the battle between the use of land for either **food or fuel** which will be discussed in case studies. Fewer food choices can cause diet-related diseases.

The exploitation of marine resources

In order to manage the exploitation of marine resources, many fisheries policies have been put in place. The EU's **Common Fisheries Policy (CFP)** is a set of rules for **managing European fishing fleets** and for **conserving fish stocks**. It allows equal access to EU waters, promotes sustainability and is focused on cooperation between nations. However, it is **over centralised**, **encourages waste** and big fisheries are able to grab other stocks. The CFP will be discussed in more detail in the case studies.

More efficient and larger trawlers have been developed that enable them to stay out at sea for longer and they can access new areas of the sea for fishing. This means that more fish can be caught leading to **increased depletion** of marine resources. Watch [this video](#) on the overexploitation of fish stocks.

The growth of fish farming

Farmed fish are less likely to run out and it is easy to sustain large levels of demand. Nowadays, a **quarter of the fish we eat comes from farmed sources**, this has **tripled in the last 20 years** with **90% coming from developing countries**.

Environmental impacts of fish farming include:

- **Disease and parasites** spreading to wild fish.
- **Pesticides** used can affect the ecosystem.
- Due to food and faeces falling to the bottom of the seafloor, the seafloor becomes covered with a layer of waste.
- **Loss of genetic diversity** can increase the spread of disease.
- **Seals and sea lions are shot** by the fishermen if they try to eat the fish.
- **Fish caught in the wild provide food for the fish in the farms** so still causes depletion of marine fish stocks.



- **Loss of natural habitat.**
- **Antibiotics** are used which can lead to resistance.
- Pollution can over-fertilise the water and **lead to toxic algae blooms.**

Economic impacts of fish farming:

- **Competes with wild fishing.**
- **Drives down the price** of fish.
- Affects the **tourism** industry due to the unpleasant site.
- **Small fisheries lose out.**

Supply of food in the wider world

The use of fertilisers and pesticides

Fertilisers are used to supplement essential plant nutrients to promote optimal production. They **increase the yields** of crops and **reduce the need for the conversion of wildlands into farmland.**

However, the fertilisers can wash into the waterways which can cause **eutrophication** and so kills aquatic life. Fertilisers can also lead to **increased depletion of organic matter** from the soil.

Pesticides protect plants from weeds, insect damage and diseases. This prevents crop failure, controls invasive plants and **leads to a greater proportion of the crop being marketable.**

However, there are health effects to humans and they are **highly toxic to fish and amphibians** when they wash into waterways.

The Green Revolution

The Green Revolution is a **set of agricultural practices aimed at increasing agricultural yields and providing food security.**

High yield varieties (HYV) of wheat were developed by Norman Borlaug in Mexico, this then spread to Asia where HYV of rice were produced in the Philippines. The Green Revolution encompasses biochemical changes, irrigation, drainage and terracing schemes and the use of machinery. Watch [this video](#) on the Green revolution.

Biochemical changes allowed crops to be grown in a **reduced timeframe** and with an **increased yield.** HYV of rice in the Philippines **increased the yield sixfold** at the first harvest. It means that a **larger population can be supported** and less land needs to be converted into farmland.

However, it can lead to **overproduction** and also **soil degradation.** **Patented** varieties lead to the increased price of seeds which can create a **bigger gap between the rich and the poor.**

Biochemical changes also involve the increased use of fertilisers and pesticides which can harm wildlife and lead to resistance.

Irrigation, terracing and drainage schemes increase the area of cultivable land, allow **more water-intensive farming to take place** and makes the land more suitable for agriculture.

However, it does **increase water use** which could become unsustainable. For example, in Saudi Arabia, **water extraction is 15 times greater than water recharge.**



The **increased use of machinery** allows for **faster planting, harvesting and processing of crops**, it also requires a smaller workforce so can increase development. However, it leads to **increased GHG emissions** which will lead to climate change, it causes unemployment for farmers and creates a bigger gap between the rich and the poor.

Land reform

Land reform is a **purposive change in the way that agricultural land is held or owned, the methods of cultivation, or the relation of agriculture to the rest of the economy**. It provides land to those who otherwise wouldn't have been able to own it. This allows an **increase in the standard of living** and is considered the fairest outcome. **Small farms in developing countries tend to be more productive**.

However, land reform is often not managed correctly. This could lead to people being placed on land which they do not know how to farm and there could be a **corruption** problem whilst redistributing the land. It could also be more beneficial for farmers to work on bigger farms so that they receive a steady income. It also means that agriculture can only operate on a **subsistence level** which could hold back the development of the country.

Land grabs

Land grabs are **large scale land acquisitions that involve the buying or leasing of land in developing countries** by domestic companies, TNCs, governments or individuals. **Since 2001 there have been 80 million land deals**. In Cambodia, land grabbing for economic gains has **displaced 10% of the population**. Although this could **increase production** and allow exportation of crops, it increases the risk of exploitation and could lead to increased food insecurity within the country. Watch [this video](#) on land grabs.

The social, economic and environmental implications of the commercialisation of agriculture

Social implications include:

- **Improving standards of living** due to profits being earned from cash crops.
- Farming becomes more individual and **communities deteriorate**.

Economic implications include:

- **Fluctuations** of cash crop prices.
- **Improvements to the country's GDP**.
- **Smallholders could become indebted**.

Environmental implications include:

- Monocultures can **damage soil quality**.
- Not as careful about managing the environment **sustainably**.
- Profits are likely to be used to buy **fertilisers and pesticides** which further damages the environment.



Alternative and appropriate technology

Intercropping and **polyculture** involves the **planting of different species** of plants on the same land at the same time. Watch [this video](#) on intercropping with sugarcane farming.

Benefits include:

- **Improving plant health.**
- **Plants do not compete with each other** as they have different traits.
- **Improves biodiversity.**
- They act as **natural pest controls** so pesticide use decreases. Studies in China show that planting different varieties of rice in the same field **increases the yield by 89%** due to a decrease in the number of diseases.
- **Water use decreases** due to more efficient irrigation systems.
- **Nitrogen in the soil is under better control.**
- There is **increased soil fertility** leading to improved yields.
- Allows a **more stable and consistent income for farmers** as they don't have to just rely on one crop.

However, there are also some negatives to intercropping and polyculture:

- Involves a lot of **planning** which needs to be done in advance and can take a lot of time.
- Lots of **knowledge** of the different plants and how they interact needs to be known by the farmer.
- **Investment** into specific equipment needs to be made initially.
- It is **harder to control and supervise** the plants.

Post-harvest losses also need to be addressed in order to secure food security. This can be done either during **harvesting, drying, or storage** such as metal silos. It makes sure that most of the food produced is sold so that resources are not going to waste. However, it can be **expensive**, the **materials might not be available** and changing the mechanisms of harvesting can cost lots of **money**.

Hydroponics involves the growing of crops in water and nutrient solutions rather than in soil. They have many benefits including:

- **Does not require any soil.**
- Uses **80% less water.**
- Provides **food security.**
- Needs **20% less space.**
- Allows **crops to be grown that wouldn't otherwise be able to be grown.**
- Allows the **control of the nutrients.**
- There are **fewer pests, diseases and weeds** so require fewer pesticides and herbicides.

Hydroponics, however, requires **more time and commitment**, **uses electricity** and the **initial expenses can be high**.



The globalisation of production and supply

Increasing demand for food

In 1915 the population was 1.8 billion, now it is around 7.5 billion and by 2050 the population is expected to be 9.7 billion. It is estimated that the **demand for food would increase by 70-100% by 2050**. There is also a huge issue in the distribution of food worldwide. In 2010, the world was **producing 20% more food than was actually needed** worldwide, it was just that some areas had a surplus of food and some had a deficit of food. Watch [this video](#) on the reason for demand for food not being over population.

Food security

The availability of food in a given area and the ability of all individuals to access food supplies. **870 million people worldwide don't have access to a sufficient supply of nutritious food.**

Ethical issues of food supply in the 21st century

- **The exploitation of migrant labour:** Migrants often pay agents to find them work in agriculture in other countries like the UK. The food industry relies heavily on licensed gangmasters to supply manual labour. Some migrants are only just able to meet their debt repayments as their wages are so low. They may also face poor working conditions, 'forced labour' and other forms of exploitation. Read more about it [here](#).
- **Religious and cultural differences:** Increased globalisation and increased development within countries have changed the dietary patterns in many countries from predominantly cereals to increased levels of meat and dairy as well as restaurants. This has caused increased levels of obesity as well as other health issues.
- **The exploitation of animals:** To increase food supply animals in intensive farms are being kept in cramped conditions. They have also undergone genetic modification. For example, many chickens have been modified to have larger amounts of breast meat. This means that they weigh too much for their legs to be able to carry them and so struggle to walk.
- **Introduction of GM crops:** These can interbreed with crops in neighbouring farms, these farms can potentially be sued by the companies who developed the crops (Monsanto is an example of this). Some farmers can't compete against farms who grow GM crops and therefore go out of business. The long term effects of GM crops on humans and the environment isn't known yet.
- **Obesity in the UK:** The percentage of adults in the UK who are overweight has roughly doubled since the 1980s. This is due to the increased production of cheap, fast food.

Environmental issues of food supply in the 21st century

- **Deforestation:** the clearing of forests for agriculture has increased as populations and demand have increased. Between 2000 and 2007, Brazil lost around 150,000 square km of forest. These areas have been planted with crops such as bananas, palms, maize and rice. Once this has been used for crops they leave it for animal grazing and therefore the quality of soil decreases overtime.
- **Tropical prawn fisheries:** Prawn farming has become increasingly industrialised and commercialised. 75% of farmed shrimp is produced in Asia. This has increased the area's susceptibility to disease due to the vast areas of monocultures.



- **Global warming and food miles:** HIC food travels between 2,500 and 4,000 km. The mean distance of this food travel has increased by 80% since 1980. The transport of food is contributing to global warming. In the long term climate change will potentially compromise food production and will increase food insecurity especially amongst the poorer nations.
- **Water pollution:** The use of fertilisers and pesticides can contaminate water supplies, killing aquatic life and compromising humans water supply. 37% of water pollution in the Philippines originates from agricultural practices. As well as this, 30% of artesian well tested in two provinces in the Philippines were found to have nitrate levels above the WHO drinking water safety limit.

Economic issues of food supply in the 21st century

- **Fairtrade:** Promotes development in poorer countries by giving farmers a better wage. The need for fairtrade originates from the exploitation of cheap labour and the demand for cheap food by those in HICs. However, fairtrade cannot help all the poor, exploited farmers. The prices of fairtrade goods are often higher than other products in HICs.
- **Commercialisation:** Cash crops can generate more income for farmers and the country. Although this can increase the standard of living it can also damage the environment and can decrease the amount of food produced and so can increase the levels of food insecurity.
- **TNCs:** Can be involved in all stages of food production. Investing in countries can bring positive effects, however, they can also exploit the workforce and end up removing the products and the profits gained.

Political issues of food supply in the 21st century

- **Role of TNCs in relation to agricultural aid:** TNCs often speculate of food markets which cause the price of food to rise. When food aid is given by NGOs, it is often bought from TNCs who themselves bought it from farmers at much lower prices.
- **Role of NGOs in relation to agricultural aid:** NGOs provide longer-term agricultural assistance aiming to improve the productivity of agricultural land in developing countries as well as providing emergency food aid. For example, after the 2010 Haiti earthquake, the FAO provided assistance by distributing seeds, fertilisers and tools, as well as reinforcing irrigation channels and river banks to prevent flooding.
- **Food aid:** Although food aid prevents malnutrition and famine it can also have massive consequences on farmers and the state of the country in the long term. Food aid undercuts local prices of farmers and so can cause farmers to go out of business. This creates a dependency on food aid. Food aid also often comes with political agendas and is normally driven by exporters not what is needed on the ground.

