AQA Geography A-level

3.2.4: Population and the Environment

Essential Notes

Understanding Population and the Environment

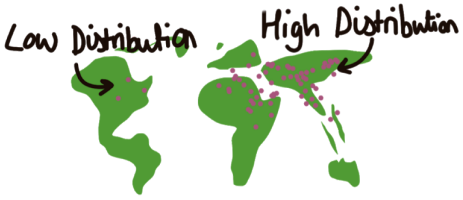
Population is the **amount of people** in a defined area, e.g. the **population of the world** is currently 7.6 billion (May 2018). Population can be **measured** in different ways:

Key Population Parameters

(**Parameter:** a **measurable** factor)

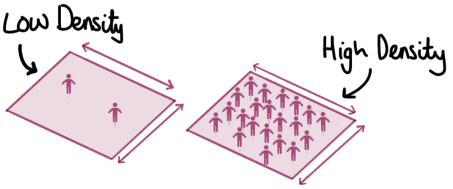
Distribution

How a population is **spread** globally or regionally.



Density

Measurement of population **per unit area**, e.g. population per km^2.



Numbers

The **amount of people** in a defined area (population) e.g. a town, a region, or a country.

Change

Increases and **decreases** in population over a **period of time**.

Factors Affecting Population

In general, population is mainly affected by **physical environmental factors** and **development processes**.

Physical Environment

The physical environment plays a **vital part** in the population as it holds **key resources** for human well-being (e.g. a poor water supply means people would struggle to grow crops or stay healthy). Different aspects of the environment affect how a population can be **supported** in an area, including:

- **Climate** (and its regulation)
- **Soils** - water content, nutrition content etc.
- **Resources** - water supply, food supply, ability to make shelter, mineral supplies, fuels

Development Processes

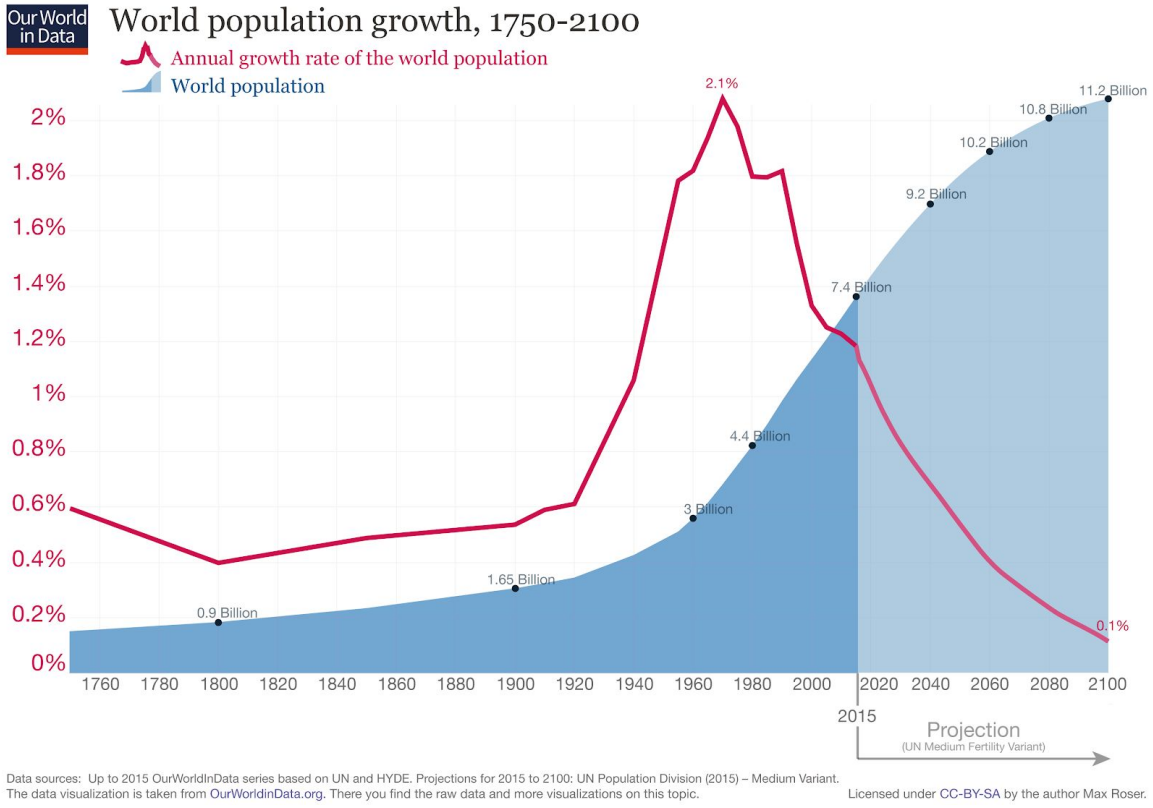
Development process: Changing and becoming more **advanced** (developing) over time. As societies develop, population growth follows a **general trend** of growing rapidly, then slowing.

Technological advancements are a development process that affects population, e.g. in the Industrial Revolution quality of life improved, hence allowing populations to grow.

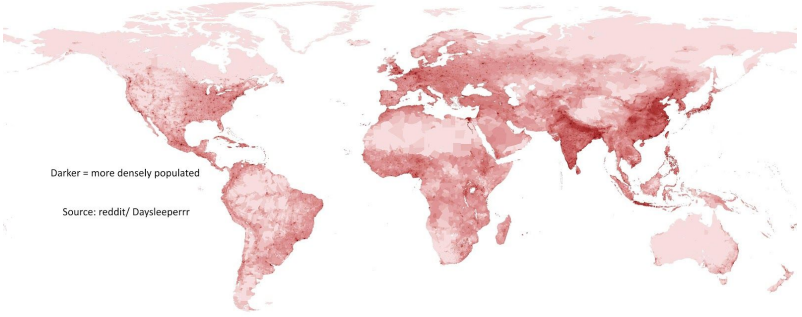
Societal advancements also affect populations, e.g. the end of pestilence, wars, and poor hygiene in many countries allowed death rates to fall and population to grow.

Global Population Patterns

Numbers: Global population has been rapidly **increasing** since the 1960s, where the population doubled from the start of the 20th century. Population is estimated to reach 9 billion by 2050.



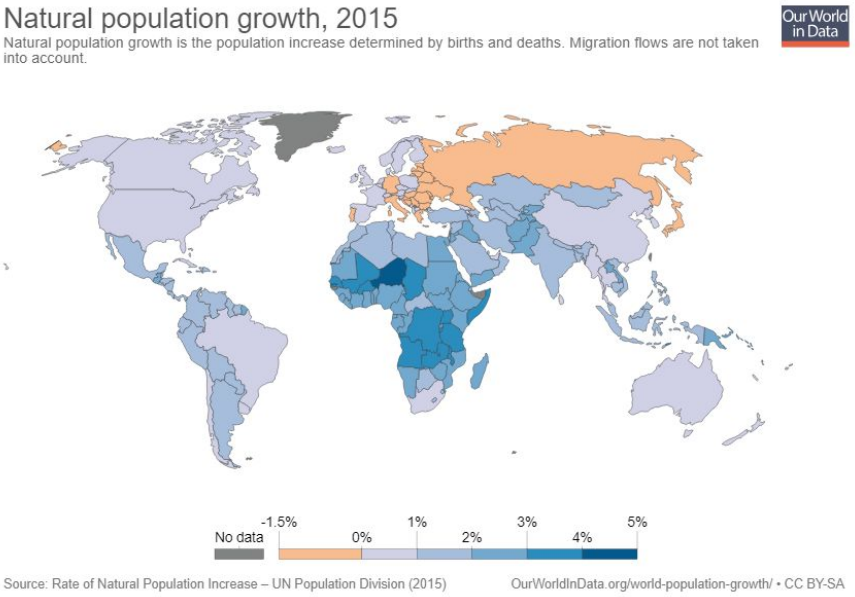
Density: **Urbanised areas** are the most **densely populated** areas. Areas that are **sparsely** populated (e.g. Sahara, Central Australia, Canada) often have **uninhabitable conditions**. Areas of China (Macau and Hong Kong) and Bangladesh are known for being **densely populated**.



For an enlarged version, visit: http://i.imgur.com/gBYMfWO.jpg

Rate of change:

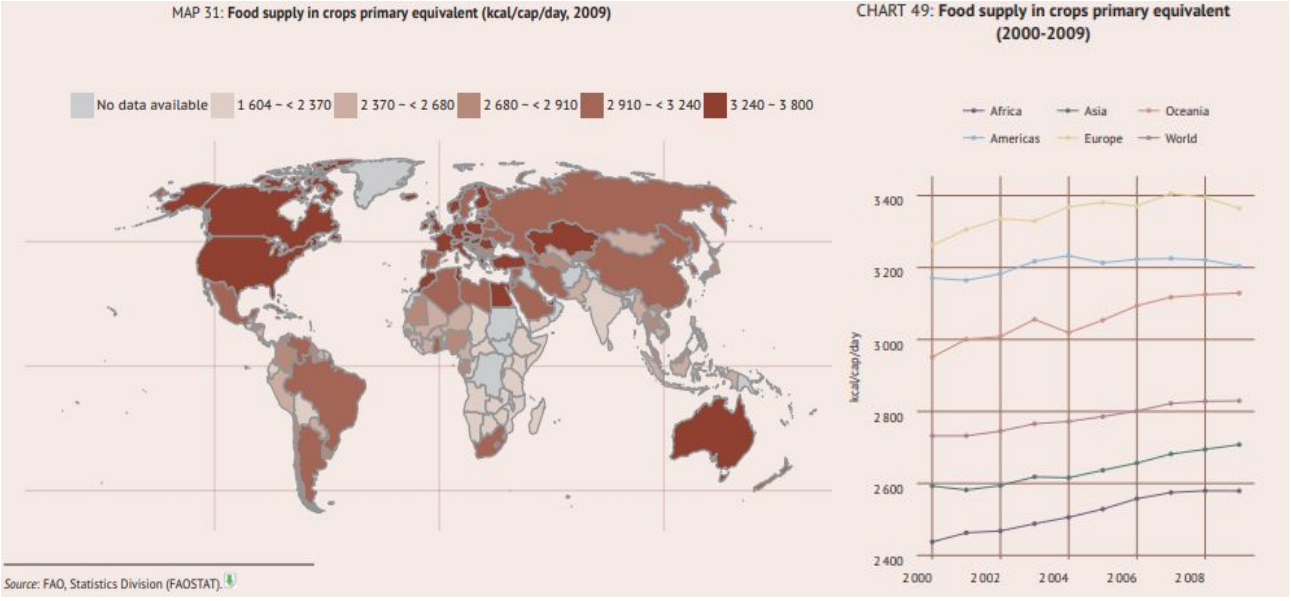
- Until the mid-1900s, the majority of population growth was in **HICs**
- Now, **HICs have the lowest population growth rates** (some even decreasing), and **developing countries/LICs have the highest growth rates**
- **Urban areas** have higher population growth rates than rural areas



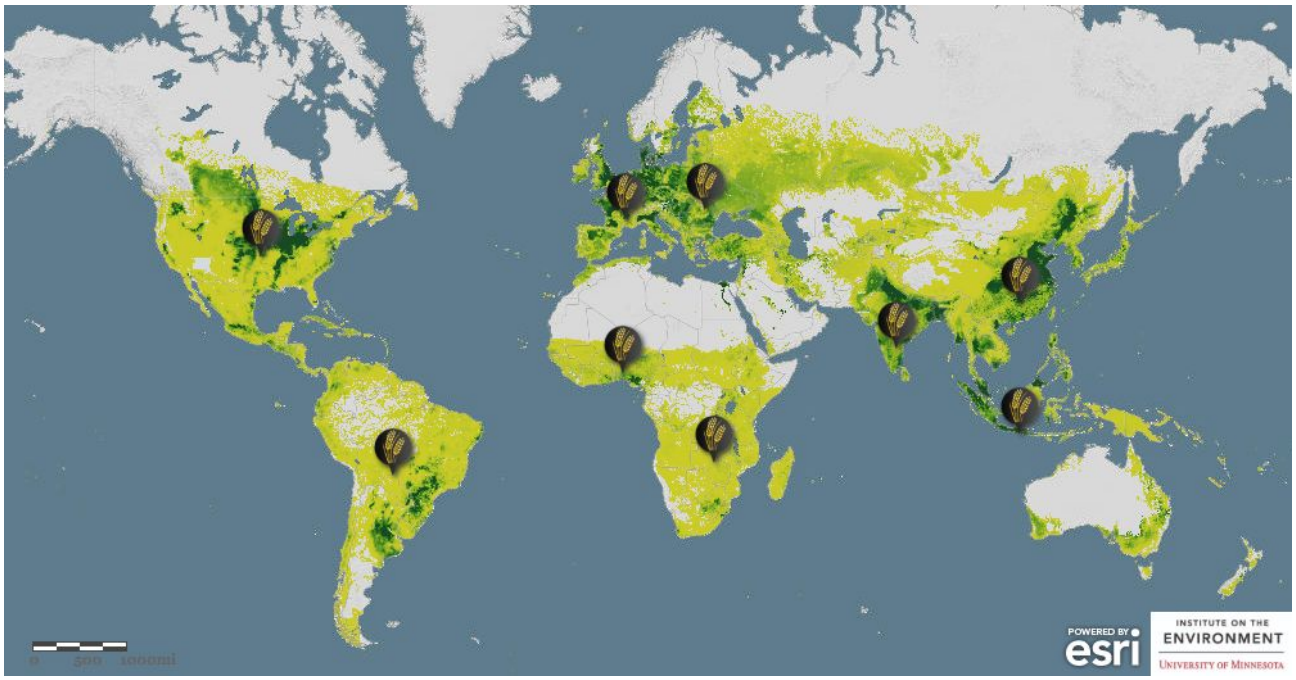
Food Production and Consumption

Production

Food production has **tripled** globally in the past 50 years, mostly due to better technology and management. The richest countries have the largest food supplies, meaning they produce enough/more calories for their population.



Current Regional Crop Yields

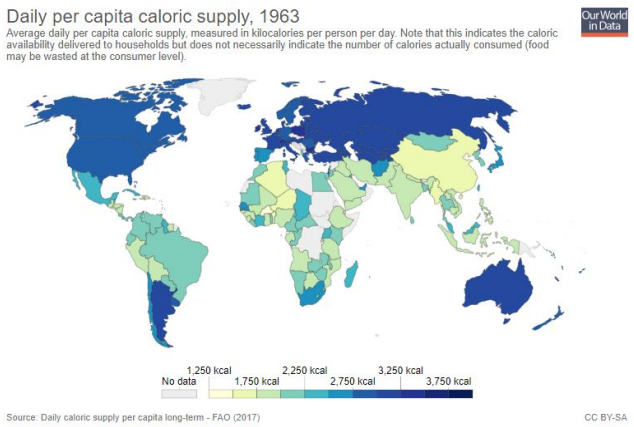


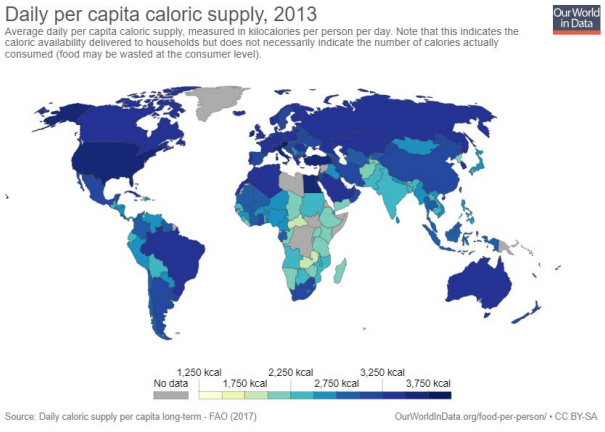
(Source: http://storymaps.esri.com/stories/feedingtheworld/)

Crop yields are especially high in Eastern Asia, North America and Europe.
Africa has the lowest food production, especially Saharan Africa. North Canada, Russia and Central Australia also have low yields, majorly due to environmental limitations.

Consumption

Globally, food consumption has **increased over time**; there are **more people** (higher populations) consuming food, and per person they are consuming **more food**. These maps show that globally food consumption has increased. Few countries now average under 1750 kcal a day.





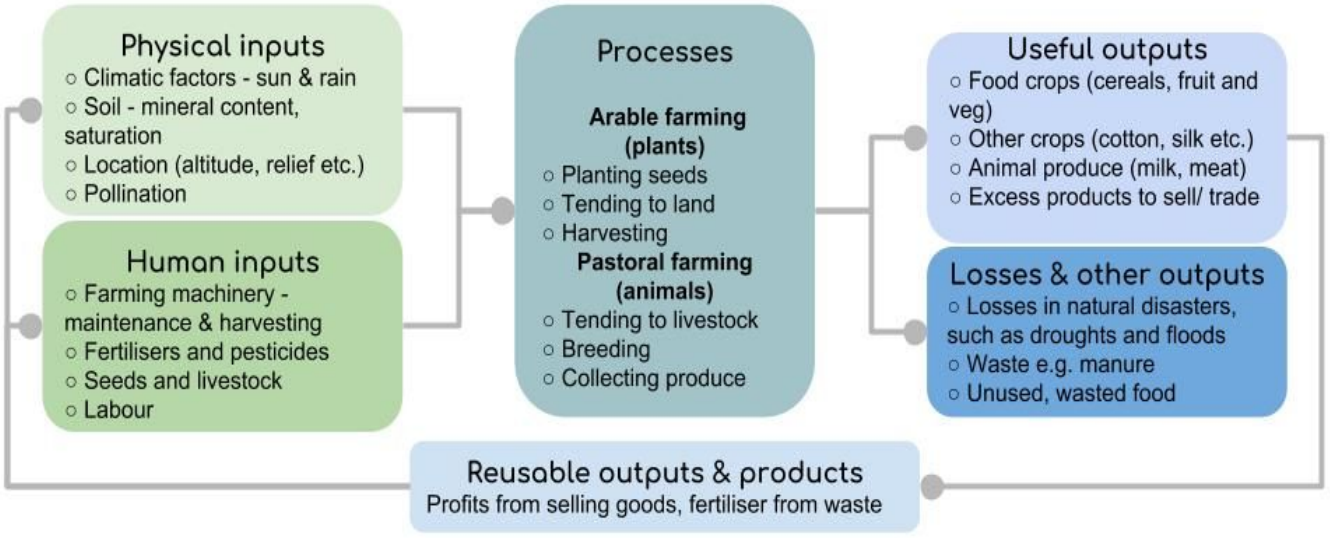
- Africa still consumes the least calories; over 27% of Africa's population are affected by severe **food insecurity**.
- Richer countries consume **more calories** (Europe, North America); North America has the highest consumption rate, followed by Europe.
- Asia's consumption rate has seen the **quickest growth**; China's consumption has increased by nearly 1000 calories in 50 years.

Agriculture

Agricultural Systems

The production of food using agriculture is a **system**, as there are **inputs**, **processes**, and **outputs**.

The Agricultural System



Agricultural Productivity

Agricultural productivity is the amount of **useful outputs (yield)** in proportion to the amount of **inputs**, showing the **efficiency** of the farm. **High productivity** means **high yields** are being achieved through **low inputs**, saving time, labour, and money.

Productivity is affected by:

- **The type of agricultural system:** management strategies with **low inputs** to maximise outputs allow for high productivity, e.g. commercial farming practices.

- **Climate:** factors such as **precipitation, temperature, humidity, and winds** affect what type of agriculture can occur. Some crops and animals can only be farmed in certain climates, such as tropical fruits, meaning the **productivity** of farms is limited with climate. Climatic conditions that are **unfavourable** for agriculture, such as **subzero temperatures** or **deserts** also reduce productivity. Climate change has also affected agricultural productivity, as specialised farming cannot produce high yields due to the changing climate, and the amount of arable land is **decreasing** (i.e. more floods, more droughts etc.)

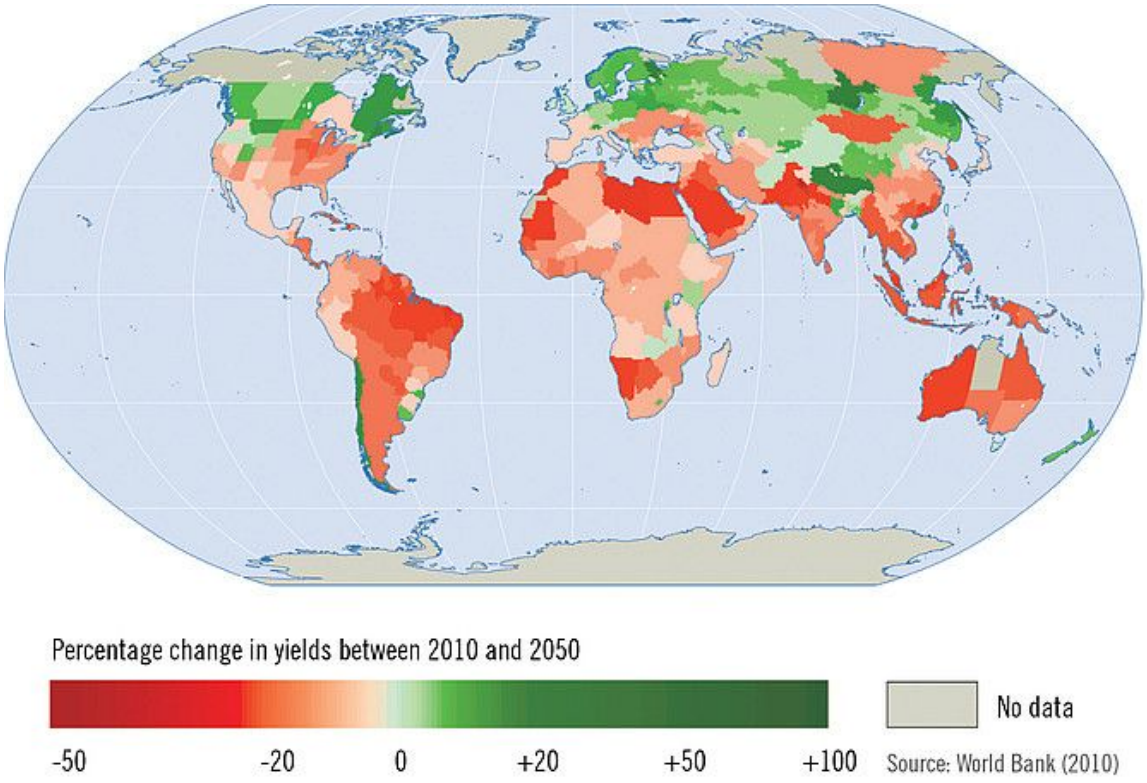
- **Soils:** Agricultural productivity is dependent on the **quality of soil**. Different soils are suited to different types of agriculture, meaning there is only productivity of certain types of crop in some soils. **Issues with soils** - such as over-farming, erosion, flooding, or desertification - may also decrease productivity, as low **nutrients** in soil will affect plant growth and animal food supply.

How Climate Change Affects Agriculture

Changes in the climate have **varying effects** on different global agricultural systems, many of which are detrimental to agricultural productivity and food security. Some places will become **more productive,** others will become **less productive**.

The majority of the world will suffer from **yield declines**, with only areas like Canada, Europe, and some areas of Central Asia having noticeable increased yields.

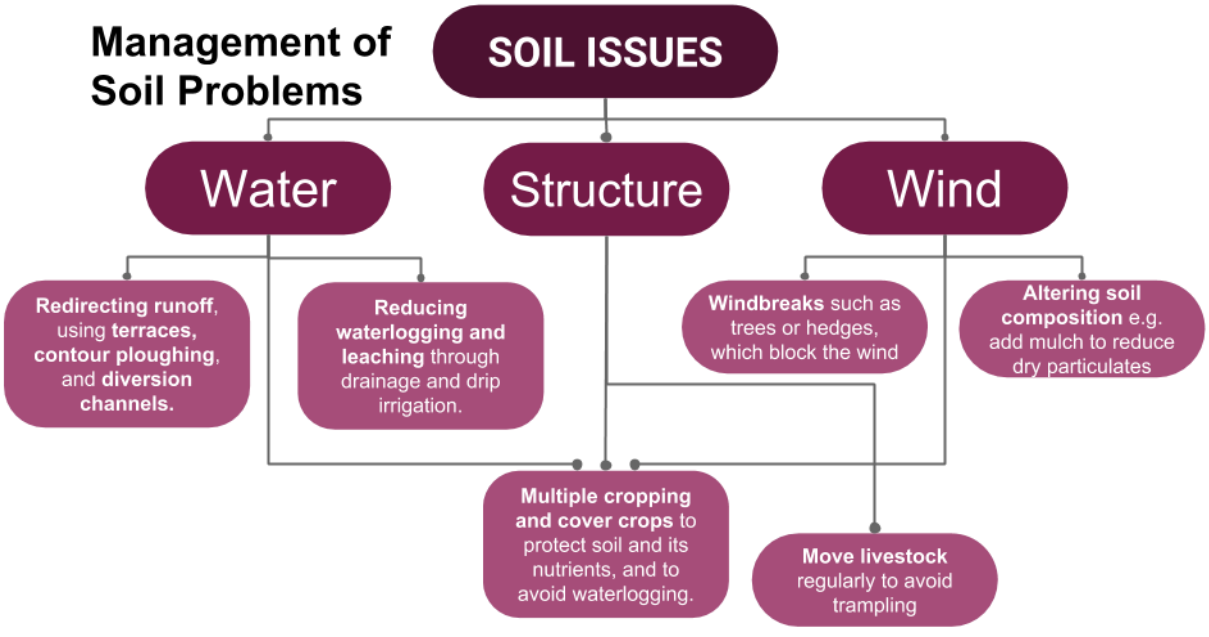
Global Change in Agricultural Yields



- The increase in **extreme weather events** (floods, droughts, tropical storms, wildfires) is likely to **decrease productivity**, as these events can devastate large areas of arable and pastoral land.
- **Temperature rises** and **precipitation changes** will also cause agricultural land to decrease in many areas. In Asia, it is predicted that per 1°C temperature rise, rice yields will decrease by **20%**.
- **Soil problems** such as erosion, desertification, and salinisation are projected to **increase** in some areas due to higher temperatures. This will continue to make arable land unusable. (On the flip side, thawing permafrost will increase agricultural productivity in colder regions).
- **Rising sea levels** due to melting sea ice is thought to cause **flooding** in low lying areas, such as Bangladesh, devastating crop yields.
- **Pests insects and plant diseases** are projected to increase in some areas due to climate change, which will continue to **decrease agricultural productivity** in some areas. There is limited evidence that this is currently occurring, but it is a definite threat in the future.

Soil Problems

Problem	Links to agriculture
Water erosion: soil **degradation** due to water, causing soil to wear away. Examples: • Sheet erosion • Rills/gullies • River bank erosion	Poor farming **irrigation** (controlled use of water) can cause soil to erode. Water erosion causes nutrients for crop growth to be **leached** away, and gullies are dangerous for **farming equipment**.
Wind erosion: displacement and **removal of topsoil** due to high winds and unstable soil.	**Ploughing** can cause fine soil to be exposed, which can be **blown** away. This also removes **nutrients** and causes agricultural issues.
Structural deterioration: loss of the soil's **structure**, including its pore spaces.	**Heavy machinery** or trampling from **livestock** causes **air** to be lost from soil, making it harder for **water and oxygen** to infiltrate soil.
Waterlogging: oversaturation of the soil, causing **leaching** of minerals and nutrients.	**Too much irrigation** can cause **waterlogging**. Waterlogged soil means crops will not be able to grow as there is **too much water surrounding roots**, and the plant 'drowns'. Land may also lose fertility due to **leached** minerals.
Salinisation: usually when the water table rises, the **soil's salts are brought to the surface**, then the water evaporates, leaving salt concentrated in the topsoil.	Poor **irrigation** and **fertilisers** can cause salinisation. Salinisation causes plants to become **infertile**, reducing yields. Salts can be toxic to some plants also.
Desertification: fertile land becoming **dry, cracked and desert-like**.	**Irrigation** can cause **desertification** in the long run, as well as **overgrazing** or **overcultivation** (causing water and minerals to be overexploited).



Food Security

Food security: The concept of having **available**, **accessible**, and **affordable** food that is safe and **nutritious**, so that people may live a **healthy** lifestyle.

Strategies to Ensure Food Security

Increasing access

Increasing a country's access to **foreign markets** means they can import food, increasing food security.

Trading agreements such as **trade blocs** can be very beneficial to a country that is struggling to **provide enough food** for its population.

In times where food security is dangerously limited, such as after a crisis or natural disaster, **aid** and **relief** can also increase food security.

Increasing amount

Strategies and **new technology** can increase the amount of food being produced, which therefore increases food security as there is more food **available**, and this food may also be **healthier**.

Managing farms more successfully through training, farming equipment, and **high yielding varieties** (HYVs) can increase food supplies. This means a country has more food **available** to distribute to its population.

Increasing efficiency

Similarly to increasing the amount of food, increasing the efficiency of a farm can save time and food, meaning overall there is more food **available** and it may be more **affordable** as there are **less expenditures**.

Equipment and **better management** can produce more crops in less time, helping affordability and availability of food.

Waste can be reduced by harvesting natural resources and having better storage.

Global Patterns of Health, Mortality, and Morbidity

HEALTH
Physical and mental well-being

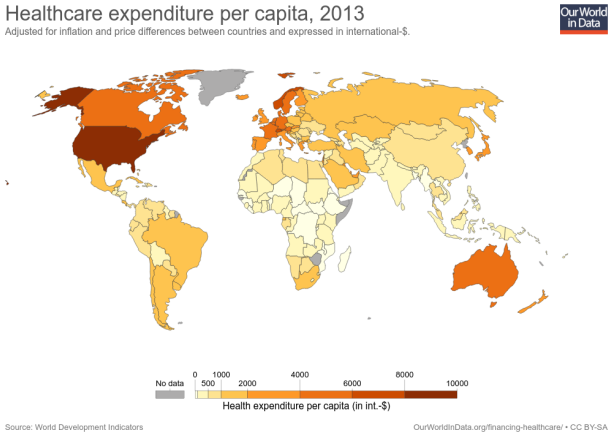
MORTALITY
Death

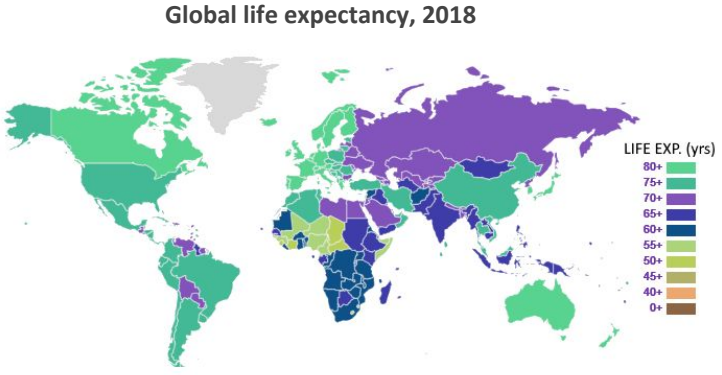
MORBIDITY
Illness from disease

Mortality and morbidity can be numerically measured by **mortality rate** (number of deaths over time, per unit of population - usually per 1000) and **disease incidence** or **prevalence**. Health can be measured using a range of measures, including mortality and morbidity rates.

Global Patterns

Health is usually better in **high income countries** compared to low income countries, and people die when they are much older. HICs usually **spend more money on health**, which often correlates to the higher life expectancy.



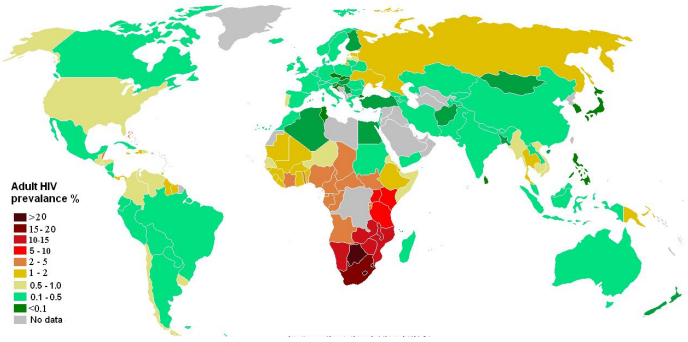


(Source:https://www.worldlifeexpectancy.com/world-life-expectancy-map)

Morbidity rates are shown through **the incidence** of diseases. In general, **non-communicable diseases** are higher in HICs, whereas **infectious diseases** are more prevalent in LICs.

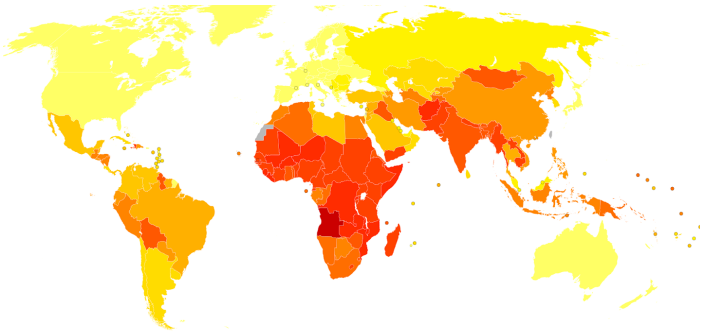
Mortality rates of a disease is dependent on the ability to **treat morbidity**. Usually, mortality rates are lower than morbidity rates as people can usually be treated. However, the proportion of those who die from the disease they have contracted is higher in LICs than HICs.

HIV prevalence



(Source:https://upload.wikimedia.org/wikipedia/commons/d/d7/JHIV_Epidem.png)

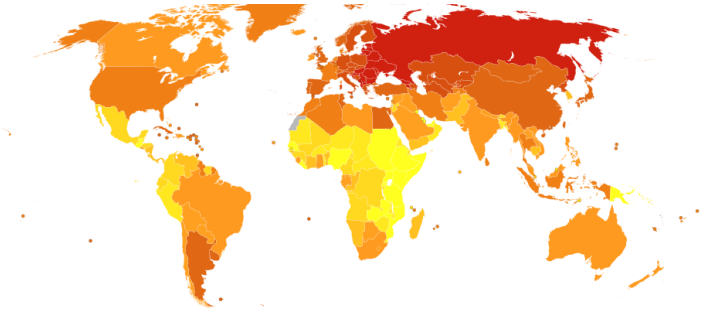
Diarrhoeal Diseases prevalence



(Source:http:/upload.wikimedia.org/wikipedia/commons/5/51/Diarrhoeal_diseases_world_map_-_DALY_-_WHO2002.svg)

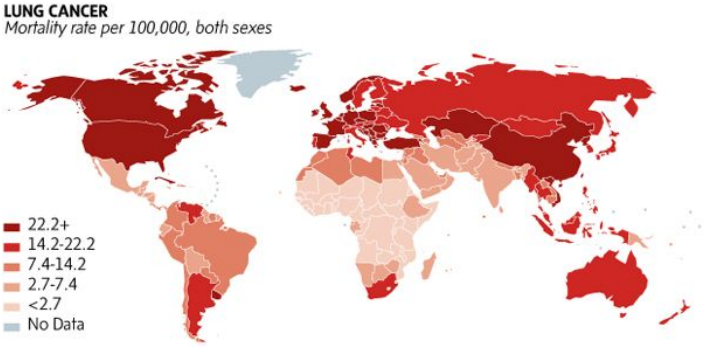
Some diseases are more prevalent in high income countries as they are influenced by lifestyle choices, e.g. lung cancer can be caused by smoking or poor air quality.

Cardiovascular Disease Prevalence



(Source:https://commons.wikimedia.org/w/index.php?curid=50287978)

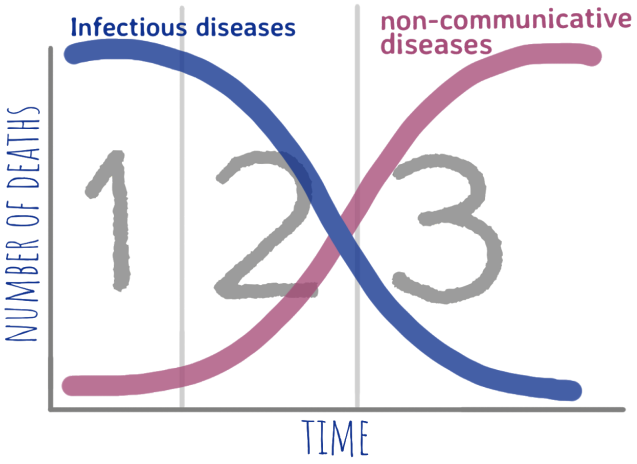
Lung Cancer Prevalence



(Source:https://www.theglobeandmail.com/life/health-and-fitness/health/five-maps-that-put-cancers-global-spread-into-focus/article16679285/)

The Epidemiological Transition

The **epidemiological transition model** shows how disease and death (hence '*epidemic*') changes as a society becomes more socially and economically developed.



1. **Pestilence and famine:**
   - Infectious disease
   - Many pandemics
   - High mortality due to disease
2. **Receding pandemics:**
   - Advances in technology
   - Advances in medicine
   - Social change - hygiene etc.
   - Less infectious disease
3. **Degenerative & man-made diseases:**
   - Developments in society creating diseases, e.g. coronary heart disease from lack of exercise
   - Infectious diseases are low

The societal transition in health and morbidity has a consequent change in population, due to changes in **birth rates and death rates**. This is commonly referred to as the **demographic transition**, which will be explored further.

The Environment and its Effects on Health

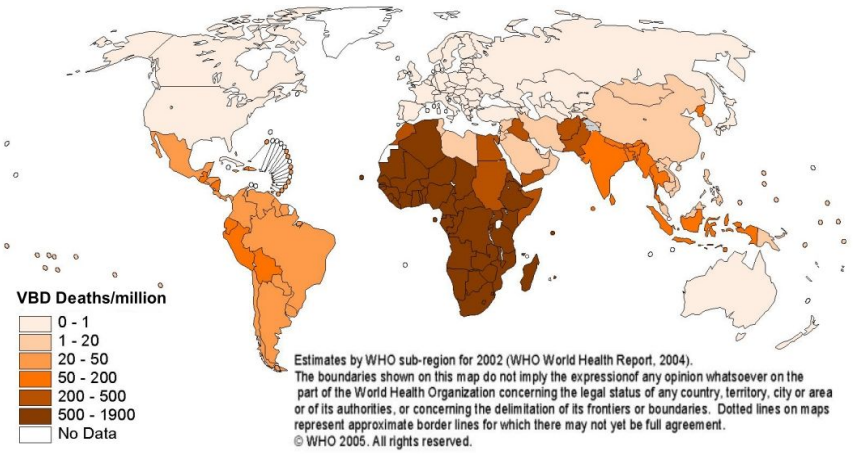
Environmental Variables and Incidence of Disease

Climate

Climatic factors can **influence** the incidence of disease, as many diseases are **dependent** on the environment. Some diseases include:

- **Vector-borne diseases**: Diseases that are caused by a 'vector' (a carrier) passing on a pathogen (disease) to a human. E.g. malaria (the pathogen) is transmitted by mosquitoes (the vector).

Vector-borne diseases are usually reliant on **specific conditions** that allow for the vectors to live and breed. High temperatures and access to water bodies (e.g. places where there is a lot of precipitation) are needed for mosquitos to thrive, which is why many mosquito-borne diseases are prevalent in the region of the tropics.



- **Sunlight and exposure:** Sunlight, or lack thereof can cause issues such as **deficiencies**, **Seasonal Affective Disorder,** or **skin cancer** (when overexposed).
- **Extreme weather events:** Some areas are more prone to **natural disasters** such as tropical storms, floods, tornadoes, wildfires etc. With these extreme climatic events brings **disease** after they strike, such as water-borne diseases (e.g. cholera).

Topography

The way in which an area is set out can influence how easy it is for disease to **spread**.

- **Drainage** in flat and low-lying areas is particularly poor as there is no runoff like in steep areas. This leads to a lot of **stagnant water**, especially after floods, increasing water-borne disease.
- **Floodplains** (sometimes flat, low-lying areas but not always) are prone to flooding, which can - again - host water-borne diseases. Furthermore, flooded areas can cause other diseases, e.g. the diseases associated with mould or contaminated water.

Environmental Variables and Effects on Health

Water Quality

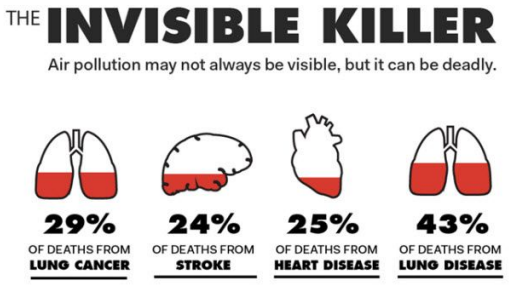
- Water is important for **health**, **sanitation** and **hygiene**, and poor water quality causes a range of problems.
- **Water-borne diseases** and other pathogens can contaminate water supplies, causing illness, complications such as infections, and sometimes death when ingested,
- **Toxicants** may also enter water supplies and have the potential to poison or kill.
- **Bathing and cleaning** in dirty water can also spread disease if the pathogen enters the body through open wounds or is ingested.
- Many people do not have **access** to clean drinking water, meaning they have to use dirty water, as there is no alternative.

Air Quality

- **91%** of the population live in areas of unsatisfactory air quality
- Air quality is separated into **ambient** (outdoor) air pollution and **household** air pollution.
- Ambient pollution is mainly from factories, fossil fuel burning etc.
- Household pollution is mainly caused by fires for cooking food
- Particulates and poisonous gases cause a range of health problems, including:

❏ Lung disease
❏ Strokes
❏ Heart attacks
❏ Cancer
❏ Respiratory problems - bronchitis, asthma etc

1 IN 9 DEATHS WORLDWIDE ARE CAUSED BY AIR POLLUTION



(Source: https://www.who.int/airpollution/en/)

Role of International Agencies and NGOs in Maintaining Global Health

Global organisations play a vital part in **promoting health** and **fighting against disease**.

International agencies **work with governments**, **conduct research**, **spread awareness**, and **provide resources** with the intention of achieving **good health globally**.

Examples:

- World Health Organisation
- World Food Programme
- UNICEF
- Food and Agriculture Organisation

Non-governmental organisations (NGOs) are non-profit organisations that work independently from governments. Many NGOs are charities that rely on donations, although international agencies can also be classed as charities. Many NGOs provide **healthcare** in areas where it is **essential**, especially in humanitarian crises or natural disasters.

Examples:

- **Médecins Sans Frontières (MSF)**
- **Oxfam**
- **The Bill & Melinda Gates Foundation**
- **Feed the Children**
- **Water Aid**

Natural Population Change

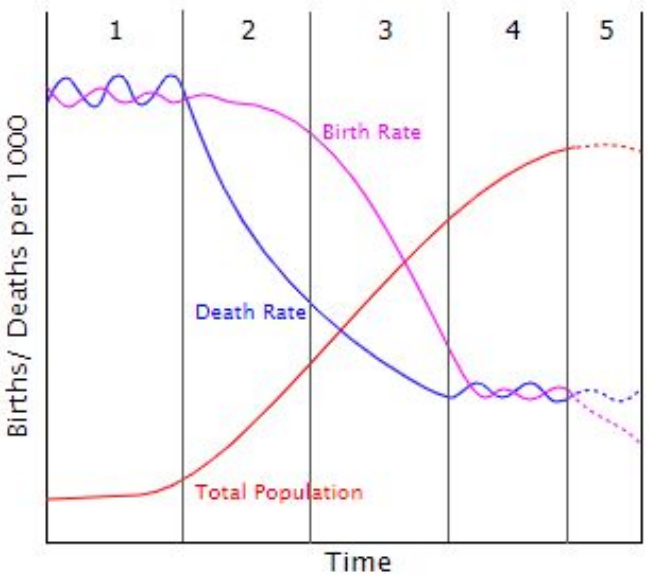
Natural population change is affected by multiple factors influencing the total population of an area.

Vital rates show how the most **important** (vital) aspects of the population **change**, and the **speed** at which they change (rate):

- **Birth rate**: Number of **live births** per 1000 of the population per year.
- **Death (mortality) rate**: Number of **deaths** per 1000 of the population per year.
- **Infant mortality rate:** Number of **deaths of infants** under the age of 1 per 1000 of the **live births** per year.
- **Total fertility rate:** The **average number of children** a mother will birth in her **reproductive** age.
- **Population growth rate**: **% change** (in a year). If birth rates exceed death rates, % change is positive, if death rates exceed birth rates, % change is negative.
- **Life expectancy**: Average number of years someone is **expected to live** for.

Demographic Transition Model

The trends of **natural population change** (from the start of a population to present day) is represented within the **Demographic Transition Model (DTM)**. This model shows how the birth rate and death rate change over time, and how this affects population numbers.



Stage 1: High, fluctuating birth and death rates due to high levels of disease, pestilence, famine etc. Population remains **low** as birth rate does not exceed death rate overall.

Stage 2: Due to advancements in healthcare, hygiene, and general living standards, **death rates fall.** Birth rates are still **high**, leading to a **rapid increase in population**.

Stage 3: Birth rates start to fall due to social change, e.g. the emancipation of women, contraception, less need for large families. Death rates also continue to fall.

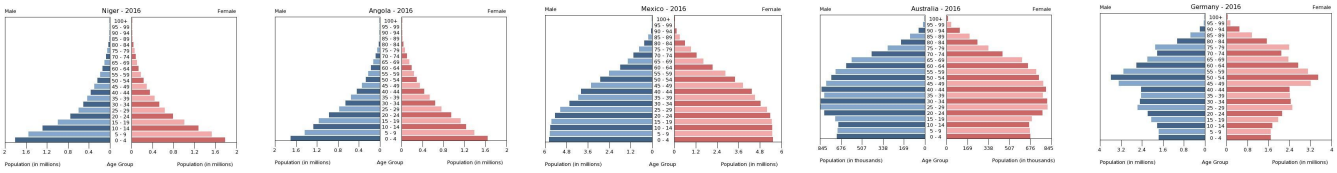
Stage 4: Birth rates and death rates are both **low**, causing **population growth to slow**.

Stage 5: This stage is not officially in the model, but has been proposed. In this model, **birth rates fall below death rates**, causing a **decline** in population.

Aspects of Demographics

Age-sex composition

Age and **sex** are the two major demographic variables in a population, and these variables can indicate a country's level of development. Age-sex composition can be shown on graphs known as **population pyramids**. These graphs can be related to different stages of the DTM.



(Source: CIA World Factbook. Left (blue) is male population and right is female population)

STAGE 1 **STAGE 2** **STAGE 3** **STAGE 4** **STAGE 5?**

Stage 3 and 4 - The Demographic Dividend: A **demographic dividend** is where **birth rates and death rates fall**, causing the **dependency ratio to decrease**, resulting in a large **work force** contributing to the economy.

Dependency ratio: The proportion of **dependants** to **economically active**. Dependants are typically under 18s and over 65s, but this definition varies.

Stage 5 - Ageing population and replacement levels: The more populous age group in stage 4 will eventually become **older and dependent**, creating an ageing population that needs to be cared for. The **'replacement level'** refers to the amount of population needed to **replace** the amount of people **getting older.** When birth rates fall, birth rates do not meet the replacement level, causing '**sub-replacement fertility**'.

Controlling Natural Population Change

Population change has been affected by a number of **cultural controls**.

- **Societal population control:** creating **policies** to artificially **alter** with populations. This may be through **encouragement** (e.g. incentives to have more children) or **laws** (e.g. China's one child policy beginning in 1980).

- Access to **contraception** and **education**: sex education and contraception can **lower birth rates** and fertility rates as people can control whether they want to have children.

- The **emancipation** of women: over time, **society's view of women has changed,** and women majorly have the **freedom** to choose whether they want children, and when they want children. Women's rights to work especially has lowered birth rates and fertility rates.

- **Societal norms** and the 'ideal family': Aspects of culture such as cultural norms and religious views can affect the number of children in families. Some cultures see large families as important and normal, whereas other cultures prefer a smaller family.

Unnatural Population Change: Migration

Population is affected by **migrants** moving in and out of countries. Types of migration differ:

Economic migrants - People who have moved **voluntarily** for reasons of work and improved quality of life.

Refugees - People who have been forced to leave their homes and travel to another country due to fleeing **conflict, political or religious persecution**. They have been granted permanent or temporary residency by the host country or the UN refugee agency (UNHCR).

Asylum seekers - People who have **left their country** and are seeking **asylum** in another. They are waiting to be granted residency and to become a refugee.

Causes of Migration

International migration is caused by **push and pull factors**.
Push factors: reasons migrants wish to **leave their current country** (pushing them away)
Pull factors: reasons migrants wish to **move to another country** (pulling them towards).

These factors may be **economic** (e.g. better incomes or opportunity), **environmental** (e.g. less pollution or better environment), or **social** (e.g. escaping war, persecution, poor health care) aspects. For example, many Polish people move to the UK in search for better job opportunities due to high unemployment in Poland.

Impacts of Migration

Migration has a range of impacts on both the country **receiving** migration and the country being **emigrated** from.

Impacts	Country that people are migrating to.	Country that people are emigrating from.
Social	o Societal **multiculturalism**. o Those fleeing from **conflicts** or **poor quality of life** may have a better life in countries they move to. o Migrants can contribute to society, e.g. **services** such as healthcare.	o **Relaxed pressure on services**, meaning people may have a better quality of life as there could be better access to healthcare, lower house prices etc.
	o **Overpopulation** can cause **pressure on services** such as healthcare o **Conflicts** between nationals and migrants due to **negative effects of migration**.	o **Underpopulation** could cause more pressure on services (less people **working** so many jobs are left unfilled). o As many migrants are more desperate for work than nationals, they may be vulnerable to **exploitation**, such as poor working conditions and low wages.
Environmental	o Larger **workforce** for **environmental protection**.	o Possibly reduces **waste**, fuel usage, emissions etc. as there are **less people.**
	o Higher demand for **environmentally unsustainable resources** (e.g. need for housing, waste, fuel) when population increases in an area.	o Smaller **workforce** for environmental protection and conservation, e.g. more derelict businesses and houses, less people employed for waste removal etc.
Economic	o Migrants become intertwined in **work forces** and do often unwanted jobs, as well as pay **taxes**.	o Workers send **remittances** back to their home country, helping their economy to grow.
	o May become **dependent** on the migrant workers, causing issues e.g. if migrants stop coming. o **Lack of jobs** for nationals o Remittances do not benefit host country's economy.	o **Skilled workers leave** to work in HICs, meaning unskilled people are left to keep the economy running. o Home country may be **dependent** on remittances, so a change in circumstance may be detrimental to the economy.
Political	o Countries that accept large quantities of migrants often have strong ties with the home country, decreasing **likelihood of conflict**.	o **Relaxed pressure on services** and resources can decrease political conflicts and tensions, e.g. less criticism of the government for doing a poor job.
	o Possible political disagreements due to **overpopulation**, causing international disputes. E.g. the UK leaving the EU partly because of free movement of EU migrants. o **Laws/policies** may be introduced to limit population.	o **Population policies**/ laws may be put to get the **workforce** to grow, e.g. encouraging more migration or more births. Population control may be seen as a restriction of freedom.

Overall impacts on the **demographic**:

- **Mass migration** can cause **overpopulation** and **underpopulation**.
- **Economic migration** can cause a **demographic dividend** in the host country, but a **'brain drain'** and a large **dependency ratio** in the home country.
- **Sex composition** may change, as men are more likely to migrate than women, leaving more women than men in home countries (this has occurred in Poland, causing women to have to take over typically 'male' jobs, such as manual labour).
- **Age composition** may change, e.g. an **ageing population** may be left as the younger people migrate.

Population Ecology

Population ecology is the study of how the **environment affects population** factors, such as size, distribution, density, age-sex composition etc. The concept of populations changing constantly is known as **population dynamics**.

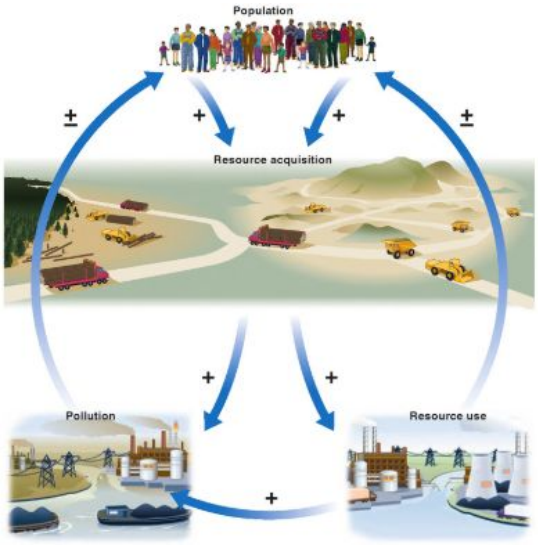
An environment that supports a population can be of **optimum population**, or it could be **underpopulated** or **overpopulated**.

Optimum population: The **ideal** number of people for the environment and its resources.
Overpopulation: **Too many** people to be supported by the environment and its resources.
Underpopulation: **Too little** people to fully utilise the environment and its resources.

Carrying Capacity: The **maximum population** that can be supported in an environment without the **environment being severely degraded**.
If the carrying capacity is reached, it can have **effects on the population**, as resources are no longer available to support the population. This is thought to lead to **increase in death rates** and **fall in birth rates** until population numbers can be supported again (e.g. famines due to lack of food, causing deaths and lower fertility rates).

Ecological Footprint: A measurement of **how much of the Earth's resources are used** in relation to the **amount of the Earth's resources that are actually available.** Measured in global hectares(gha), where 1 gha = overall annual amount of resource use per hectare of productive area available.
If an ecological footprint is larger than 1, consumption is larger than available resources on Earth, which is clearly unsustainable.

The Population, Resources and Pollution Model (PRP)

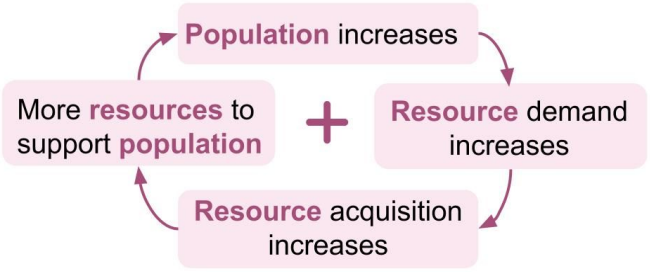


(Source: Chiras, D. (2013). *Environmental science*. Burlington, MA: Jones and Bartlett Learning.)

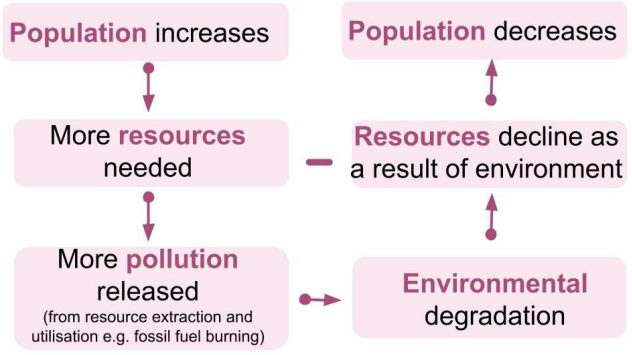
The model shows the relationship between **population, resources, and pollution,** and the positive (+) and negative (-) **feedback loops** that are created from these relationships.

In general, the population needs to **acquire and use resources in order to grow**, and this usage creates **pollution**, which in turn affects the **population**. The population is dependent on the environment and its resources.

Positive Feedback



Negative Feedback

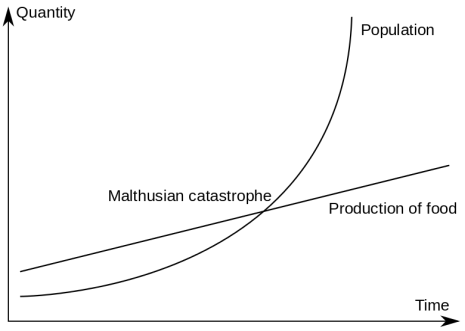


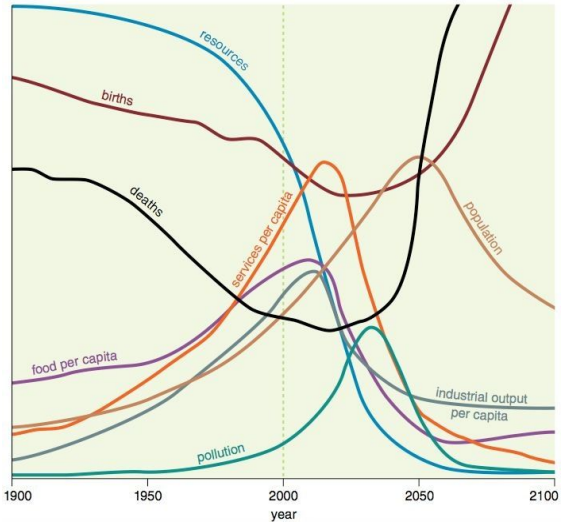
Population Perspectives

Malthusian (and neo-malthusian) Perspectives

Negative population perspectives, stating that the population **cannot** be sustained and will decline as a result of insufficient resources.

Malthus (1798): Population increases exponentially, but **resources only increase linearly**, meaning the population would eventually run out of food and resources, and decrease as a result. (Source:commons.wikimedia.org/wiki/File:Malthus_PL_en.svg)





Club of Rome Limits to Growth (1972): An extended and more complicated version of Malthus' theory. Overall it shows that there is a **limit to the amount of people, pollution, services, food production** etc, eventually leading to a large increase in **death** rates.

(Source:www.financialsense.com)

Non-malthusian perspectives

Positive population perspectives, stating that the population **can** be sustained and will continue to find new ways to support the population.

- **Boserup**: Boserup's theory is that no matter how large a population grows, the **population will always discover new ways to sustain food supplies**, such as new technologies and systems.
- **Simon**: Supporting of Boserup, Simon's theory is that **humans are 'the ultimate resource'**, and in spite of finite resources, humans will come up with new ways to sustain resources (e.g. finding new materials, recycling, new means of energy).

Environmental Change and Effects on Health

Although the future of the Earth's climate is uncertain, there are prospective changes in the environment that are thought to have negative impacts on the global population's health.

Ozone Depletion

The Earth's ozone has been **depleting as a result of pollution**, and has been observed since the 70s. Although the 'hole in the ozone layer' is starting to stabilise and shrink, the effects of this depletion have increased.

Ozone Depletion allows more **UV radiation** to enter through the atmosphere, which has increased diseases caused by UV exposure

- **Skin cancer** can be caused by **UV exposure**. 90% of all non-melanoma cases are associated with UV exposure.
- **Skin cancer** cases have **increased in the 21st century**, which is thought to be related to ozone depletion.
- Between 1992 - 2006, treatment of nonmelanoma skin cancers increased by nearly **77%**. The incidence of squamous cell carcinoma increased **200%** over the past three decades in the US. (Source:www.sunsaferx.com/health-and-wellness/effects-ozone-depletion-skin-eyes/)
- UV radiation is also thought to cause **cataracts**, and it is projected that cases of cataracts will continue to rise.

Climate Change

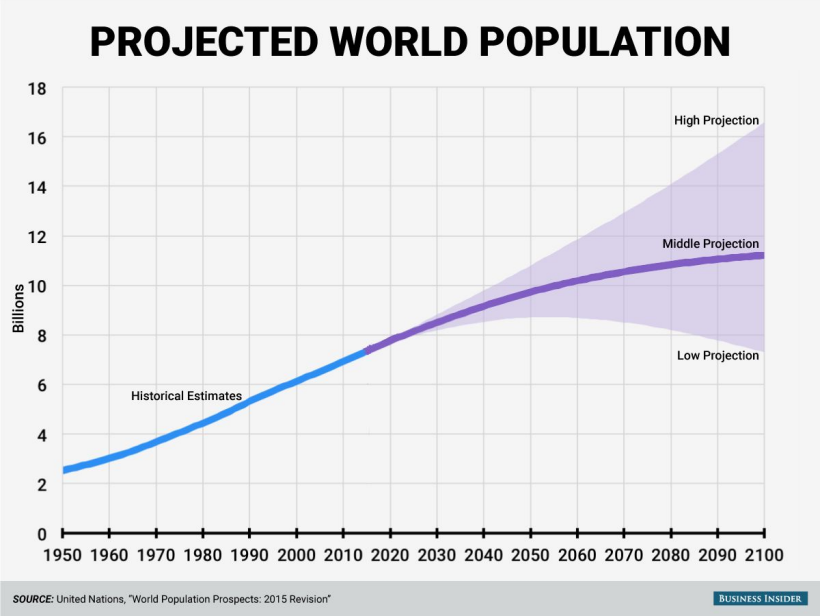
The projected effects of climate change are estimated to have primarily negative effects on health:

Deaths from heat waves in Australian cities are projected to double in 40 years.

- **Thermal Stress** (**heat exhaustion** and **hyperthermia**): As global temperatures rise, so does the prevalence and risk of **intense heat waves**. **Overheating** can cause **heat stroke** and other forms of **hyperthermia**, which can quickly become **fatal**. **Elderly people** and those **subjected to high temperatures** (such as those in military training) are especially at risk.
- **Vector-borne diseases**: With climate change comes **altering weather patterns** and a rise in **extreme weather events**. Although every disease is different, a large amount of these diseases are becoming more **widely distributed**, and the **seasons** in which they are a risk have **lengthened**.
- **Hunger**: Climate change is projected to affect **nutritional standards**; lower yields will cause less food to be **available**, and the food that is available will be of **lower quality** in some cases. Overall, this puts many at risk of **extreme hunger and famines**. **Food prices** are also likely to rise as a result of lower yields, causing even **more** people to lack access to food. This overall causes more ill health, such as vitamin deficiencies and famine, and also heightens the risk of disease as people are less healthy to fight these diseases.

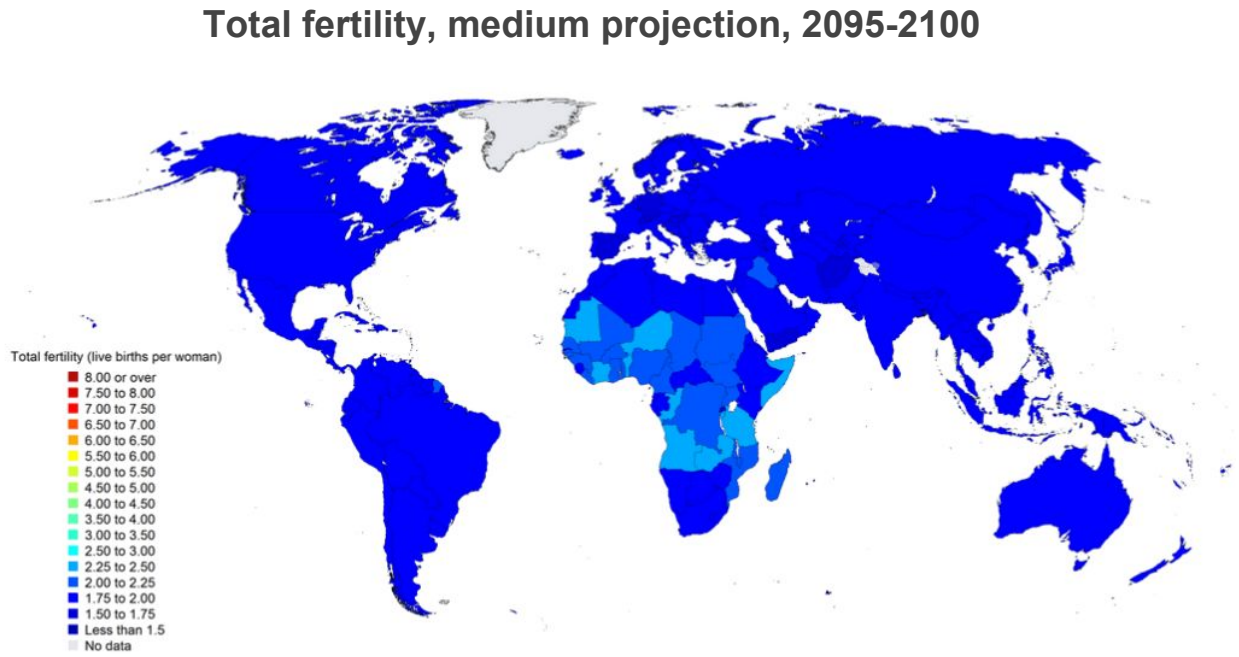
Future Global Population Prospects

1. Global population will continue to **increase**, and will reach an estimated 11.2 billion by 2100 according to the UN.



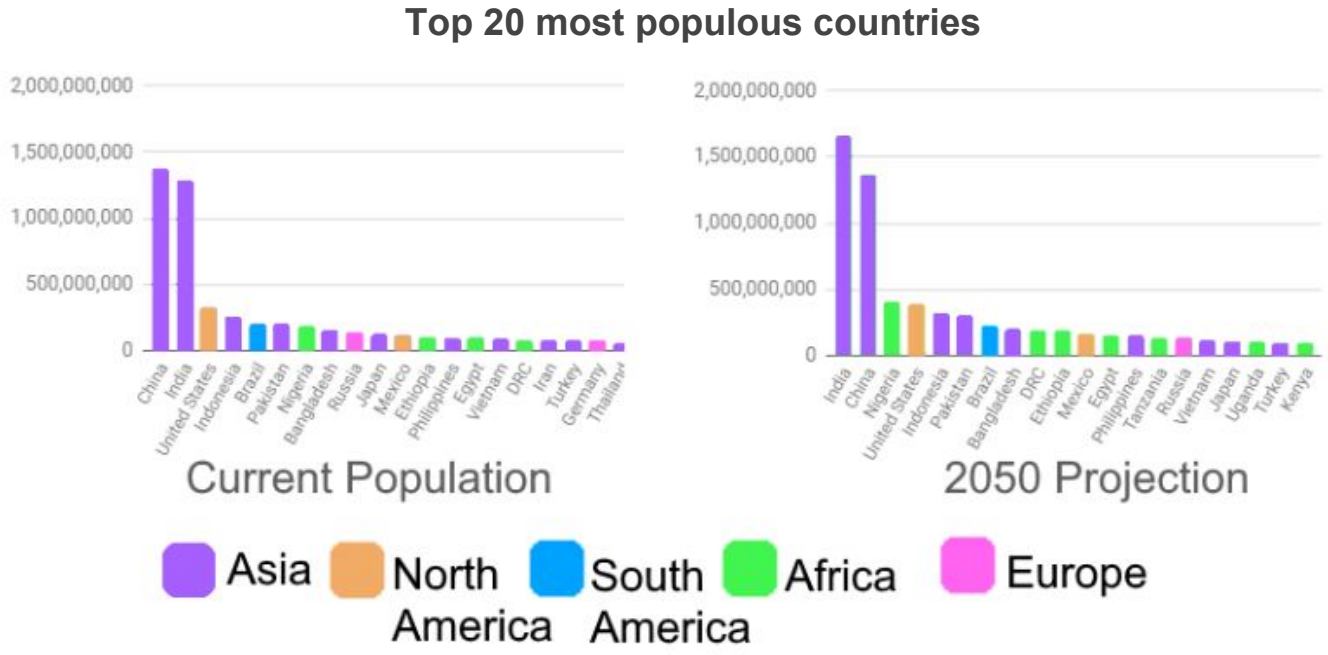
(Source: http://uk.businessinsider.com/un-world-population-projections-2015-7?r=US&IR=T)

2. Population growth rate will **slow**, as it has already done. This is majorly due to the projected lowering **total fertility rate**.



(Source: https://population.un.org/wpp/Maps/)

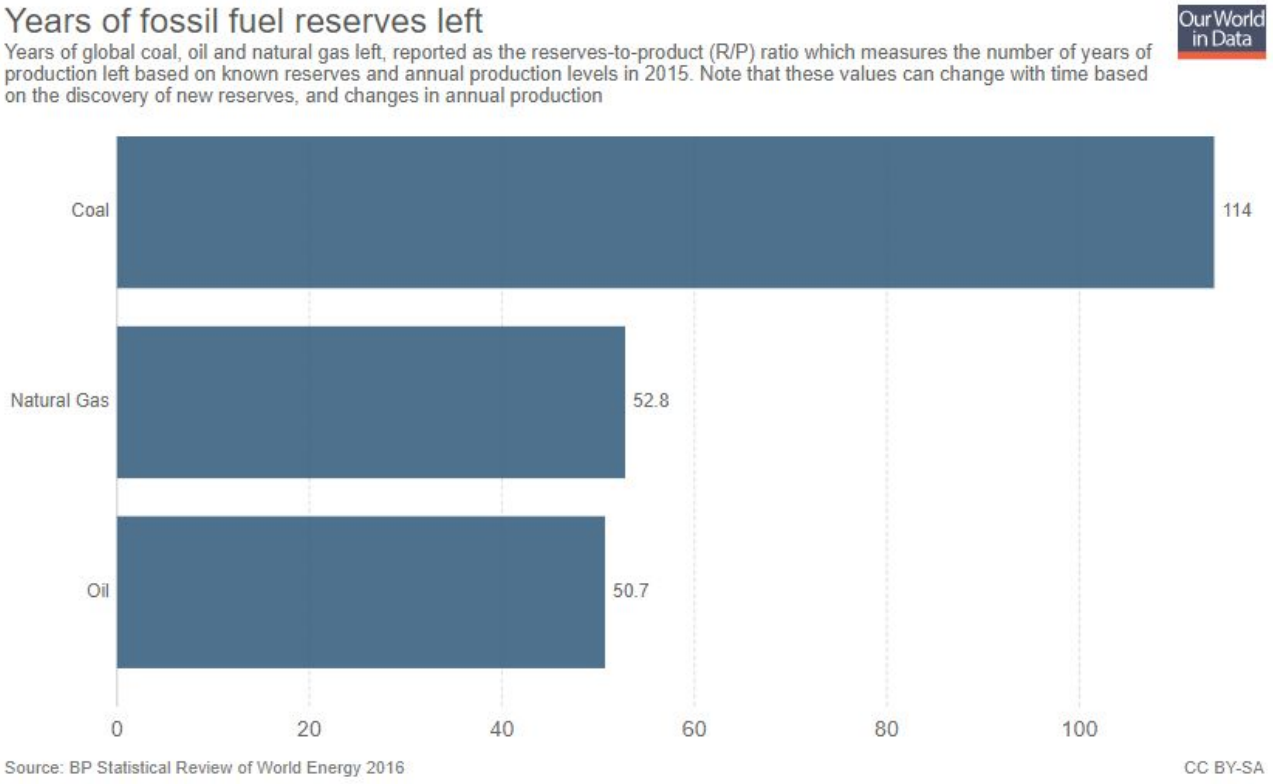
3. Population **distribution** is projected to change, because some country's **growth rates** are faster than others. India is expected to overtake China as the most populated country, and Nigeria will grow from the 7th most populous country to the 3rd, overtaking the US.



Projected Population-Environment Relationships

As countries continue to grow **socio-economically**, so will **consumption of resources** (fuel, food, consumer goods etc.). The future relationship between the population and the environment will affect how severely both the population and the environment are affected.

- **Fuel:** Fossil fuels are finite, and are expected to **run out** in the future.



Presently, the population is heavily reliant on fossil fuels, whereas **renewable energy** is globally not used as much. The population may need to alter its reliance on fossil fuels with investments into renewable energy, and **environmental agreements**, as fossil fuels are not permanent.

- **Food and other resources:** **Technological advancements** in farming, mining, recycling etc. can lower the **negative effects of exploiting** the Earth's resources. The population must continue to develop ways to sustain population growth without degrading the Earth, or the population will simply not be able to be supported.

- **Pollution**: The growing population may struggle to be supported if pollution issues are not **resolved**. This current population-environment relationship is not a sustainable one. **CO2 emissions, methane** from farming, **plastics** in the oceans, landfill and many other sources of pollution all degrade the Earth and its natural resources. As population grows, so does the **demand for pollution-causing resources** and goods. By 2050, it is said there will be more plastic than fish. This relationship must be altered, through a 'greener' way of living, or the population will not be **supported**.