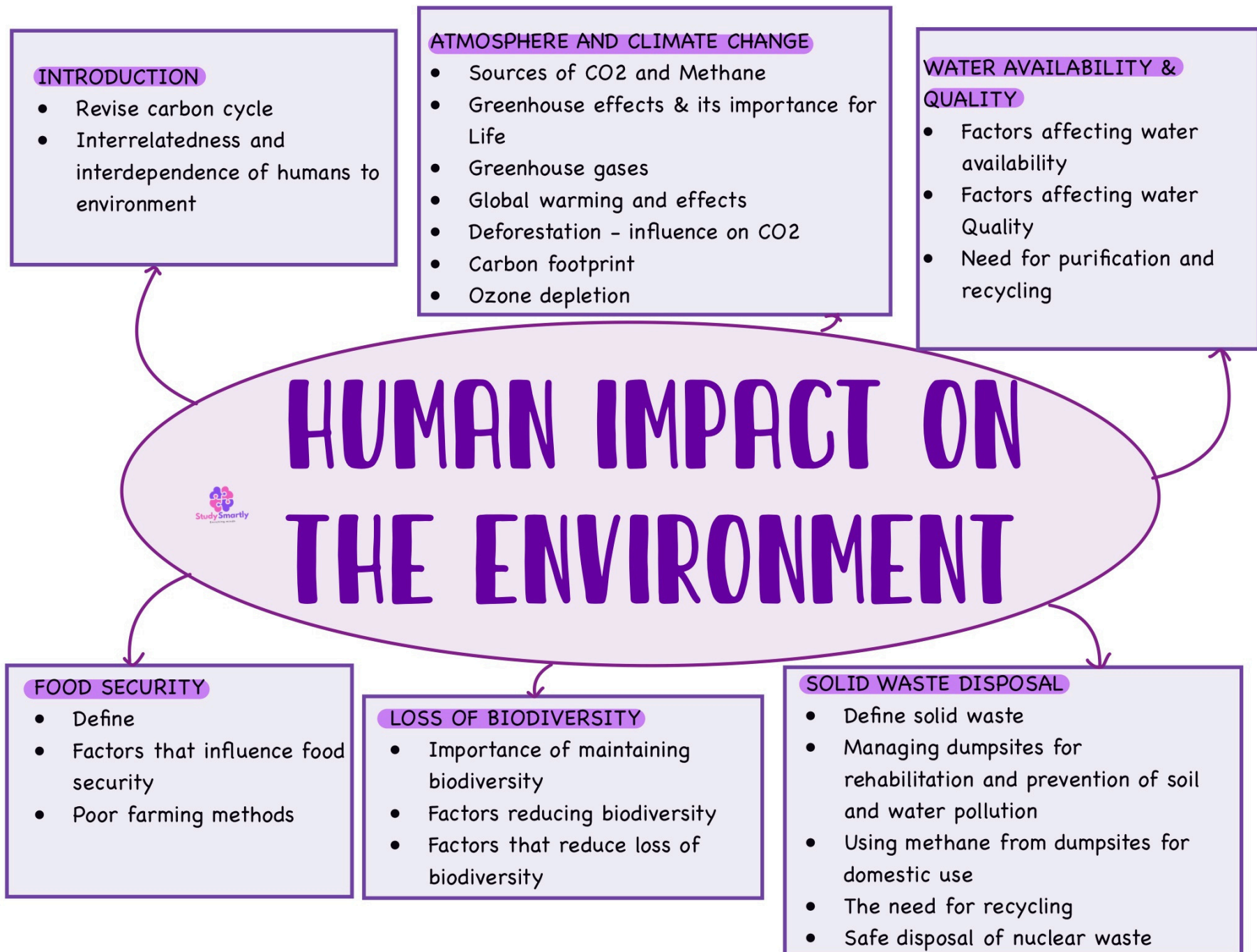
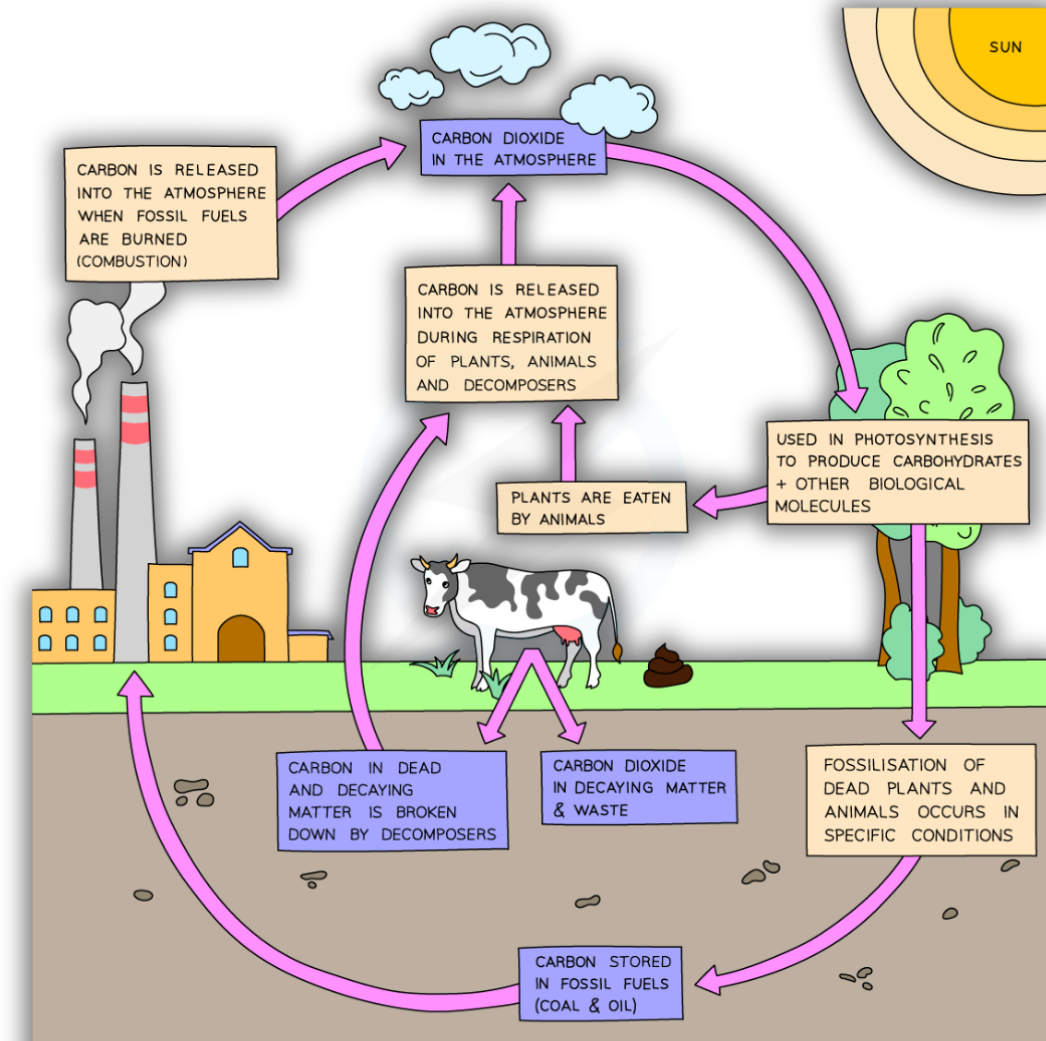




Human Impact on the environment

Introduction

Revision of the carbon cycle



StudySmartly Enriching minds The Atmosphere & Climate change

Climate - the average weather conditions of a large area over a long period of time

Climate change - any change or disturbance to an established climate pattern

Sources of carbon dioxide CO_2

- Cellular respiration
- Decomposition
- Burning fossil fuels
- Chemical reactions (cement industry & fertiliser production)
- Veld fires & Domestic wood burning (Combustion)

Sources of Methane CH_4

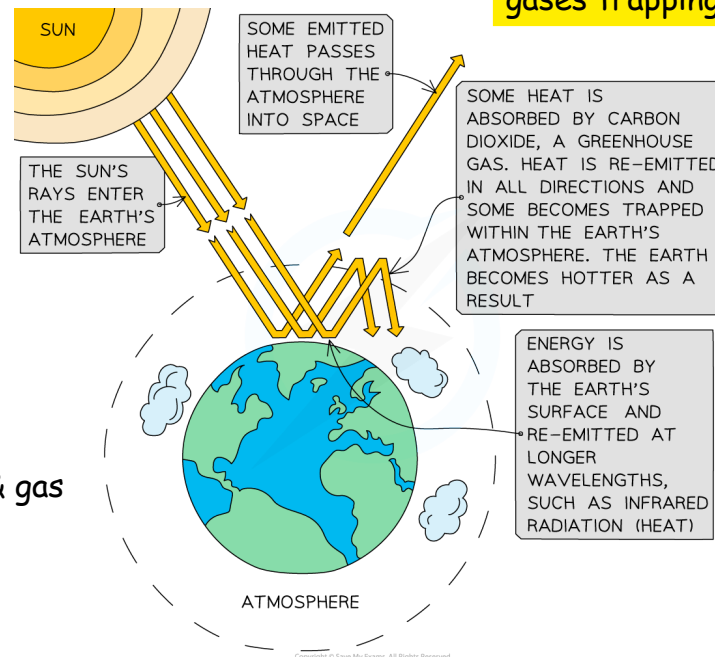
- Anaerobic decomposition
- Melting of polar ice caps
- Decomposition of marine organisms
- Agriculture (decomposing dung/compost & gas released by ruminants)
- Industries/Mines (refining fossil fuels)
- Landfill sites
- Termite polutions

Other Greenhouse gases

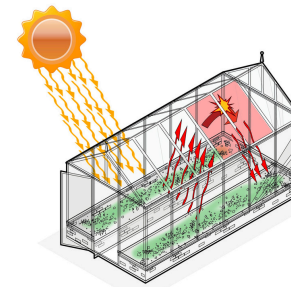
- **Nitrous oxide N_2O** - burning fossil fuels, denitrification & N_2 fertilisers
- **Ozone O_3** - Upper atmosphere & vehicle emissions
- **CFCs** - Aerosol sprays, Fridges, Foams

Greenhouse effect

warming of the surface of the Earth by greenhouse gases trapping heat in the atmosphere second



A **greenhouse** is a structure is built with transparent glass or plastic.



Light - Source of heat
Carbon dioxide pumped through gas tankers

Importance

Greenhouse gases act as an insulating blanket in the Earth atmosphere to keep the temperatures warm in a range that supports life on earth. If there were no greenhouse gases that atmosphere temperature would be -18°C (this temperature is unable to sustain life)

Human activities

That increase CO_2 emissions

- Use of fossil fuels
- Use of products or services processed with fossil fuel energy

NB: the rising greenhouse gases to human activities leads to an enhanced greenhouse effect. This may lead to average temperatures of the Earth surface rising and therefore leading to global warming.

The Atmosphere & Climate change

Global warming - the rise in the average of a temperature as a result of enhanced greenhouse effect.

Deforestation - the destruction of nature of forests through human activities

Effects of Global warming

- Rising temperatures (heat waves & Powerful storms)
- **rising sea levels**
- change in rainfall patterns
- increase in periods of droughts
- decrease in food production - due to dying crops
- seawater becoming too acidic
- Desertification
- melting of ice caps
- economic political and social conflicts increase

Carbon Footprint



The total amount of carbon dioxide emitted by an individual or group in one year



**REMEMBER
THE Rs!**



Influence of deforestation on CO2 concentration Reasons

- Land clearance for farming/**urbanisation**
- Mining
- Fuel - wood supply/Charcoal
- Traditional medicines (**indigenous trees**)
- Forest fires
- Acid rain

Effects

- Increase in atmospheric carbon dioxide
- Forests act as natural **carbon sinks**, when cut down, CO2 remains in the atmosphere
- Increase in Methane
- produced by livestock
- termites feed on dead trees
- Other
- Soil degradation
- frequent flooding
- **Desertification** & extinction of species

Ozone Depletion

Reduction in the concentration of all ozone in the ozone layer in the stratosphere.

Causes

- CFCs
- Bromine from pesticides
- Carbon tetrachloride

Consequences

- Skin cancer
- Marine damage
- Material damage

Strategies to decrease

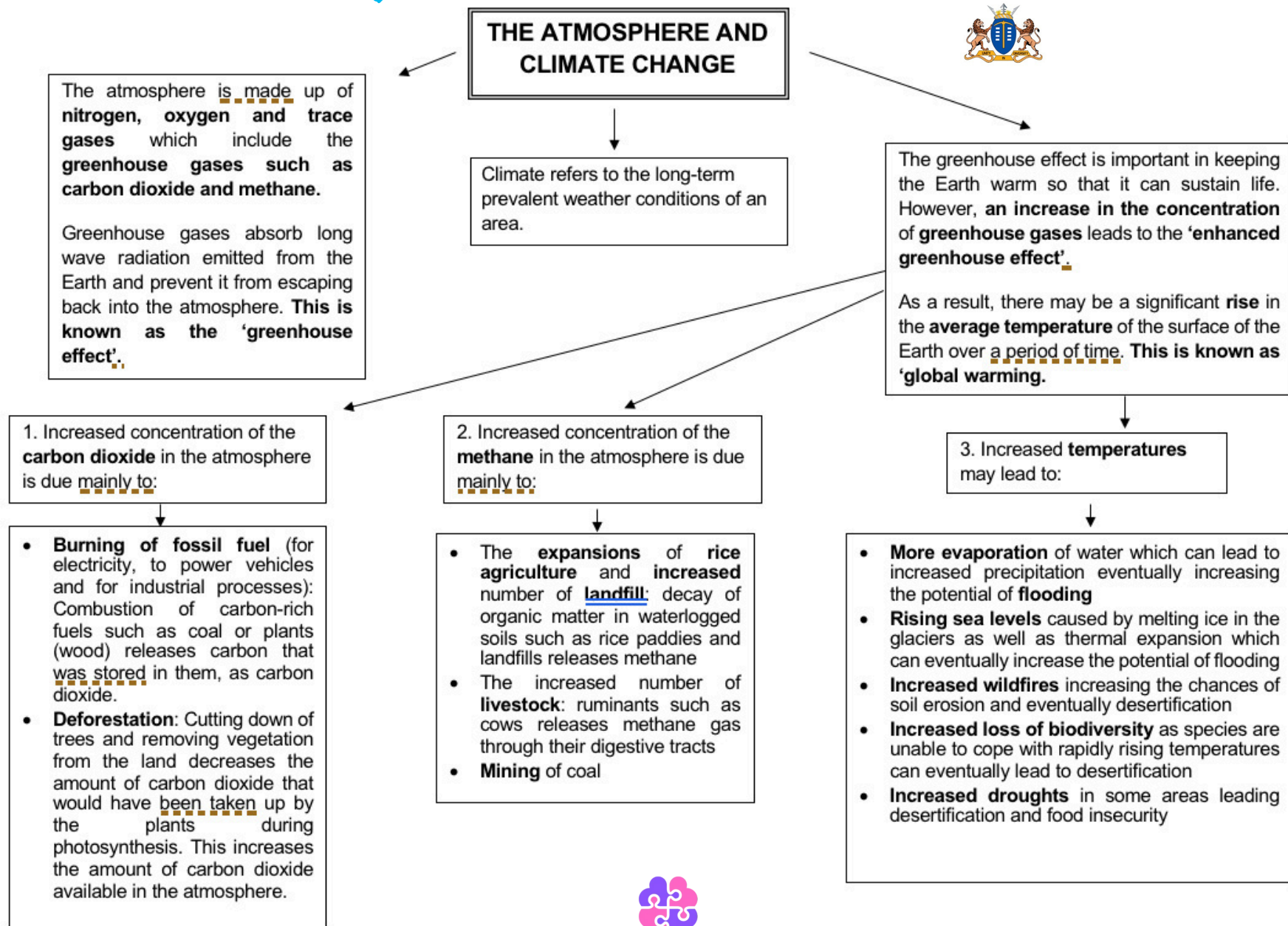
Montreal protocol - a global treaty to reduce/ stop production of ozone destroying substances

The Atmosphere & Climate change

Key terminology

greenhouse gases (GHGS)	gases which trap heat in the atmosphere: the two main GHGS are carbon dioxide and methane
emissions	released gases which are usually harmful to the environment
the greenhouse effect	warming of the surface of the earth by greenhouse gases trapping heat in the atmosphere
the natural greenhouse effect	when greenhouse gases are in balance they regulate earth's temperature and enable life on earth
the enhanced greenhouse effect	when excessive greenhouse gases are emitted they trap too much heat in the atmosphere
global warming	the rise in earth's average temperature as a result of the enhanced greenhouse effect
carbon sink	any natural system (soil, water or plant) which absorbs and stores carbon dioxide (CO ₂)
carbon footprint	the amount of carbon dioxide released into the air because of individual or group energy needs
ozone depletion	reduction in the concentration of ozone in the ozone layer in the stratosphere (upper atmosphere)
deforestation	the destruction of natural forests through human activities
desertification	the process by which fertile land becomes desert

The Atmosphere & Climate change



The Atmosphere & Climate change



Destruction of the ozone layer

CAUSES

Mainly caused by the chemicals called **CFCs** (chlorofluorocarbons) released by **refrigerators**, **aerosol sprays** and **fast-food packaging**.

What is OZONE?

Ozone (O_3) is a greenhouse gas that is found at low concentrations 15 – 50km above the Earth's surface. It **absorbs** the **ultraviolet rays** from the sun.

If the measures to reduce the destruction of ozone layer fail:

- There will be a significant increase in the number of **skin cancer** cases
- Ultraviolet rays reaching the Earth's surface may cause a **permanent damage** to **eyes**

CARBON FOOTPRINT

DEFINITION:

This is a measure of the total amount of greenhouse gas emissions of an individual, a defined population or a company per year.

Strategies to reduce the carbon footprint

- **Reuse and recycle** – **less** fossil fuels burnt in the production of some of the material
- **Drive less** – by using public transport, walking, bicycles
- **Reduce the need for heating** by insulating walls and building energy efficient homes
- **Carbon offsetting** – by using alternative energy (solar and wind) and reforestation for trees to act as carbon reservoir.
- Technological developments- **decrease** the amount of **energy** needed for **production**/ decreasing the dependency of carbon emitting fuels

Water Availability & Water Quality

Clean water is essential for the survival of living species on Earth. Although water is a renewable resource, its availability depends on climate conditions.

Factors affecting water availability

Construction of Dams

IMPORTANCE

- supply water for domestic and industrial use
- supply water for agricultural and food production
- controls flood
- generates hydro-electricity

NEGATIVE IMPACTS

- Loss of habitats below the dam
- changes natural flow of water
- reduce water quality
- increase sedimentation
- prevent natural fish migration

Destruction of natural wetlands

IMPORTANCE

- Act as sponges to store rainwater & release it slowly in dry seasons. Preventing flooding and soil erosions from quick run off of flood waters.
- habitat for animals, plants and aquatic plants **that act as filters to clean water flowing through them**

WETLANDS ARE DESTROYED BY

- building roads, factories and houses (**urbanisation**)
- Damming
- mining, industrial and domestic waste pollution

Exotic/ alien plants

THESE DEplete THE WATER TABLE

Alien plants are grown to supply timber in SA for paper. They are fast growing and water hungry which deplete groundwater and reduce biodiversity.

Water wastage

- Water is wasted in homes, farms, industries through carelessness, poor management and inefficiency. (Leaking pipes)
- Droughts or veld fires increase water demand

Cost of water

Due to expensive water treatment, municipalities charge for extra water usage. Areas far from dams increase the cost of water

Poor farming methods

- **Monoculture** - planting of a single crop
- **Overgrazing**, vegetation destruction, burning & **deforestation** causing **erosion** leads to increase in water run off
- incorrect ploughing up and down slopes causes more erosion

Droughts & Floods

- Droughts decrease water availability. Temperature increase lead to high evaporation rates in dams and lakes.
- Removing natural vegetation leads to arid land, as nothing holds excess water.

Boreholes deplete aquifers

- Borehole monitoring is needed to prevent too much water being taken from **aquifers**
- Mining drains and polluted aquifers

Water Availability & Water Quality



Water must be clean and treated so that it is safe to drink

Eutrophication

Eutrophication occurs when high levels of nutrients from fertilisers and sewage-polluting water bodies encourage the **rapid growth of algae**.

- Nitrates and phosphates from fertilisers, sewage and detergents are **rich food for algae** which then reproduce very quickly. This is called an **algal** (or **algae**) **bloom** and shows as a thick layer of green scum on the water.

- The **algae block out light needed by aquatic organisms for photosynthesis**, so these organisms **die**. Anaerobic bacteria use up all the oxygen in the water to **decompose the dead organisms**. The result is that all other organisms (including fish) which are dependent on the oxygen, **die as well**.



Mining

Water from mines pollute water by:

Thermal pollution, Chemical contamination, Metal contamination, Acid mine drainage.

Factors affecting water quality

Domestic, agricultural and industrial pollution

DOMESTIC

Detergents, pesticides, fertilisers, sewage affect water quality negatively.

Domestic waste must be disposed through controlled sewerage systems to be treated. Untreated waste can spread diseases or lead to eutrophication.

AGRICULTURAL CONTAMINATION

Commercial farms use fertilisers, hormones to speed plant growth. Pesticides to kill pests. These are washed into wetlands, dams and rivers.

INDUSTRIAL EFFLUENT

Waste from industries is pumped into rivers causing: **Toxic chemical pollution, Increase salinity of water and Oil and petrol spills**

Thermal pollution

This is a result of warm/extremely hot water waste from industries being pumped to water bodies.

Hot water kills sensitive organisms, is low in Oxygen and favors algal bloom & eutrophication

Role of water purification

Expensive but necessary

- Large scale water treatment and sewerage plants.
- Home purification using filters or boiling

Recycling of water

Power stations, mines, and industries should recycle water

Domestic grey water can be used to water plants

Cities can reclaim and purify water from sewerage

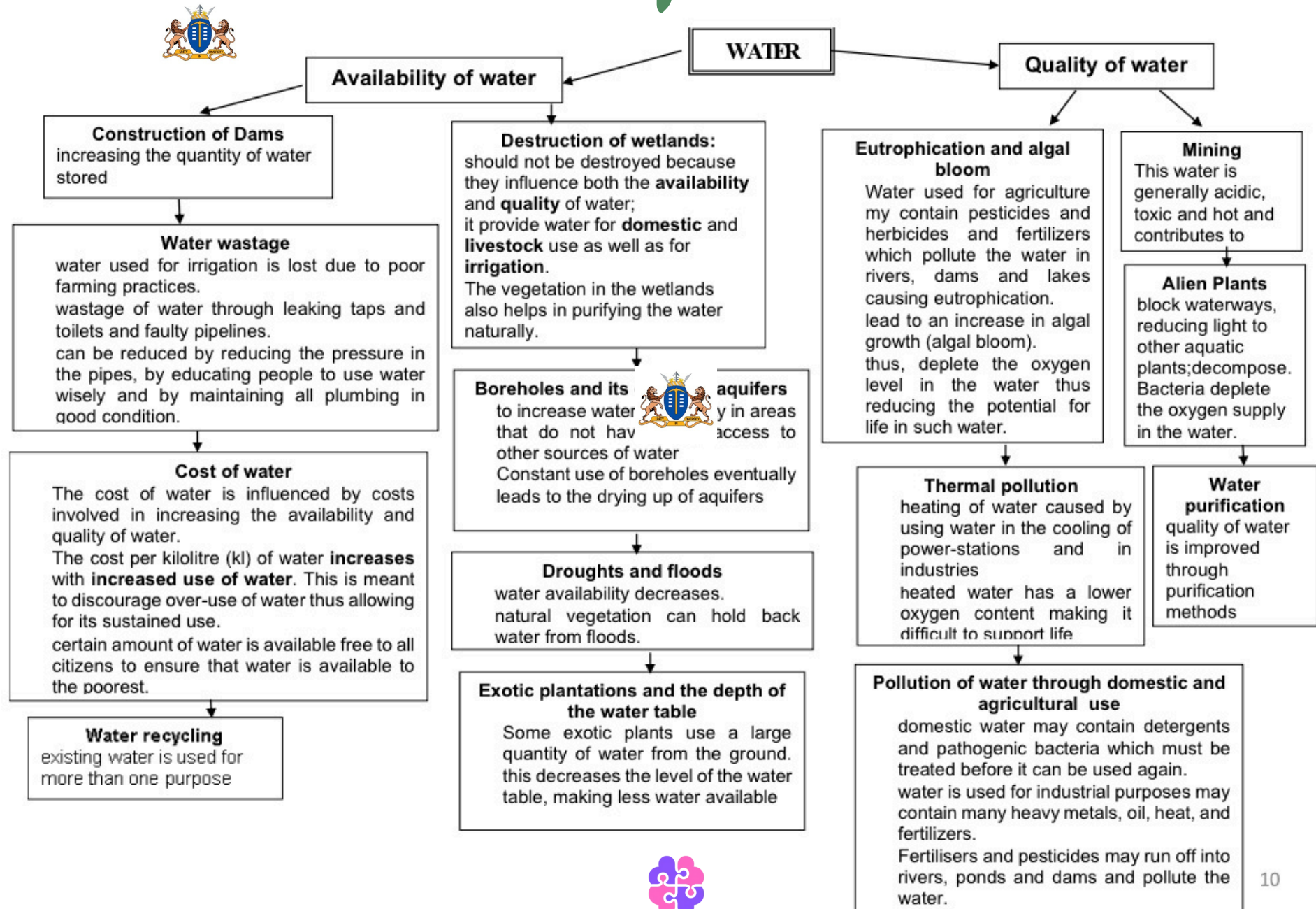
Alien plants

Plants that are not indigenous to an area. Invasive and outcompete indigenous species for space and resources. Can also lead to eutrophication in water bodies. Eg Water hyacinth

Water Availability & Water Quality Terminology

hydroelectricity	electricity generated by the power of water
wetland	ecosystem saturated permanently or seasonally with water
aquifer	underground layer of water-bearing, sponge-like rock
irrigation	supply of water to land or crops to help growth
eutrophication	excessive nutrients in a waterbody causing excessive growth of algae or aquatic plants
sewage	liquid waste: water and excrement (urine and faeces) in sewers
sewers	drains and pipes
sewerage system	sewers carrying sewage to a sewerage plant or place of water treatment
sanitation system	a hygienic or waterborne sewerage system
contamination	pollution or poisoning
thermal (pollution)	heat pollution (in this case from hot water)
AMD	acid mine drainage
purification	cleaning by removing contaminants
reclamation	returning something to a previous, better condition

Water Availability & Water Quality



Loss of biodiversity

Importance of biodiversity

- Good quality fresh water and air quality
- Climate stabilisation
- Healthy soil quality
- Pollination and seed dispersal
- Natural pest control
- healthcare and medicinal plants
- ecotourisms and recreation in nature

Biodiversity refers to the variety of all living organisms on earth

Factors reducing biodiversity

Habitat destruction

Through farming methods like **overgrazing** and **monoculture**, reducing diversity of vegetation, loss of indigenous species
Golf estates are built in ecologically sensitive areas destroying biodiversity to build houses, private gardens and golf airways represent monoculture.

Mining destroys habitats by dust pollution and noise pollution. This destroys vegetation and reduce soil drainage ability. It also exposes topsoil to erosion.

Urbanisation - clearing land to build cities/roads.

Deforestation - destruction of woodlands for timber, agriculture etc destructs habitats

Poor farming methods

Monoculture - growing a single species in a large area for many consecutive years

Overgrazing - too many animals graze an area for prolonged period depleting topsoil nutrients

Use of fertilisers - Can drive up food cost

Use of pesticides - A lot of crops are lost to pests. Chemical pesticides are toxic to the environment and may affect aquatic animals when washed off to water bodies.

Poaching

The illegal hunting or collection of species for food or money is known as poaching. Eg - rhino for its horns

Culling - is the careful and legal control of animals to protect biodiversity.

Factors that reduce loss of biodiversity

Control alien plants

MECHANICAL - by hand or machine. It is effective but time consuming

CHEMICALLY - by spraying herbicides. It is expensive & can pollute land or water

BIOLOGICALLY - by introducing natural alien invaders. It is easier and affordable. Invaders could multiply and attack indigenous species.

Sustainable use

managing resources so that future generations can still use them. By growing plants and harvesting wild plants responsibly

Useful indigenous plants impact biodiversity

Some indigenous plants at risk of overexploitation

- **Fynbos** - threatens species
- **Rooibos** - Global demand due to medicinal properties
- **Devils claw** - Unsustainable demand (grows 4 years before harvesting)
- **African potato** - increasing popularity leads to reduction
- **Hoodia gordonii** - threaten as it is harvested illegally and shipped out

Loss of biodiversity

Key terminology

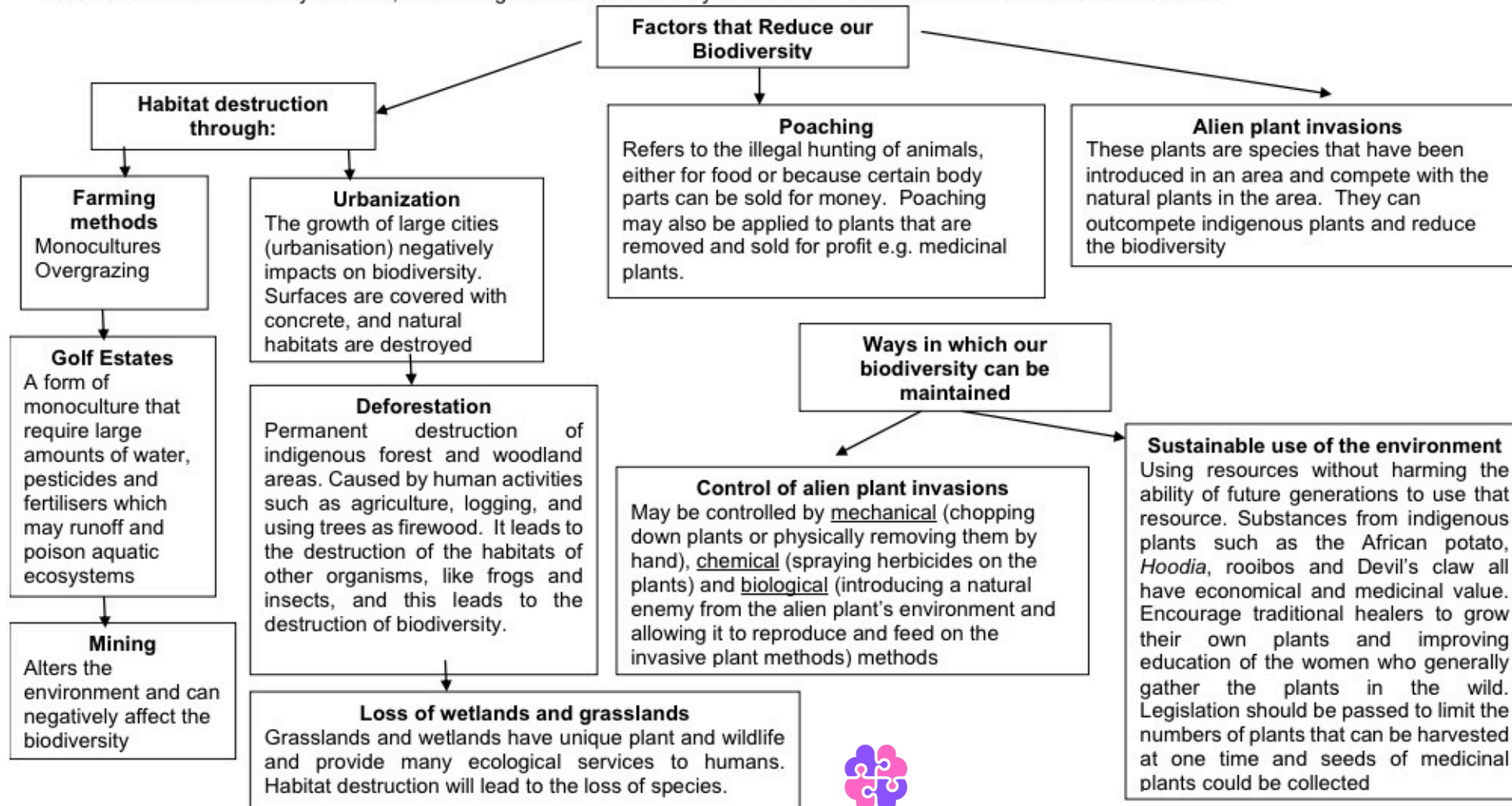
extinction	when a species has completely died out
maintain	provide for, or enable, life to keep stable and existing
diversity	a wide range of different things
biodiversity	the variety of all living organisms on Earth
biome	large community of plants and animals occupying a region with distinct climate conditions, e.g. grassland, desert, tundra
predators	organisms that capture and feed off other organisms (prey)
habitat	place where organisms live, including all living and nonliving factors or conditions of the surrounding environment.
urbanisation	the increasing development of towns and cities
migration	long-distance movement of organisms, often seasonal
sustainable	enabling or maintaining growth without depleting resources
invasion	rapidly spreading and taking over an area

Loss of biodiversity



LOSS OF BIODIVERSITY

DEFINITION: Biodiversity refers to the variety of plant and animal species on Earth. Biodiversity ensures that humans have food, fresh water, medicines and fuel that we obtain from our environment. It also ensures that the climate is regulated, floods are controlled (wetlands), diseases are kept in check (predators eat the sick animals) and water is purified (filtering by wetlands). Biodiversity ensures that seeds are dispersed, nutrients are cycled (e.g. nitrogen and phosphorus) and oxygen and soil continue to form. It also helps with human quality of life by providing us with forms of recreation and ecotourism. As biodiversity declines, these things do not occur as they should and the survival of humans become threatened



Food Security

Food security is the access to safe and nutritious food for healthy living by all people at all times

Factors affecting food security

Human exponential growth

Human population has increased over the years and that has put strain on food resources

Droughts and floods

Climate change and extreme weather conditions are caused by **global warming**. An increase in droughts are a threat to crops which decreases food security. Floods have become more frequent which puts pressure on food production and the ability of humans to recover agri/cultural land.

Wastage

From harvesting, growing, processing to retailing and consumption. Food is lost during production and transportation because:

- Poor quality soil
- Lack of storage facilities
- Extreme weather, pests and diseases
- bad roads and limited railways
- harvesting
- surpluses
- sell by or eat by dates

Loss of wild varieties

Modern food crops come from plants and animals that are selectively bred. Wild varieties are pest/disease resistant and can be used to breeds resistant genes into domesticated crops.

The **gene pool** - a wide variety of genetic characteristics increases genetic diversity. While a small gene pool mean low genetic diversity. Destruction of habitat leads to extinction of species and shrink the gene pool

GMOs

Genetically modified (GM) foods are pest and disease resistant
Have extra nutrient and greater yields
Tolerate droughts or salty conditions

Alien plants

Alien plants use more water and lower the water table. This reduces water supply for irrigation.
Some alien plants change the pH of soil.
Some plants outcompete crops

Poor farming methods

Monoculture - growing a single species in a large area for many consecutive years

Overgrazing - too many animals graze an area for prolonged period depleting topsoil nutrients

Use of fertilisers - Can drive up food cost

Use of pesticides - A lot of crops are lost to pests. Chemical pesticides are toxic to the environment and may affect aquatic animals when washed off to water bodies.

Food Security

Key terminology

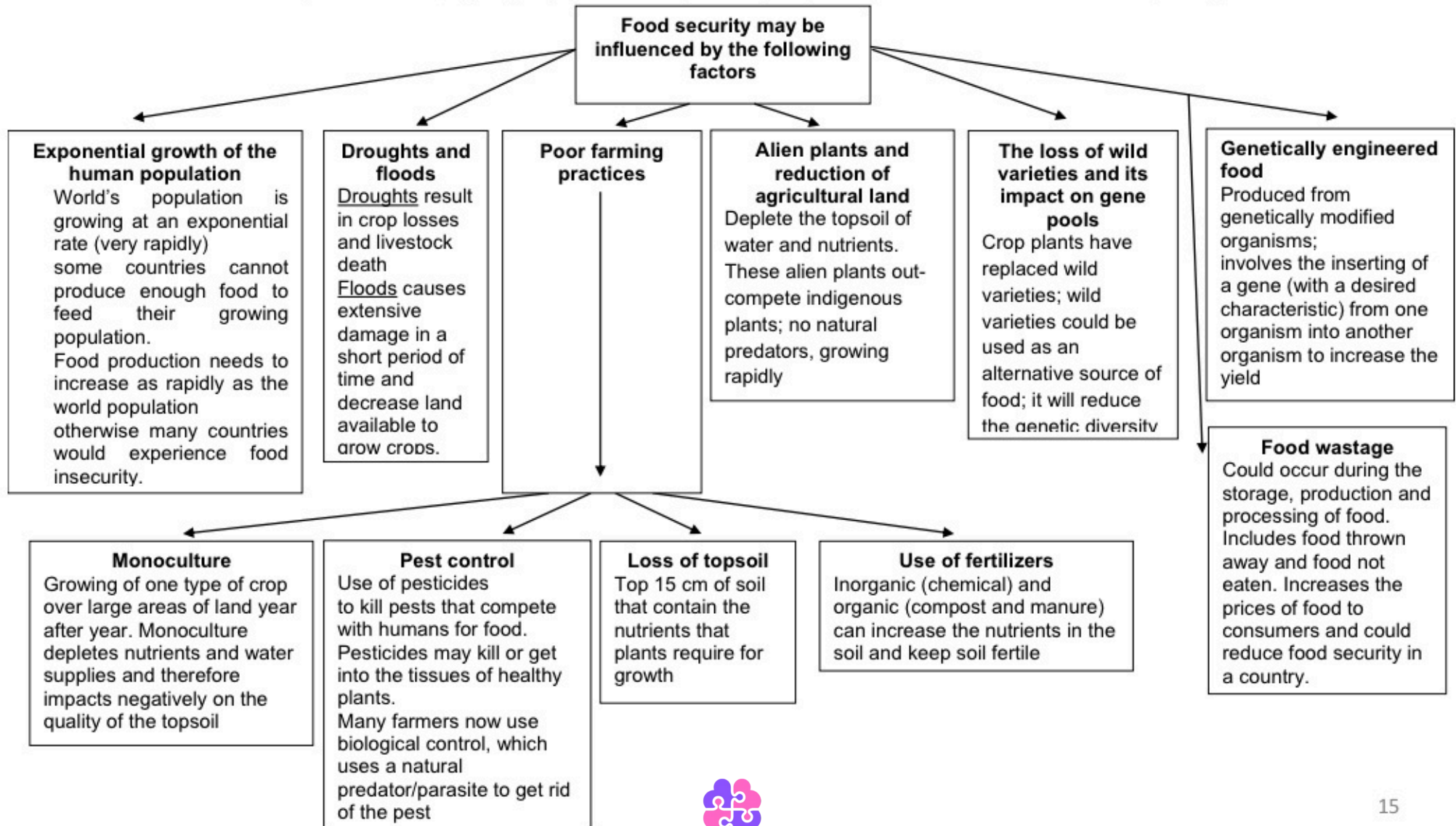
food security	access to enough or sufficient nutritious food at all times
exponential growth	where size increases at a greater and greater rate
famine	severe shortage of food that causes starvation
monoculture	farming a single crop or breed over a large area
pesticide	insect or rodent killer or poisons
herbicide	weed / plant killer
fertiliser	food for plants
gene pool	all the different genes in a breeding population
genetic engineering	altering the genes of organisms
subsistence farming	farming traditionally to feed themselves to survive
commercial farming	farming with machinery to sell products for profit

Food Security



FOOD SECURITY

DEFINITION: Food security is the access, by all people at all times, to adequate, safe and nutritious food for a healthy and productive life.



Solid waste disposal

Waste material yes is of no use to humans



The need to reduce waste

Burying solid waste in landfills

Landfills or dump sites are toxic, flammable & cause air pollution.

Vermin & flies can carry diseases in dumpsites

Toxins can leach into underground water or rivers



Aspects of solid waste disposal

Management and rehabilitation of dumpsites

Isolate landfills from groundwater

Can be rehabilitated by:

- planting species that absorb contaminants (bioremediation)
- developing parks over landfills

Using methane for heat & electricity

Methane produced by decomposing bacteria can be trapped and used to generate electricity which is a clean source of energy.

The need for recycling

RECYCLING is important because:

- reduces air, water and land pollution
- reduces the use of raw material and saves energy
- reduces waste
- provides employment

Safe disposal of nuclear waste

Nuclear waste is toxic to human health. Can be disposed by burying it deep under earth in thick concrete containers. Eg. Koeberg & Pelindaba. NB: nuclear waste is not biodegradable.

Solid waste disposal

Key terminology

bio-degradable	organic matter that can decompose or breakdown by bacteria or other living organisms and avoid pollution
hazardous	extremely dangerous
radioactive	having or producing radiant energy that comes from breaking up of atoms
nuclear	energy produced when the nucleus of an atom is divided or joined to another nucleus
landfill	an excavated dumpsite which can be filled with rubbish
leachate	water that has filtered through solids and leached out some of the dissolved or broken-down parts of the solids
rehabilitate	return something to its former or original good condition
bio-remediation	use of biological agents, such as bacteria, fungi, or green plants, to remove or neutralize pollutants in soil or water
nuclear reactor	a structure in which controlled nuclear reactions can occur to release energy

Solid waste disposal



Solid-waste Disposal

Solid waste is any solid material that is of no use to humans and which needs to be disposed of in a safe and environmentally friendly way.

Managing dumpsites for rehabilitation and prevention of soil and water pollution

The simplest and most cost effective way of disposing of solid waste is to bury it in landfill sites. It is a hole where solid waste is dumped and then covered by soil. However, this way of disposing of solid waste contributes to soil and groundwater pollution because rain seeps through the waste to produce a toxic substance called leachate. To prevent the toxic leachate from reaching the groundwater, a plastic liner is placed under the dumpsite area.

Rehabilitation of landfill sites occurs before it is closed down. This involves the covering of the old landfill site with clay soil, which is impermeable to water, and then it is covered with topsoil. Grass or other vegetation is then planted on the old landfill site. The growth of the plants stabilizes the area and the old landfill site may be used as a recreational area such as a park or a golf course.

The need for recycling

Re-using waste products includes re-using plastic shopping bags, re-using glass and plastic containers – this helps to reduce the waste produced.

Recycling is a process whereby used materials/waste products are recycled to make new products, for example plastic, glass, tin and paper. The advantage of recycling is that it provides employment, reduces the use of raw materials and energy, and reduces air, ground and water pollution.

Using methane from dumpsites for domestic use: heating and lighting

Methane is a gas produced as a result of the decomposition of organic waste. The methane gas can be used as a fuel. Methane can be collected from landfill sites and used to generate electricity for domestic use – heat for cooking and electricity for lighting.

Safe disposal of nuclear waste

South Africa also uses radioactive material for example uranium, to power its nuclear power station at Koeberg in the Western Cape. Unfortunately, a by-product of using uranium is nuclear waste that is still radioactive and therefore dangerous to living organisms. The nuclear waste is stored in thick steel drums and buried in trenches at special protected sites.