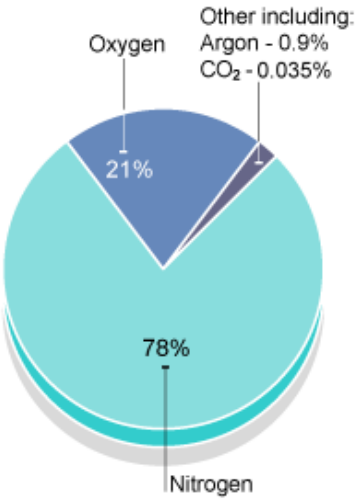
CHAPTER 7: The atmosphere and human activities

STRUCTURE AND COMPOSITION OF THE ATMOSPHERE: 7.1

- **The composition of the atmosphere:**



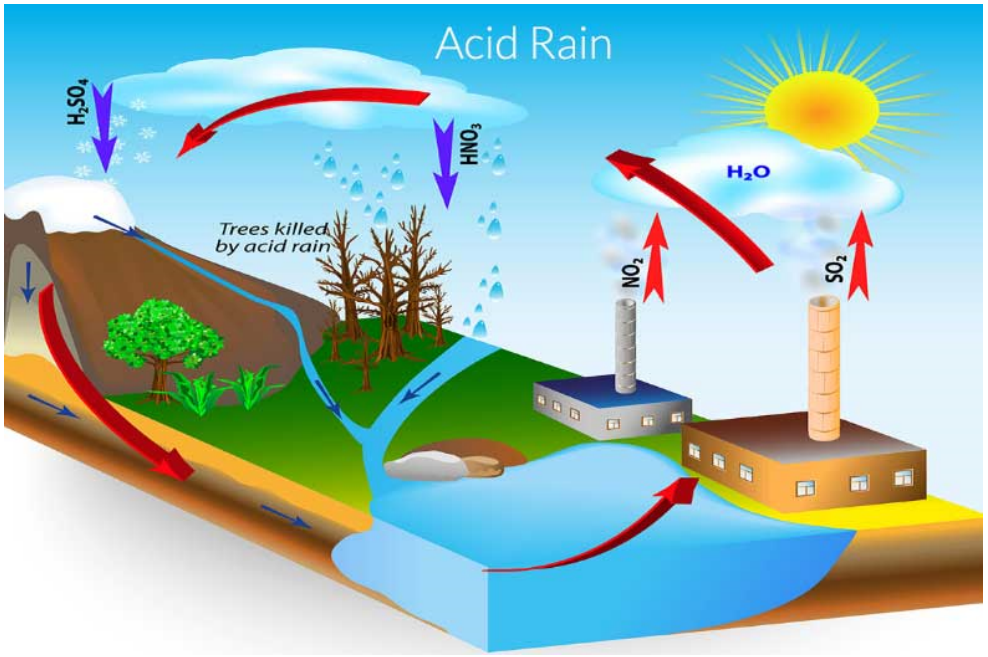
component	% in atmosphere	importance to life on Earth
nitrogen (N_2)	78.09	• Growth of plants.
oxygen (O_2)	20.95	• Produced by photosynthesis; • Used in respiration.
water vapour (H_2O)	0.2-4	• Source for precipitation; • Provides most of the natural greenhouse gases; • Vital for existence of life.
carbon dioxide (co_2)	0.03	• Used by plants in photosynthesis; • Greenhouse gas.
argon (Ar)	0.93	• Can create an inert atmosphere that protects materials from reacting with oxygen or other gases.
Helium (He), Neon (Ne), Krypton (Kr)	Trace	• Can create an inert atmosphere that protects materials from reacting with oxygen or other gases.

Number of years gas stays in the atmosphere

Carbon dioxide	200 years
Methane	12-17 years
CFCs	1000 years
Nitrous Oxides	114 years

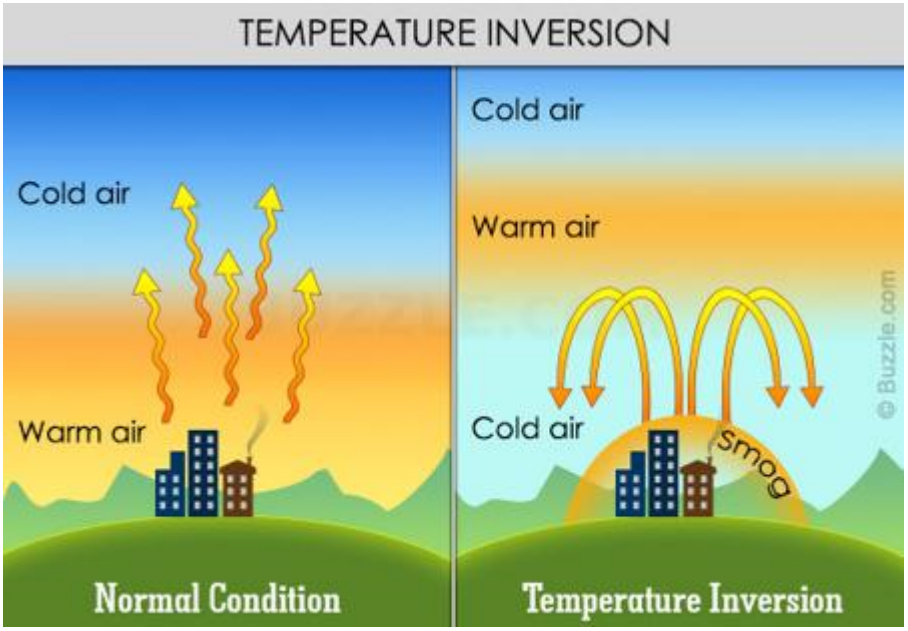
ATMOSPHERIC POLLUTION AND ITS CAUSES: 7.2

- Acid rain:
  - precipitation with a pH value of less than 7.



  - Burning of fossil fuels in factories and power stations release sulfur dioxide and nitrogen oxides.
  - Vehicle emissions add further nitrogen oxides.
  - When these gases mix and react with the water vapour in the atmosphere, they form weak solutions of nitric and sulfuric acid.
  - They are carried by prevailing winds.
  - They eventually fall to Earth as acid rain.
- Smog:
  - Burning of fossil fuels in industry, homes and vehicles provides particles like smoke and dust for fog to form around.
- Photochemical smog:
  - Involves chemical reactions induced by sunlight on certain pollutants.
  - These reactions convert them into harmful substances, like ground-level or tropospheric ozone ('bad' ozone).
- Volatile Organic Compounds (VOCs):
  - Chemicals that easily enter the atmosphere as gases, mainly from evaporation.
  - **Examples**: hydrocarbons (like methane), ammonium nitrate, carbon monoxide (incomplete combustion), etc.

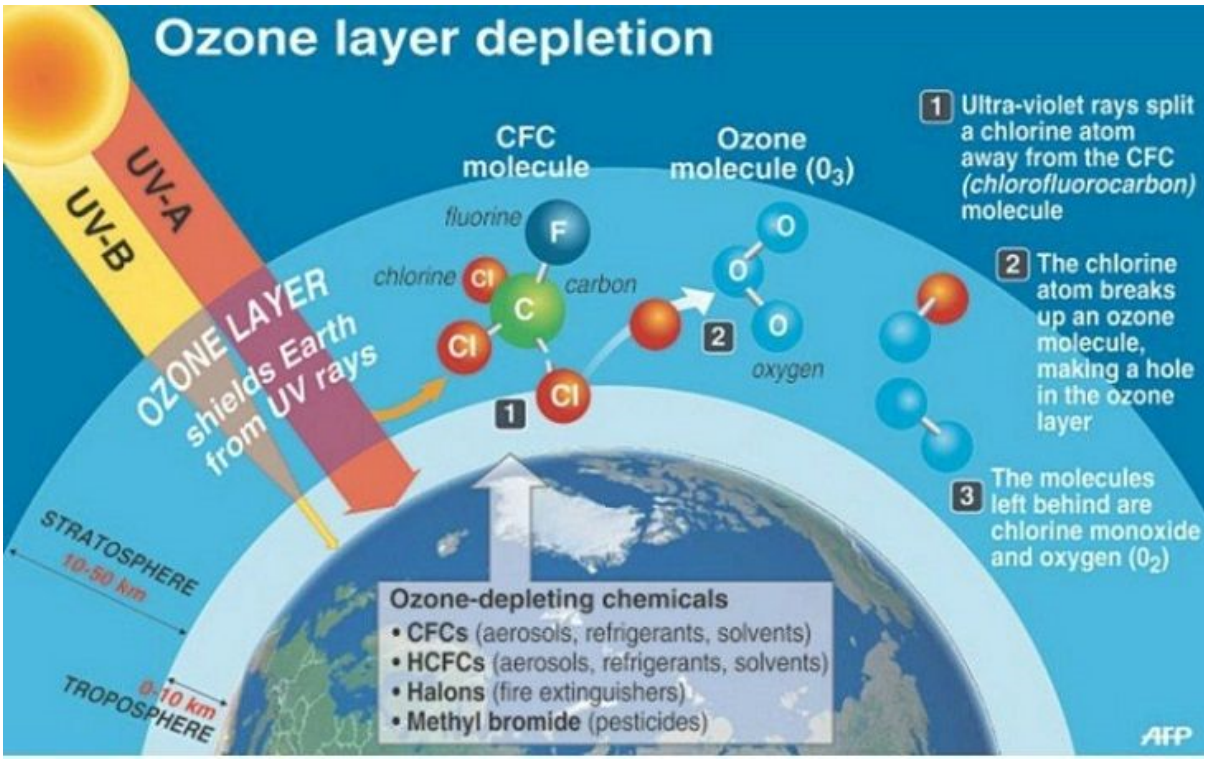
- **Temperature inversion:** a weather condition when the air temperature increases with altitude, rather than decreasing.



  - During the day, the surfaces is heated due to longwave radiation.
  - On calm and clear nights, the Earth surface cools very quickly, emitting radiation, cooling the air above it.
  - At higher altitude, the air doesn't cool as quickly, so this air becomes warmer than the air below it.
  - This layer of warm air is the inversion layer, that disrupts the regular convection currents.
  - The concentration of smog (pollutants) increases, often in valleys surrounded by steep-sided hills.
- **Enhanced greenhouse effect:** created by addition of greenhouse gases to the atmosphere through human activities.
  - More heat retained in the atmosphere.
  - Increased temperature of the Earth's surface, leading to global warming and climate change.

Greenhouse gas	Human activities that increase their abundance
carbon dioxide	• Burning of fossil fuels • Deforestation.
methane	• Cattle and rice production • Coal mine ventilation • Deforestation • Decomposition of waste (landfill sites).
CFCs	• Aerosol sprays • Fire extinguishers • Refrigeration • Air conditioning.
Nitrogen Oxides	• Vehicle exhausts • Chemical fertilisers.
Tropospheric ozone	• Chemical reactions involving nitrogen oxides and unburnt fuel vapours.

- **Ozone layer depletion:**
  - Ozone layer protects the Earth from the Sun's harmful radiation.
  - It is formed when oxygen (O_2) filters from the top of the troposphere and reacts under the influence of ultraviolet radiation to form ozone (O_3).
  - It is continually formed, destroyed and replaced naturally, creating a dynamic balance, that is disturbed by human activities.



  - When CFCs reach the stratosphere, the ultraviolet radiation breaks them down, releasing chlorine.
  - Chlorine reacts with oxygen in a destructive process, breaking down the ozone molecules to chlorine monoxide and oxygen, depleting the layer and forming a hole.
  - This hole allows harmful radiation to enter the Earth's atmosphere.

IMPACT OF ATMOSPHERIC POLLUTION: 7.3

Pollutant	impact
Smog	Irritation of eyes and throat; Respiratory diseases, like asthma; Fine particles carried into lungs, leading to lung cancer, strokes and heart attacks; Breathing difficulties.
Acid rain	Acidification of ground water, making the water undrinkable; Can cause diarrhoea and stomach upset if the water is consumed; Aluminium leached from the soil to groundwater; Acidification of groundwater damages tree roots Crop yields decline; Nutrients like calcium are leached out of the soil; Fish die as acidity levels increase; Limestone buildings are chemically weathered.
Ozone Depletion	Higher levels of ultraviolet radiation cause sun burn, skin cancers, retina damage and cataracts; Extra ultraviolet radiation limits the reproduction of phytoplankton, affecting the entire food webs; Changes in biochemical composition of some plant leaves make them less attractive as food.
Climate change	Melting of ice sheets, glaciers and permafrost cause a rise in sea-levels; Damage to low-lying countries from flooding; Forced migration as people lose their homes and farmland from rising sea-levels; Loss of biodiversity, habitat or extinction if animals and plants can't adapt; Increased droughts could lead to desertification and famine; Sea-level rise leads to the loss of coastal land and increased erosion.

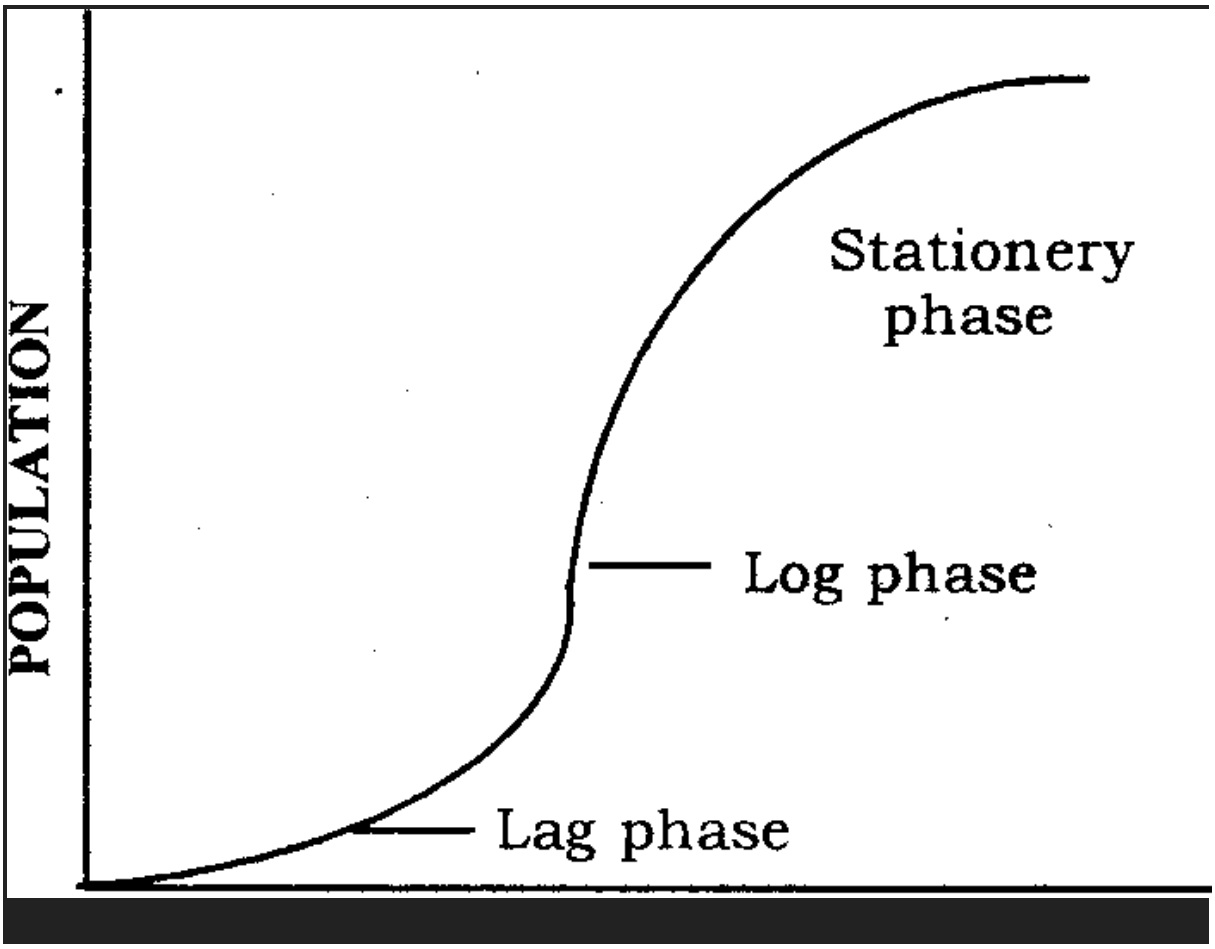
MANAGING ATMOSPHERIC POLLUTION: 7.4

- **Reduction of carbon footprint:**
  - **Carbon footprint:** a measure of the impact of our activities on the environment.
- **Reduced use of fossil fuels:**
  - Low sulfur coal can be used;
  - Increased use of renewable energy.
- **Energy efficiency:**
  - Using energy efficient appliances.
- **Carbon capture and storage:**
  - Waste carbon dioxide from power stations can be transported via pipelines to storage sites.

- *Transport policies:*
  - *Creation of cycle lanes, bus lanes, metro systems and trams;*
  - *Electric or hybrid cars can be encouraged;*
  - *Biofuels can be used;*
  - *Vehicles can be banned from certain parts of city by pedestrianisation;*
  - *Public transport and residential parking can be made free.*
- *International agreement and policies:*
  - *Policies such as Montreal Protocol, Kyoto Protocol and Paris Climate Conference can be passed on worldwide;*
  - *An international cooperation is required.*
- *CFC replacement:*
  - *Reduction in the use of CFCs;*
  - *Hydrochlorofluorocarbons (HCFCs) can be used as an alternative;*
  - *Safe disposal of items containing CFCs.*
- *Taxation:*
  - *Higher road tax to decrease car ownership.*
- *Catalytic converters:*
  - *Catalytic converters in vehicles reduce sulfur dioxide emissions;*
  - *They also convert nitrogen dioxide and carbon monoxide to carbon dioxide and nitrogen;*
  - *Low-sulfur vehicle fuels can also be used.*
- *Flue-gas desulfurisation:*
  - *Scrubbers can be used to remove 95% of sulfur dioxide emissions;*
  - *Lining chimneys with lime also reduce the emissions.*
- *Reforestation and afforestation:*
- *Reforestation: replanting an area with trees;*
- *Afforestation: planting trees in a barren land.*

CHAPTER 8: Human population

CHANGES IN POPULATION SIZE: 8.1



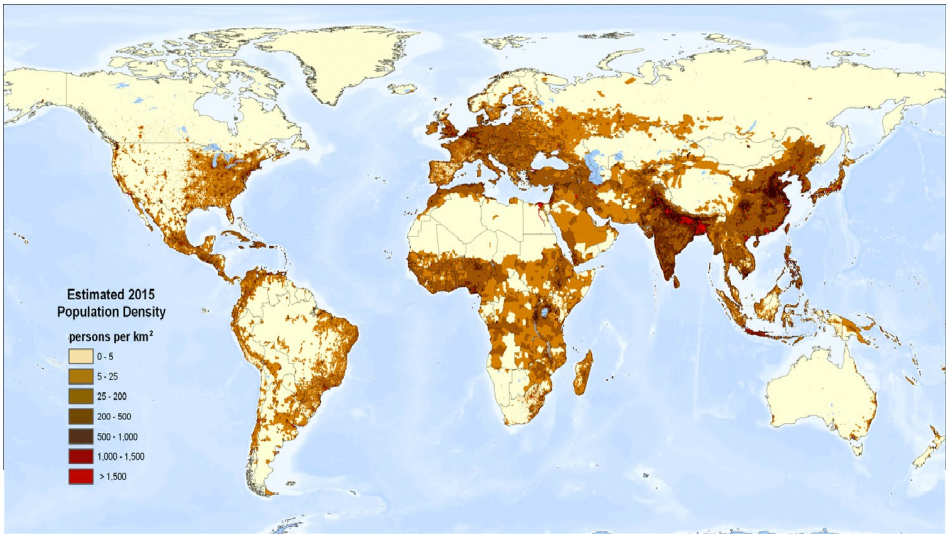
- **Population:** all the organisms of one species living in a defined area at the same time.
- **Lag phase:** the period of time in population growth when an organism is adapting to its new environment and the growth is slow.
- **Log/exponential phase:** when the growth rate of a population increases overtime as all requirements are in superabundance.
- **Stationary phase:** when the growth rate of a population has slowed down to zero as the carrying capacity is reached.
- **Carrying capacity:** the maximum size of a population that an environment can support in terms of food, water and other resources.
- **History of human population:** about 10000 years ago, there were about 5 million people living as hunter-gatherers. **Significant points in the growth of the human population since then** are:
    - About 6000 years ago, humans started growing crops and rearing animals, which provided more food and allowed the population to begin to grow;
    - By the time the modern system of counting years started, the population was about 250 million;
    - It then took another 1800 years to reach 1 billion;
    - After this, the growth become very rapid;
    - By 1930, it was 2 billion;
    - By 1975, it was 4 billion;
    - By 2016, it was over 7 billion, a rise of 3 billion in just 37 years.
    -

- Birth rate: the number of live births per thousand of population per year.
- Death rate: the number of deaths per thousand of population per year.
- Natural increase: the difference between birth rate and death rate.
- Factors effecting birth rate:
    - In countries with a high death rate for the very young (high infant mortality), birth rates are also high.
    - In farming economies of many LEDCs, more people are needed for manual labour hence families tend to be larger.
    - In MEDCs, it is expensive to have children and pensions are provided by the state.
    - As pensions are provided, they do not need children to take care of them in their old age.
    - Many social and political factors result in low use of birth control in LEDCs, whereas in MEDCs birth control is widely used, so both birth and death rates are lower.
- Migration: the movement of people into (immigration) or out of (emigration) a region, country or an area.
    - Most common worldwide movement is from rural to urban areas in LEDCs.
    - Sometimes urban to rural migrations also occur, mostly in MEDCs.
- Population growth: (birth rate + immigration) – (death rate + emigration)

Push factors: factors that encourage people to move away from an area.	Pull factors: factors that encourage people to move into an area.
Drought/famine;	Good supplies of food whatever the weather;
Poverty;	Well-paid jobs;
Poor links with outside world;	Good roads;
Poor services;	Hospitals, schools, water, electricity;
Work on the land only, subsistence;	Factory, shops, office work for a wage.
Desertification;	No comparable pull factors
Sea-level rise;	
Seasonal weather events.	

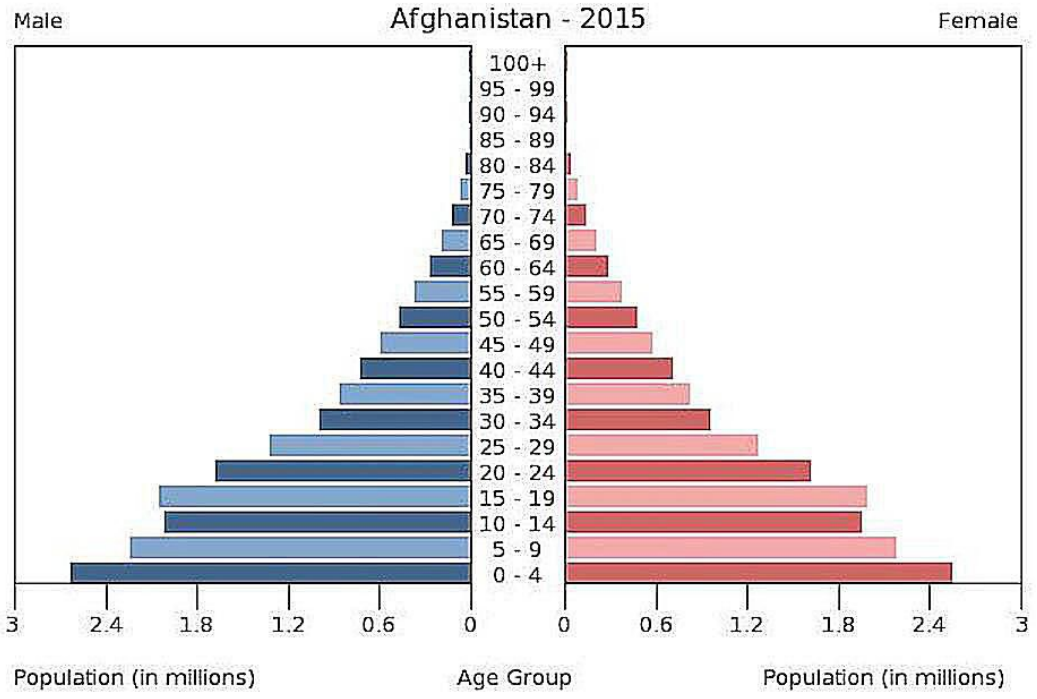
HUMAN POPULATION DISTRIBUTION AND DENSITY: 8.2

- **Population density:** *population per area (figures providing an average value).*
- **Population distribution:** *how the population is spread over an area.*
    - **Example:** *very few or no people live in deserts and mountains, whereas populations are very high in coastal areas due to availability of fresh water.*

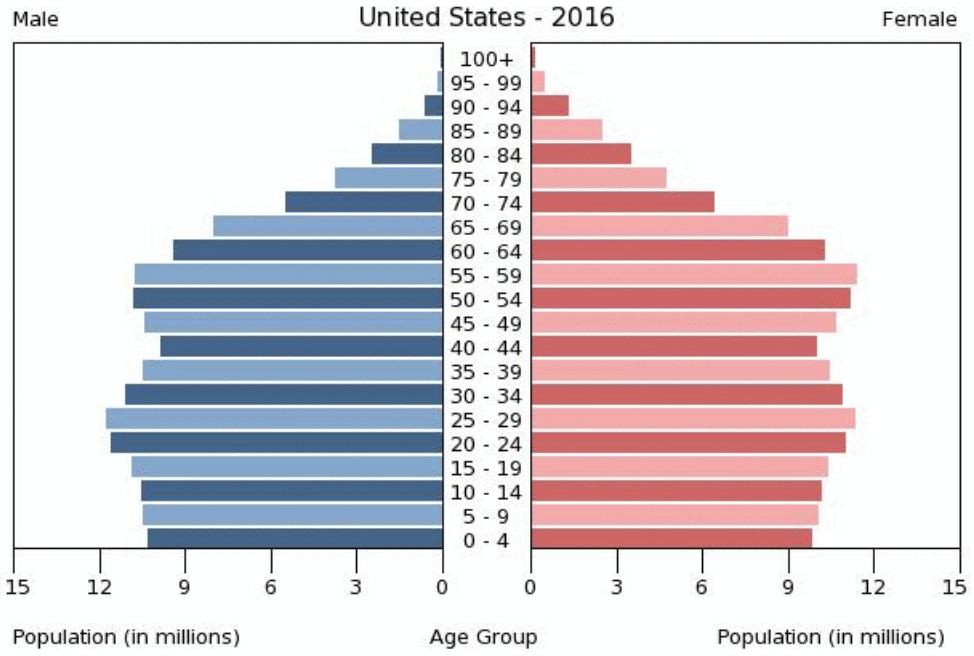


POPULATION STRUCTURE: 8.3

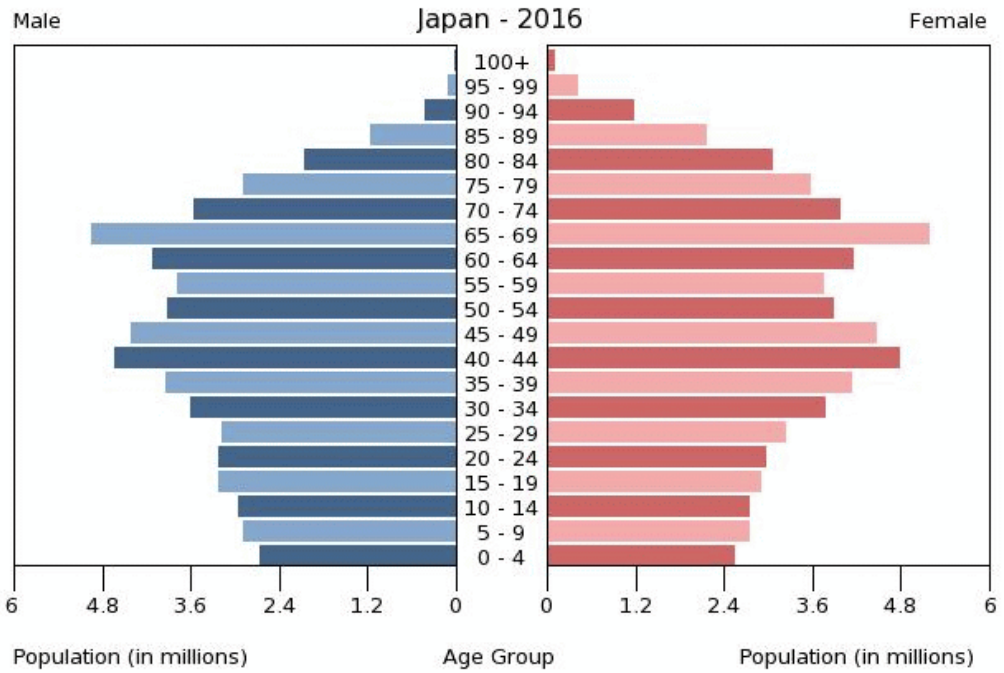
- **Population/age pyramid:** *a diagram that shows the proportion of the population that is male and female in different age groups (usually 5-year interval).*



- **Expanding (young) populations (Afghanistan 2015):** *a typical pyramid for LEDCs with high proportion of young people due to high birth rate.*



- **Stationary populations (USA 2016):** *population that is almost stationary, with a rectangular shape, except at the top when old people die.*



- **Contracting (old) populations (Japan 2016):** *population is declining because of low birth rates, and its pyramid is top-heavy because of low death rates.*
- **Dependant:** *those people in the population who are not economically active (working) i.e. the young (<16) and old (65+) and thus rely on those who are working for their needs.*
- **Independent:** *those people in the population who are economically active (working) i.e. the middle-aged (between 17 and 65).*
- **Taxes from the independent population is used for:**
- *Education for the youngsters and provision of school places for the children yet to reach school age.*
- *Creating care-home places and hospitals for the ageing population.*

MANAGING HUMAN POPULATION: 8.4

- **Family planning:** methods used by couples to decide the number of children to have and when, which is mostly encouraged by governments
- **Contraception:** used to prevent pregnancy.
- **Improved health and education: makes people more aware of methods to limit family size.**
- Educated women may plan a career as well as having children, the former frequently limiting how many children are born.
- Education can also lead to a tendency for later marriages and thus later child bearing.
- High infant mortality causes couples to have more children. When it is reduced by better healthcare and sanitation, the trend is reversed.

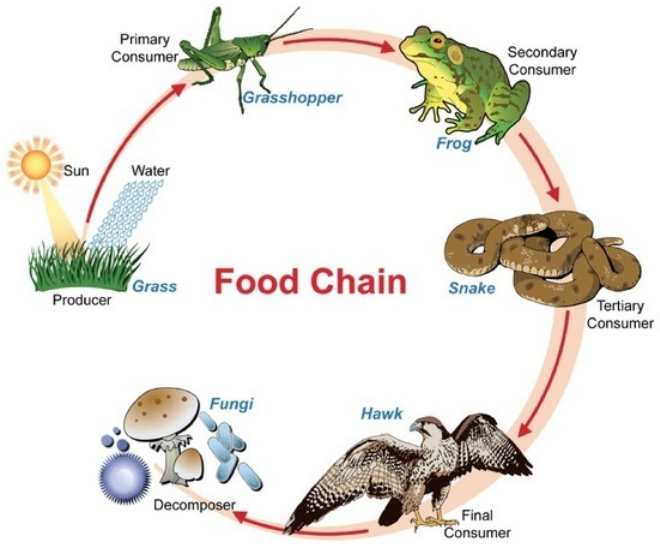
National population policies:

- **Pronatalist policy:** a national or regional policy that aims to encourage couples to have children.
    - In countries like France, couples were encouraged to have more than 2 children.
    - Parents are paid the equivalent of the minimum wage for a year after they have a third child.
    - They enjoy subsidised train fares, pay less tax the more children they have, and subsidised day care.
- **Antinatalist policy:** a national or regional policy that aims to discourage couples to have children.
    - In LEDCs, population increases too fast, and these policies can form in weak measures such as the provision of family planning, contraceptives and education, to laws encouraging couples to have only one child.
    - Some countries have no population policies at all and usually have high birth rates.

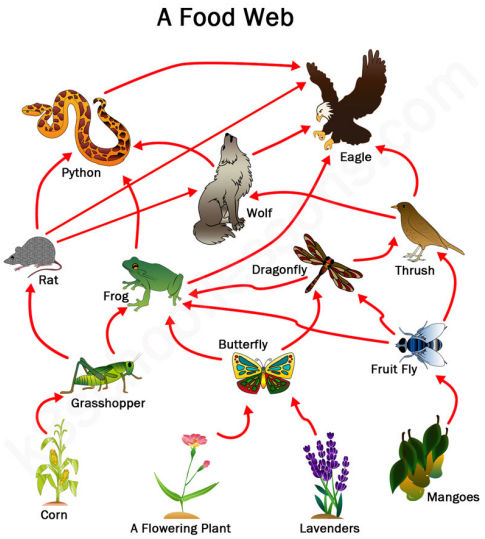
CHAPTER 9: Natural ecosystems and human activity

ECOSYSTEM: 9.1

- **Ecosystem:** *all the living things (biotic components) together with all the non-living things (abiotic components) in an area.*
- **Population:** *all the organisms of one species living in a defined area at the same time.*
- **Community:** *a group of populations of different species that live together in an area and interact with each other.*
- **Habitat:** *the place within an ecosystem where an organism lives.*
- **Niche:** *the role of a species within the ecosystem.*
- **Food chain:** *a diagram showing the relationship between a single producer and primary, secondary and tertiary consumers.*

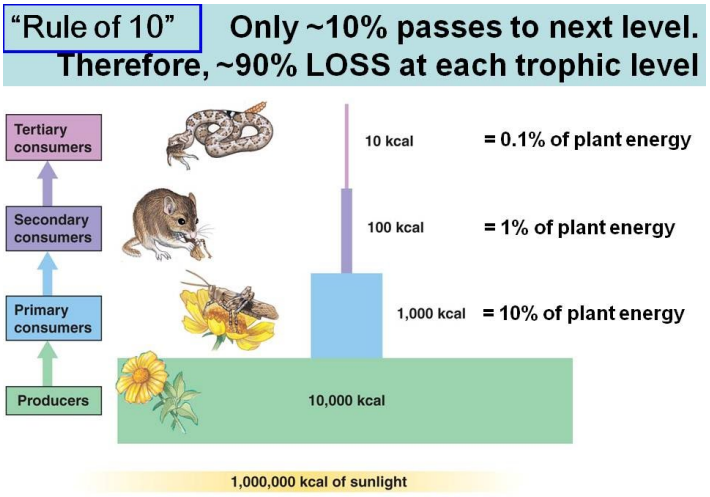


- **Food web:** *a diagram showing the relationship between all (or most) of the producers, primary, secondary and tertiary consumers in an ecosystem.*



- **Trophic level:** *a feeding level within a food chain or food web.*

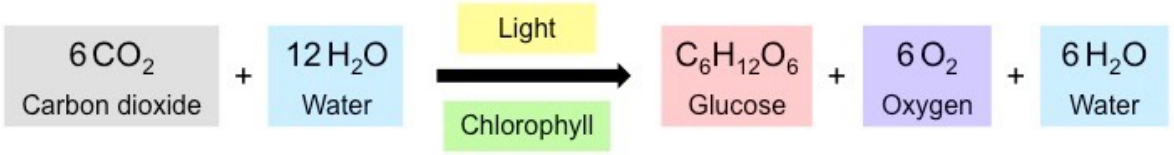
- **Pyramid of numbers:** a diagram that represents the number of organisms at each trophic level in an ecosystem by a horizontal bar whose length is proportional to the numbers at that level.



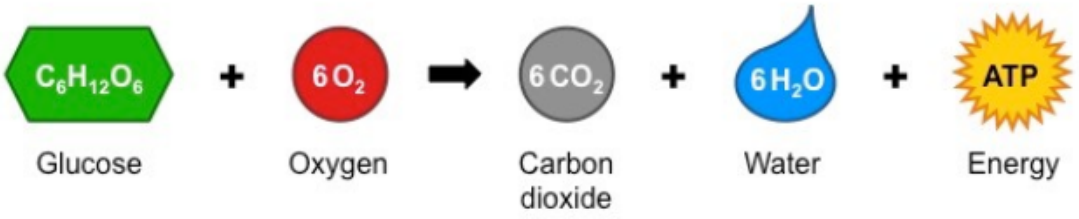
- The pyramid shape reflects the loss of energy at each trophic level.
- Energy is:
  - Lost during transfer as heat to the environment;
  - Used for cellular respiration;
  - Used for growth;
  - Lost as faeces;
  - Lost by incomplete digestion by higher trophic level.
  - Food chains cannot have more than 4 or 5 trophic levels as there's not enough energy to pass on.
- Biotic factors:
  - **Producers:** organisms within an ecosystem that can carry out photosynthesis.
  - **Primary consumers:** organisms within an ecosystem that derive their food from producers.
  - **Secondary consumers:** organisms within an ecosystem that derive their food from primary consumers.
  - **Tertiary consumers:** organisms within an ecosystem that derive their food from secondary consumers.
  - **Decomposers:** organisms within an ecosystem that derive their food from the bodies of dead organisms.
- Abiotic factors:
  - **Temperature:** usually expressed in °C. Living things have a range of temperatures within which they can survive.
  - **Humidity:** a measure of how damp the air is; how much water vapour it holds.
    - Usually expressed as relative humidity (RH) – RH expresses the humidity as a % of the amount of water vapour the air could hold if fully saturated.
  - **Water:** essential for all life as it's a raw material for photosynthesis and a medium for chemical reactions.
    - Plants obtain water from the soil and water content of soil is an important factor in determining where exactly a plant species lives.
  - **Oxygen:** nearly 21% in the air; decreases with increasing altitude.
    - Usually expressed as parts per million (ppm) in water.
    - Not very soluble in water so all aquatic organisms have adaptations to get enough e.g. gills in fish.

- **Salinity:** how salty something is, measured as ppm or parts per thousand (ppt) or concentration e.g. milligrams/litre)
  - **Brackish water:** water that is salty (>0ppt) but not as salty as seawater (<35ppt).
- **Light:** essential for photosynthesis; expressed as lumens.
- **pH:** (refer to section 4.8 Impact of water pollution; pH).

- Photosynthesis:

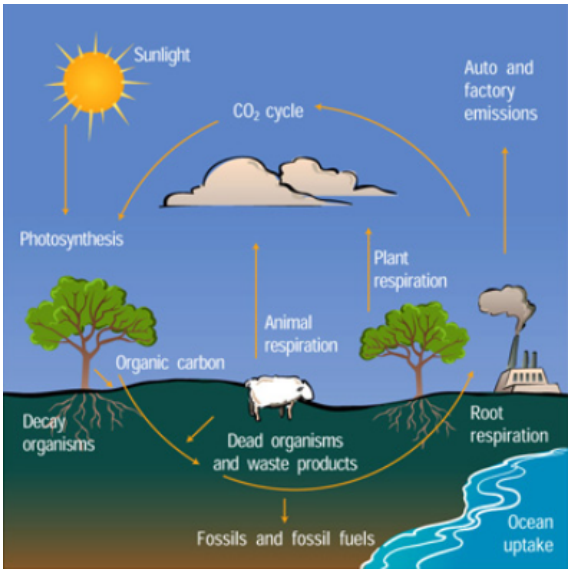


  - Plants trap light energy with the help of chlorophyll.
    - This green pigment splits water into hydrogen and oxygen.
    - The hydrogen is added to CO_2 to make glucose.
    - The oxygen not used in respiration is given off to the atmosphere.
  - Plants obtain CO_2 from the atmosphere through their stomata in the leaves and water from the soil through their roots.
  - Glucose is used by plants in respiration to release energy and is converted to substances the plant needs eg starch, cellulose, proteins etc.
  - Nitrogen is needed to form some substances such as proteins, but in every case, chemical energy remains stored in the substance.
- Respiration: the process by which living things release energy from food to carry out the process of life, such as movement.



- Biotic interactions:
  - **Competition:** living things need a range of resources from the environment.
    - Many younger are produced than will survive, so there is often competition of resources.
    - Individuals least adapted to the current conditions will either die or fail to reproduce.
  - **Predation:** when one animal eats another.
  - **Pollination:** the transfer of pollen grains (male gametes) from the anther to the stigma for it to fuse with the ovule (female gamete).
    - In plants, male sex cells are found in pollen grain, made in the anther.
    - Pollen grains are either blown by wind or carried by insects.
    - The anther is in the flower, attracting the animals with bright colours, scent and the production of nectar.
    - The pollen grain lands on the stigma of another flower and sends out a tube that grows down to where the ovule is.
    - The ovule is then fertilised to form an embryo in a seed that grows into a plant.

- ***The carbon cycle:***

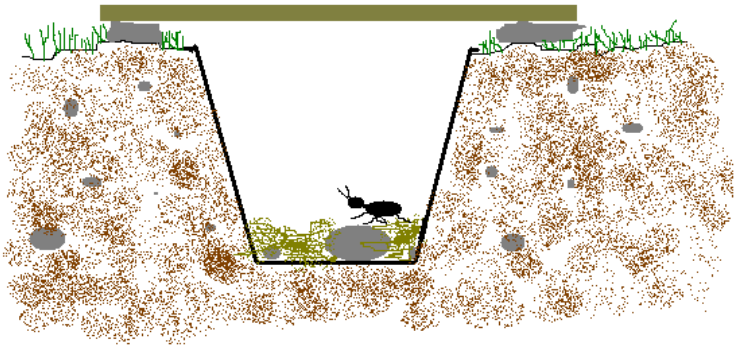


ESTIMATING BIODIVERSITY IN ECOSYSTEMS: 9.2

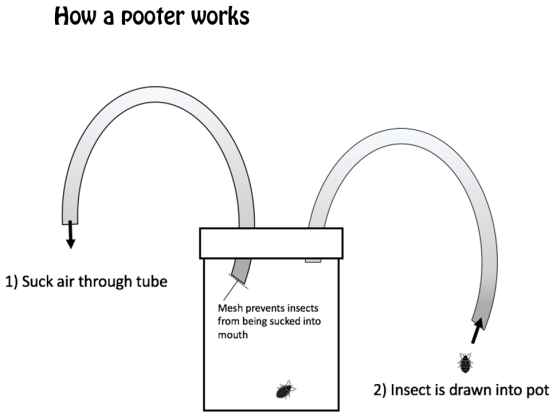
- *Types of sampling:*
  - *Random sampling: a sampling method in which the sampling device is placed using random tables or the roll of dice.*
  - *Used when two areas are to be compared e.g. number of insects in wet and dry areas.*
  - *Systematic sampling: a sampling method in which the sampling device is placed along a line or a pre-determined pattern, usually a transect.*
  - *Used to check how the species change along a gradient in the environment e.g. from the shade of a woodland to an open field.*
- *Quadrat: a frame of known area placed on a part of the site to be sampled.*

  - *Used to sample sedentary organisms e.g. plants.*
  - *The number of organisms of the species is then counted.*
  - *Sometimes, the percentage cover of the organism in the quadrat is calculated.*

- **Transect:** a sampling method in which sampling devices are laid out along a line already placed across an area.
    - Used to sample sedentary organisms.
    - An example of systematic sampling.
- Pitfall traps:



    - Used to sample non-sedentary organisms (insects).
    - Consists of a jar sunk up to its rim in the soil.
    - The jar may or may not be covered (depending on the predicted likelihood of rainfall).
    - Traps should be inspected and emptied regularly.
    - Can be used randomly or systematically.
    - Drawback: measures the activity and number of the species.
- Pooter:



    - Used to sample non-sedentary organisms e.g. insects.
    - Insects in short vegetation or on trees are usually trapped in a net.
    - A pooter is used to transport the organisms, from the nets or traps to a laboratory, for example.

Method	Advantages	Disadvantages
quadrats	• Quick • Inexpensive • Portable.	• Not always very accurate • Unless many quadrats are placed, the sample can be unintentionally biased.
transects	• Quick • Inexpensive • Portable.	• Often used in inappropriate situations.

pitfall traps	• Inexpensive • Easy to set up and use.	• Often kill the organisms captured • May oversample or undersample.

CAUSES AND IMPACT OF HABITAT LOSS: 9.3

Causes of habitat loss:

- **The drainage of wetlands:**
    - Drainage for agriculture, forestry and mosquito control;
    - Dredging for flood protection;
    - Use for disposal of waste created by road construction;
    - Discharge of pollutants;
    - Peat removal;
    - Removal of groundwater.
    - **Importance of wetlands:**
        - Shoreline protection;
        - Maintenance of water quality;
        - Flood control;
        - Recharging of aquifers;
        - Biological productivity;
        - Provide habitats;
        - Source of variety of products eg fish, fuel and fibres.
- **Intensive agricultural practices:** wetlands are drained and other land is occupied to provide for intensive agricultural practices, resulting in habitat loss.
    - Overcultivation of soil leads to soil erosion, causing habitat loss for decomposers living in the soil.
- **Deforestation:** Clearance of climax communities that would otherwise provide habitat for a wide range of tree and ground dwelling species.
    - **Climax community:** An ecological community in which populations of plants or animals remain stable and exist in balance with each other and their environment.

Impacts of habitat loss:

- **Extinction:** the process by which a species or other named group ceases to exist on Earth or other named area.
- **Loss of biodiversity:** various species die or relocate when their habitat is destroyed.
- **Genetic depletion:** the loss of species containing potentially useful genes.
    - Species and genetic diversity that exist in the wild may have many currently unknown uses e.g. medicinal, drought-resistant, etc.
    - These characteristics of modern crop plants may prove useful in the future e.g. due to climate change, drought-resistant strains are needed.
    - These useful, ancient strains (genes) of important crop plants should be retained.
    - However, due to habitat destruction, genetic diversity is reducing, leading to species becoming extinct, making the genetic loss irretrievable.
    - Modern strain of crop plants may not be able to adapt to future changes.

CAUSES AND IMPACT OF DEFORESTATION: 9.4

Causes of deforestation:

- Timber is needed in MEDCs for products ranging from luxury furniture to paper, or as a source of energy.
- Lumber (planks and boards).
- **Clear land for:**
    - Farming;
    - Roads and settlements (logging tends to be selective as only a few species create timber, however building roads for transporting logs is the most damaging process.)
    - Rock and mineral extraction.

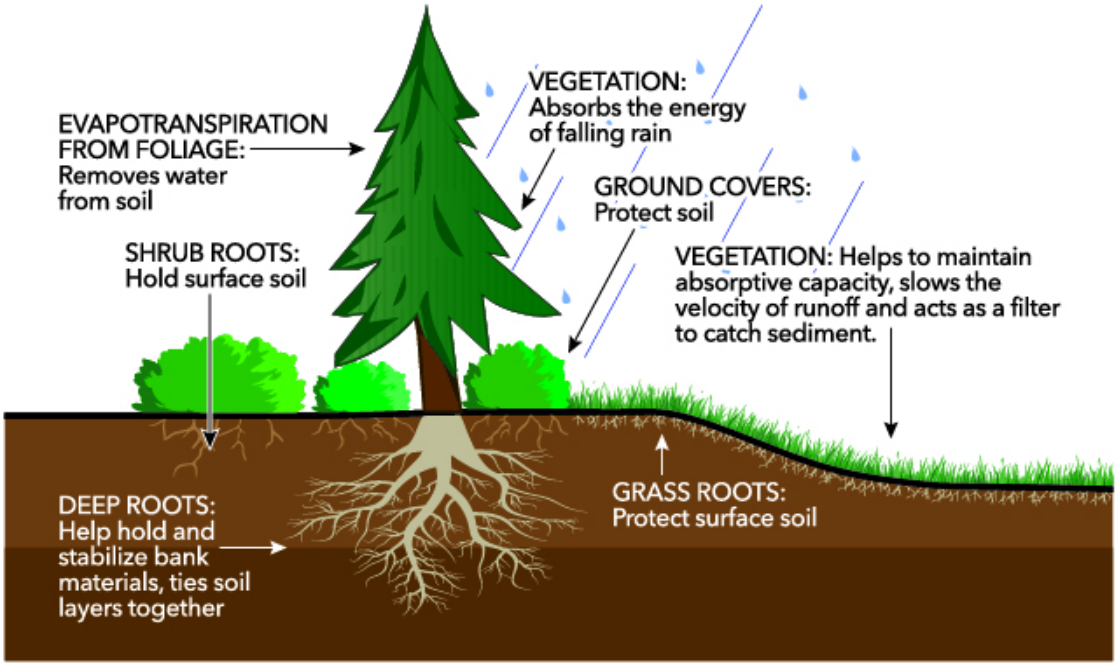
Impacts of deforestation:

- **Habitat loss:** biodiversity is lost when habitats are lost.
    - Tropical rainforests are centers of great biodiversity, so loss of habitat here is serious.
    - Huge volume of trees acts as massive carbon stores that's also home for rare species which may be useful to us.
- **Soil erosion and desertification:**
    - Forests reduce the impact of heavy rainfall on the ground, reducing soil erosion.
    - Tree roots bind the soil in place and the layer of fallen leaves and branches protect the soil.
    - Overtime, after deforestation, the area that once supported luxuriant growth may become a desert, because of desertification.
    - (refer to section 3.6 Causes and impacts of soil erosion).
- **Climate change:**
    - Changes caused in the levels of various greenhouse gases in the atmosphere.
    - CO_2 and methane are rising and so are atmospheric temperatures.
    - **Greenhouse gas:** gas that stops energy in the form of heat from being lost from the atmosphere.
    - **Rise in CO_2:** due to the burning of fossil fuels, deforestation, industries.
    - If the rate of trees photosynthesising and respiring were equal, removal of trees would have no effect.
    - However, permanent removal of trees leads to large quantities of CO_2 when burnt or decomposed.
    - Moreover, the machinery of burning fossil fuels releases more CO_2.
- **Loss of biodiversity and genetic depletion:** (refer to Section 9.2 Ecosystems under threat; Loss of biodiversity and genetic depletion)

NEED FOR SUSTAINABLE MANAGEMENT OF FORESTS: 9.5

- **Carbon sinks:** a vegetated area where the intake of CO_2 from the atmosphere in photosynthesis exceeds its output from respiration, so the net flow of carbon is from the atmosphere into plants.
- **Carbon store:** a mature vegetated area where the intake of CO_2 from the atmosphere by photosynthesis equals its output from respiration, so the mature plants store carbon.
- **Role in water cycle:** forests add water to the atmosphere during transpiration, leading to formation of clouds, eventually releasing it by precipitation.
- During deforestation, this process is reduced and local droughts are caused in the area.
- Forests generate moisture in the atmosphere that can affect rainfall around the world.

- **Prevention of soil erosion:
**



EFFECTS OF VEGETATION IN MINIMIZING EROSION

- By intercepting rain, forests reduce heavy rainfall on the forest floor.
- Debris such as tree leaves on the floor of the forest slows run-off.
- Roots of trees hold soil in place.
- Forests on the coast reduce erosion by absorbing energy from storms.
- (refer to section 3.7 Managing soil erosion).
- **Ecotourism:** responsible travel to a natural area that promotes conservation of the environment.
- Visitors travel with the main aim of appreciating its natural beauty.
- Ecotourism is both a reason to manage forests sustainably and a method by which this can be achieved.
- It may be mainly economic in focus, with success measured by income, or focused on sustainability, with success measured by a limit on numbers of visitors.

STRATEGIES FOR CONSERVING THE BIODIVERSITY AND GENETIC RESOURCES OF NATURAL ECOSYSTEMS: 9.6

- **Sustainable harvesting of wild plant and animal species** (refer to section 5.4 Management of the harvesting of marine species):
    - Many plants have medicinal properties because of the secondary metabolites they produce.
- **Secondary metabolites:** organic compounds produced by bacteria, fungi, or plants which are not directly involved in the normal growth, development, or reproduction of the organism.
    - Wild plants are preferred source as cultivated varieties only produce small or none of the chemicals to be used.
- Management plan to control harvesting of wild-grown medicinal plants:
    - Assessing the abundance of the plant (refer to section 9.5 Measuring and managing biodiversity).
    - Investigate species' growth rate, reproductive biology and impact of harvesting.
    - Assess the yield that can be sustained by the wild population.
    - Details of how the harvesting should be monitored.

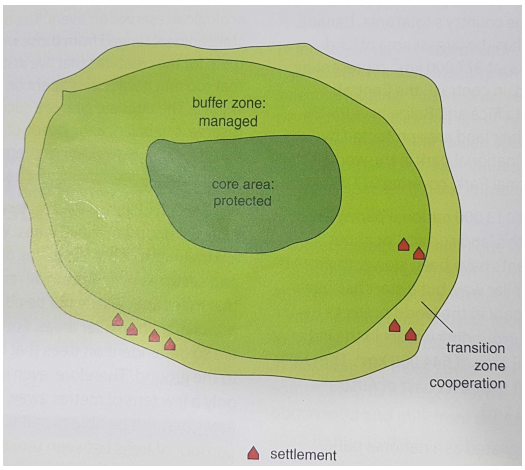
- **Sustainable forestry:**
  - **Selective logging:** removal of only mature trees of species that are valuable. Other species and immature trees of value species are left, allowing the forest to repair overtime.
    - Non-valued trees still provide habitat for many species and immature valued trees can be used years later.
- **Agroforestry:** land management system in which crops are grown around trees.

  - Trees enrich the soil when the leaves fall, provide food for animals, firewood for people, and sometimes medicine.
  - Tree roots bind soil together, and in some cases, fix nitrogen, further enriching the soil.
  - Farmers obtain food and milk from the farm, and their animals enrich the soil with manure.
  - **Alley cropping:** planting rows of trees at wide spacings with a companion crop grown in the alleyways between the rows.
    - Trees are pruned and the prunings are used to improve the soil and provide minerals to the crop. (if the tree is a legume, these minerals would include nitrates)
    - Mineral recycling and the suppression of weeds by the trees are combined with cropping on the same land, these thereby allow the long-term survival of farmland.

- **National parks:** an area of land protected by the government to preserve entire ecosystems e.g. flora, fauna and landscape.
  - Laws that ban/limit activities such as hunting, logging and collection of wildflowers are implemented.
  - Enforcement requires regular inspection and threat of hefty fines or imprisonment for breaking the law.
  - Extensive facilities for tourists are provided, that includes a system of roadways, carparks and natural trails.
  - An entry fee charged is used for conservation work.
  - A guidebook/leaflet is provided that includes information on the dos and don'ts, and the importance of the conservation of wild nature.
  - The largest national park in the world is the Northeast Greenland National park, covering 972001km^2.
- **Wildlife and ecological reserves:** the practice of protecting wild plant and animal species and their habitat that plays an important role in balancing the ecosystems and different natural processes eg rainfall, fertility of the soil, etc., thus also meeting the needs of people.

- **Extractive reserves:** an area of land, generally state-owned where access and use rights, including natural resource extraction, are allocated to local groups or communities.
- **Wildlife corridor:** a link of wildlife habitat, generally native vegetation, which joins two or more larger areas of similar wildlife habitat.

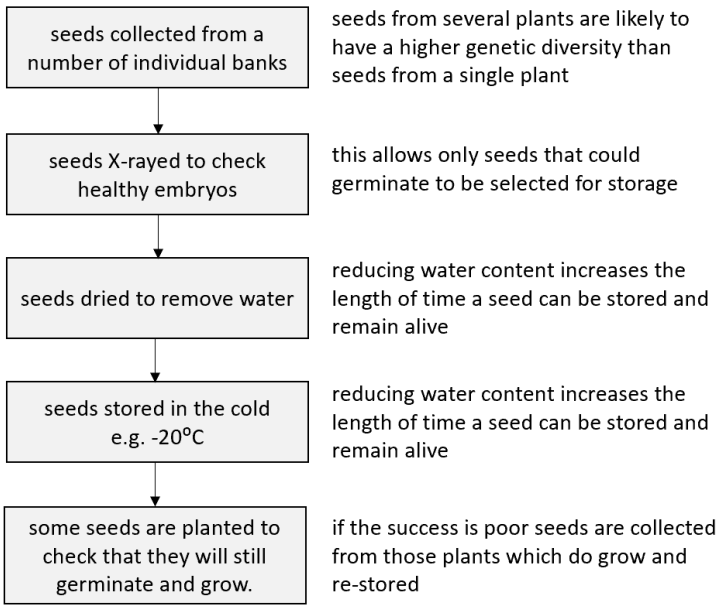
  - Corridors are critical for the maintenance of ecological processes including allowing for the movement of animals and the continuation of viable populations.
- **World biosphere reserves:** an ecosystem with plants and animals of unusual scientific and natural interest.



  - The plan is to promote management, research and education in ecosystem conservation.
- Advantages:
  - Recognised internationally via UNESCO.
  - Attracts funding and support of experts in the conservation community, improving the success of the reserve.

Core area	Buffer zone	Transition zone
Ecosystems that need protection.	• More research, along with tourism and education.	• Local communities and conservation organisations work together to manage the area for the benefit of the people living there.
Monitoring and some research.	• May contain field stations with laboratories and recreational facilities.	

- **Seed banks:** *stores seeds to preserve genetic diversity when it's not possible to protect the area where the endangered plant lives.*



    - *Wild plants carry genes that could be used in crop plants to confer resistance to pests and diseases;*
    - *Seeds occupy lesser space than plants, thus more species can be held;*
    - *Collecting small samples of seeds is unlikely to damage the wild population as most plants produce large number of seeds;*
    - *Seeds are dormant and need minimal care, thus easier to store than living plants.*
- **Role of zoos and captive breeding:**
    - *Provide education about the illegal trade in animals and products, and the need to maintain biodiversity;*
    - *Involved in scientific research on the control of diseases, animal behavior and techniques to improve breeding success;*
    - *Captive-breeding programmes increase species numbers, thus reducing the risk of extinction;*
    - *Aim to release captive-bred animals into the wild when habitats have been restored;*
    - *Such programmes try maintaining genetic biodiversity of a species, as interbreeding leads to a reduction in diversity and therefore reduces adaptability when the species is placed back in the wild.*
- **Ways to reduce inbreeding:**
    - *Organisms aren't allowed to breed repeatedly with the same partner;*
    - *A variety of partners for an organism can be achieved through in-vitro fertilisation and inter-zoo swapping of individuals;*
    - *Use a database (studbook) to record breeding history of individuals in captivity.*
- **Sustainable tourism and ecotourism:** *management of tourism in a sustainable way to prevent damage to habitat and provide what people want.*
    - *Key to successful sustainable ecotourism is realising that the growth of the tourist industry depends on maintaining the environment.*
    - *Measures are taken to safeguard wildlife and the resources are used sustainably.*