Year 10 Geography – End of Year Exam

You will sit 1 paper which will have a mixture of physical geography in it. Your exam will last 1 hour 30 minutes and will be out of 90 marks. There will be a mixture of 1 mark, 2 marks, 4 marks, 6 marks and 9 marks questions.

Below is a detailed revision list, taken from the specification. Use the knowledge organisers attached, plus your revision guide, to help you effectively revise for this exam.

Internet geography is also really useful, and has some quizzes to complete at the end of each section: https://www.internetgeography.net/aqa-gcse-geography/

PHYSICAL SECTION A: Natural Hazards – Tectonic

Natural hazards pose major risks to people and property.

- Definition of a natural hazard
- Types of natural hazard
- Factors affecting hazard risk

Earthquakes and volcanic eruptions are the result of physical processes

- Plate tectonics theory
- Global distribution of earthquakes and volcanic eruptions and their relationship to plate margins
- Physical processes taking place at different types of plate margin (constructive, destructive and conservative) that lead to earthquakes and volcanic activity.

The effects of, and responses to, a tectonic hazard vary between areas of contrasting levels of wealth

- Primary and secondary effects of a tectonic hazard
- Immediate and long-term responses to a tectonic hazard
- Use **named examples** to show how the effects and responses to a tectonic hazard vary between two areas of contrasting levels of wealth – **Nepal and Christchurch (New Zealand)**

Management can reduce the effects of a tectonic hazard

- Reasons why people continue to live in areas at risk from a tectonic hazard
- How monitoring, prediction, protection and planning can reduce the risks from a tectonic hazard

PHYSICAL SECTION B: The living world – Ecosystems and Tropical Rainforests

Ecosystems exist at a range of scales and involve the interaction between biotic and abiotic components

- An **example** of a small-scale UK ecosystem to illustrate the concept of interrelationships within a natural system, an understanding of producers, consumers, decomposers, food chain, food web and nutrient cycling – **Gawthorpe Woodland, Burnley**
- The balance between components. The impact on the ecosystem of changing one component.
- An overview of the distribution and characteristics of large scale natural global ecosystems.

Tropical rainforest ecosystems have a range of distinctive characteristics

- The physical characteristics of a tropical rainforest
- The interdependence of climate, water, soils, plants, animals and people
- How plants ad animals adapt to the physical conditions
- Issues related to biodiversity

Deforestation has economic and environmental impacts

- Changing rates of deforestation
- A **case study** of a tropical rainforest to illustrate:
    - Causes of deforestation – subsistence and commercial farming, logging, road building mineral extraction, energy development, settlement, population growth
    - Impacts of deforestation – economic development, soil erosion, contribution to climate change – **Malaysian Rainforest**

Tropical rainforests need to be managed to be sustainable

- Value of tropical rainforests to people and the environment
- Strategies used to manage the rainforest sustainably – selective logging and replanting, conservation and education, ecotourism and international agreements about the use of tropical hardwoods, debt reduction

PHYSICAL SECTION C: River landscapes in the UK

The shape of river valleys changes as rivers flow downstream

- The long profile and changing cross profile of a river and its valley.
- Fluvial processes:
    - Erosion – hydraulic action, abrasion, attrition, solution, vertical and lateral erosion
    - Transportation – traction, saltation, suspension and solution
    - Deposition – why rivers deposit sediment

Distinctive fluvial landforms result from different physical processes

- Characteristics and formation of landforms resulting from erosion – interlocking spurs, waterfalls and gorges.
- Characteristics and formation of landforms resulting from erosion and deposition – meanders and ox-bow lakes.
- Characteristics and formation of landforms resulting from deposition – levees, flood plains and estuaries.
- An **example** of a river valley in the UK to identify its major landforms of erosion and deposition – **River Tees**

Different management strategies can be used to protect river landscapes from the effects of flooding

- How physical and human factors affect the flood risk – precipitation, geology, relief and land use.
- The use of hydrographs to show the relationship between precipitation and discharge.
- The costs and benefits of the following management strategies:
    - Hard engineering – dams and reservoirs, straightening, embankments, flood relief and channels
    - Soft engineering – flood warnings and preparation, flood plain zoning, planting trees and river restoration
- An **example** of a flood management scheme in the UK to show:
    - Why the scheme was required
    - The management strategy
    - The social, economic and environmental issues – **The River Tees Barrage**

HUMAN SECTION A: Urban issues and challenges

A growing percentage of the world's population lives in urban areas

- The global pattern of urban change
- Urban trends in different parts of the world including HICs and LICs
- Factors affecting the rate of urbanisation – migration (push-pull theory), natural increase
- The emergence of megacities

Urban growth creates opportunities and challenges for cities in LICs and NEEs

- A **case study** of a major city in an LIC or NEE to illustrate (**Rio de Janeiro, Brazil):**
    - The location and importance of the city, regionally, nationally and internationally
    - Causes of growth: natural increase and migration
    - How urban growth has created opportunities:
        - Social: access to services – health and education; access to resources – water supply, energy
        - Economic: how urban industrial areas can be a stimulus for economic development
    - How urban growth has created challenges:
        - Managing urban growth – slums, squatter settlements
        - Providing clean water, sanitation systems and energy
        - Providing access to services – health and education
        - Reducing unemployment and crime
        - Managing environmental issues – waste disposal, air and water pollution, traffic congestion
- An **example** of how urban planning is improving the quality of life for the urban poor – **Favela Bairro Project**

HUMAN SECTIONC: Resource Management and Food

Food, water and energy are fundamental to human development

- The significance of food water and energy to economic and social well-being
- An overview of global inequalities in the supply and consumption of resources

The changing demand and provision of resources in the UK create opportunities and challenges

- An overview of resources in relation to the UK.
- Food:
    - The growing demand for high-value food exports from low income countries and all-year demand for seasonal food and organic produce
    - Larger carbon footprints due to the increasing number of 'food miles' travelled, and moves towards local sourcing of food
    - The trend towards agribusiness
- Water:
    - The changing demand for water
    - Water quality and pollution management
    - Matching supply and demand – areas of deficit and surplus
    - The need for transfer to maintain supplies
- Energy:
    - The changing energy mix – reliance on fossil fuels, growing significance of renewables
    - Reduced domestic supplies of coal, gas and oil
    - Economic and environmental issues associated with exploitation of energy sources

Demand for food resources is rising globally but supply can be insecure, which may lead to conflict.

- Areas of surplus (security) and deficit (insecurity):
    - Global patterns of calorie intake and food supply
    - Reasons for increasing food consumption: economic development, rising population
    - Factors affecting food supply: climate, technology, pests and disease, water stress, conflict, poverty
- Impacts of food insecurity – famine, undernutrition, soil erosion, rising prices, social unrest

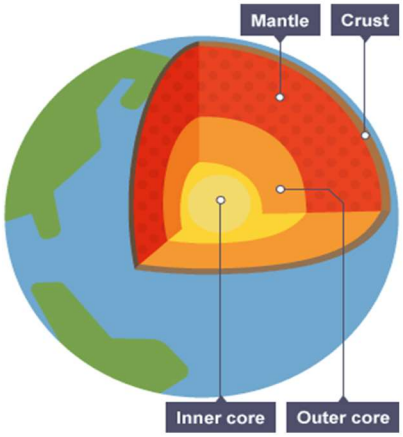
Different strategies can be used to increase food supply.

- Overview of strategies to increase food supply:
    - Irrigation, aeroponics and hydroponics, the new green revolution and the use of biotechnology, appropriate technology.
    - An **example** of a large-scale agricultural development to show how it has both advantages and disadvantages – **Almeria, Spain (Greenhouses)**
- Moving towards a sustainable resource future:
    - The potential for sustainable food supplies: organic farming, permaculture, urban farming initiatives, fish and meat from sustainable sources, seasonal food consumption, reduced waste and losses.
    - An **example** of a local scheme in an LIC or NEE to increase sustainable supplies of food – **Makueni, Kenya**

Tectonic hazards

Tectonic hazards: threats to people and property that are caused by the movement of tectonic plates e.g. earthquakes and volcanoes

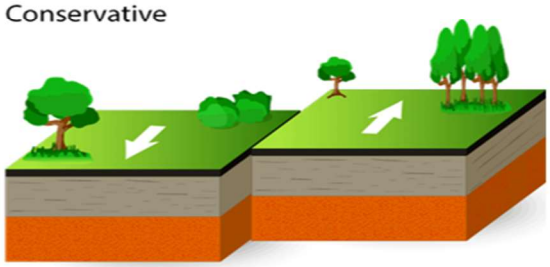
Structure of the earth



1. **The inner core** is in the centre and is the hottest part of the Earth. It is solid and made up of iron and nickel with temperatures of up to 5,500°C.
2. **The outer core** is the layer surrounding the inner core. It is a liquid layer, also made up of iron and nickel.
3. **The mantle** is the thickest section of the Earth at approximately 2,900 km. The mantle is made up of semi-molten rock called magma.
4. **The crust** is the outer layer of the Earth. It is a thin layer between 0 - 60 km thick. The crust is the solid rock layer upon which we live.

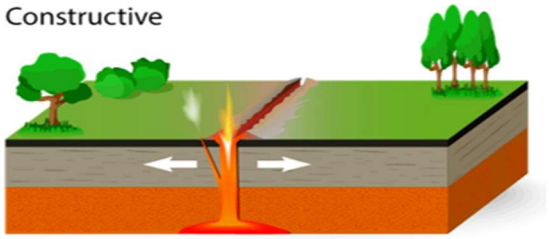
PLATE MOVEMENT

Conservative



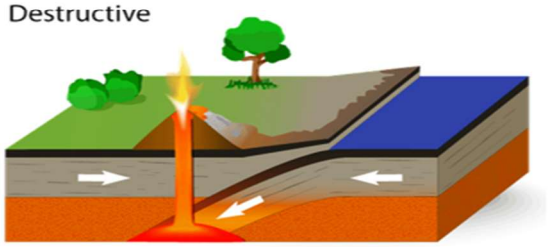
Conservative plate margin: the plates move past each other or are **side by side** moving at different speeds. As the plates move, friction occurs and plates become stuck. Pressure builds up because the plates are still trying to move. When the **pressure is released**, it sends out huge amounts of energy, causing an **earthquake**. The earthquakes at a conservative plate boundary can be very destructive as they occur close to the Earth's surface. There are no volcanoes at a conservative plate margin.

Constructive



Constructive plate margin: the plates move **apart** from one another. When this happens the magma from the mantle rises up to make (or construct) new land in the form of a **shield volcano**. The movement of the plates over the mantle can cause earthquakes.

Destructive



Destructive plate margin: usually involves an **oceanic** plate and a **continental** plate. The plates move **towards** one another and this movement can cause earthquakes. As the plates collide, the oceanic plate is forced beneath the continental plate. This is known as subduction. This happens because the oceanic plate is denser (heavier) than the continental plate.
When the plate sinks into the mantle it melts to form magma. The pressure of the magma builds up beneath the Earth's surface. The magma escapes through weaknesses in the rock and rises up through a **composite volcano**. The volcanic eruptions are often violent, with lots of steam, gas and ash.
If two continental plates collide, neither can sink and so the land buckles upwards to form fold mountains. This is called a **collision margin**. Earthquakes can occur at collision margins.

Features of oceanic crust:
Primarily found beneath the oceans, the crust has an average thickness of about 5km. Oceanic crust is denser than continental crust and is mainly composed of basalt.

Features of continental crust:
This crust is considerably thicker, sometimes reaching depths of up to 60km. Continental crust is mainly made up of granitic rock, which is less dense than the basalt found in oceanic crust. Another point of interest is that the continental crust is much older geologically than oceanic crust.

Why do people live in areas at risk of tectonic hazards?

Economic Reasons for Living at Risk

Agriculture: Volcanic soils are exceptionally fertile, resulting in high agricultural yields. This fertility supports robust farming sectors that offer employment and sustain local economies.

Geothermal Energy: Areas with volcanic activity possess vast geothermal potential, providing a renewable energy source. Harnessing this energy can generate significant economic benefits, including energy security and job creation.

Mining: Tectonically active regions often contain concentrated mineral deposits, including precious metals. Mining these resources is economically lucrative, attracting investment and offering employment opportunities.

Tourism: The dramatic landscapes created by volcanic and seismic activity attract tourists from around the globe. Tourism related to natural wonders significantly contributes to local economies, supporting businesses and creating jobs.

Social Reasons for Remaining in Hazard Zones

Living Near Family and Friends: Strong social ties to the community, including family and friends, create a sense of belonging and support that is hard to leave behind. These relationships provide emotional and sometimes financial support, making moving less appealing.

Lack of Understanding of the Risks: Some residents may not fully understand the risks of living in tectonically active areas. A lack of awareness or underestimation of potential hazards can lead to complacency about staying.

Confidence in Safety Measures: Trust in the effectiveness of local disaster preparedness and mitigation strategies can bolster residents' confidence in their safety. This includes faith in building codes designed to withstand earthquakes, early warning systems for volcanic eruptions, and community disaster response plans.

Case study tectonic hazards in LIC/NEE: Nepal earthquake 2015

Context:

7.9 magnitude earthquake. Nepal is an LIC located in the Himalayan mountains with poor infrastructure and many buildings are made of wood.

Effects:

- 9,000 people dead and 3 million homeless.
- Cost of $5 Billion.
- Avalanches and landslides blocked the relief effort.
- Tourism employment and income declined.

Responses:

- 'Tent city' in Kathmandu of 500,000 tents.
- Aid from charities such as red cross.
- £73 million donated by the UK.

Case study tectonic hazards in HIC: Christchurch, New Zealand earthquake 2011

Context:

6.3 magnitude earthquake. New Zealand is an HIC with good infrastructure.

Effects:

- 185 people died and 3129 injured
- 100 000 properties were damaged, and 10 000 were destroyed
- Water, sewage and power supplies cut off.
- Cost of $28 billion.

Responses:

- $6-7 million of international aid was provided
- 30 000 residents were provided with chemical toilets
- Construction of 10 000 affordable homes.

Ecosystems: Tropical rainforests

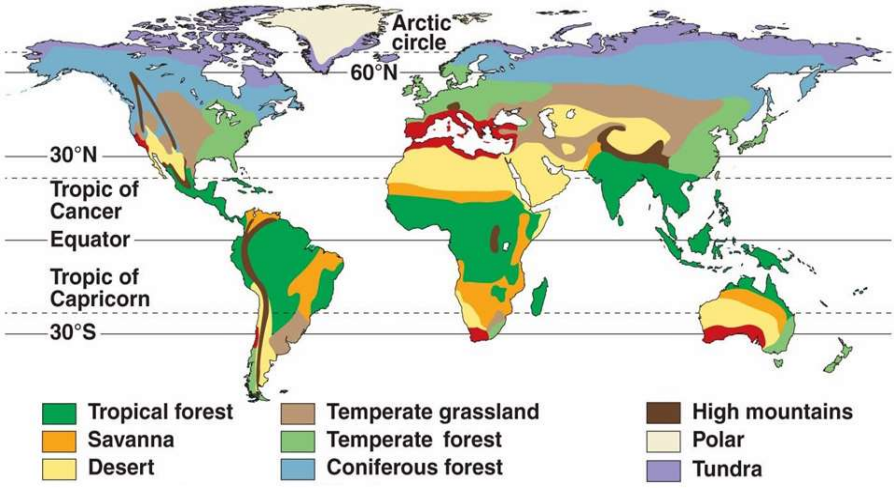
Key terms:

Ecosystem	A natural system of living and non-living things.
Biotic	Refers to living organisms e.g. rabbit, fox
Abiotic	Non-living parts of an ecosystem e.g. sunlight, soil
Biodiversity	The number of different plants and animals living in an area.
Interdependence	The way in which different organisms depend on each other for survival.
Climate	The average weather conditions in a large area over the last 30 years.
Producers	Make their own energy through photosynthesis e.g. plants
Primary consumers	Take their energy from producers e.g. rabbits
Secondary consumers	Take their energy from primary consumers e.g. fox
Decomposers	Break down dead plant and animal organisms and return their nutrients to the soil e.g. mushrooms
Biome	A large scale ecosystem, country or continent sized e.g. desert

Examples of the world's biomes (below), the main factors influencing their location are; **Latitude** – distance to the equator which dictates how much sunlight they receive.

Altitude – height above sea-level, higher land will lead to lower temperatures.

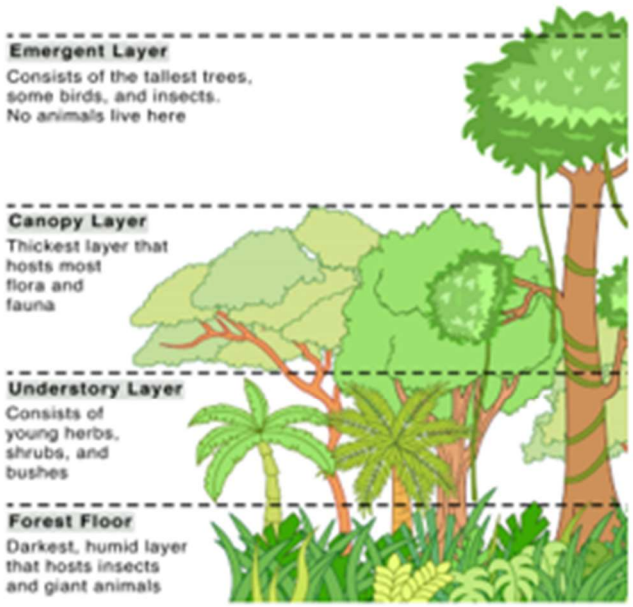
Air pressure – Rising and falling air will lead to rainfall or a lack of rainfall (Global atmospheric circulation, there will be more on this in the atmospheric hazards unit of work).



Your **case studies** for this unit:

Case study small scale ecosystem: Gawthorpe Woodland, Burnley	Case study large scale ecosystem/deforestation: Malaysia, tropical rainforest

Structure and characteristics of tropical rainforest



Plant adaptations in the TRFs:

Pitcher plant – Lures insects onto its waxy top, once fallen and trapped inside the pitcher plant decomposes the insect for its nutrients.

Epiphytes – Plants that do not grow in soil but instead grow high up on the bark of trees to gain better access to sunlight.

Buttress roots – Strong wide roots at the base of canopy and emergent trees, these roots grip the thin soil tightly to ensure the tree stays standing.

Drip tip leaves – Allow water to run off leaves. This stops the leaves from becoming weighed down or damaged by the volume of rainfall.

Animal adaptations in the TRFs:

Poison dart frog – blue to deter predators

Flying lemur - strong limbs, large eyes, connected limbs

Sloth – nocturnal, slow metabolism, camouflage

Gecko – tail can fall off and regrow, sticky hands and feet

Spider Monkey – strong tail bone

Deforestation:

The cutting down or burning of trees. In Malaysia deforestation happens for urban expansion, logging and in particular for the farming of **palm oil**.

Deforestation can lead to biodiversity loss, soil erosion and can contribute towards climate change.

How can rainforests be protected from deforestation?

Selective logging – Only logging older or diseased trees to allow new trees space and time to grow.

Ecotourism – Making money off the rainforest without damaging it, ecotourism is an expensive and authentic holiday 'live like a local'.

Conservation and education – Turning rainforests into protected national parks and educating local people about the value of the rainforest.

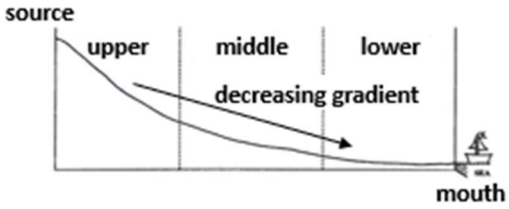
Hardwood forestry – Educating manufacturers and consumers on the damages of deforestation to reduce the demand for rare hardwoods.

Debt reduction – Cancelling or reducing the debts of countries with tropical rainforests in exchange for the protection of these natural spaces by the government.

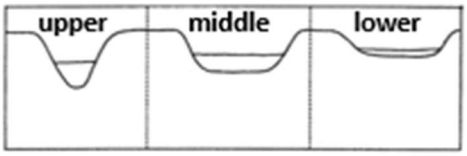
International agreements – Deals between countries to protect rainforests internationally.

Physical Landscapes in the UK – Rivers

Changing long profile and cross profile of a river



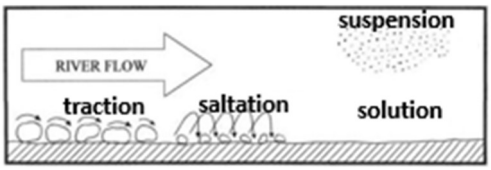
The long profile of a river shows how the gradient of the land changes from the source to the mouth of a river.



The cross profile of the river shows the cross-section of the river and the river valley.

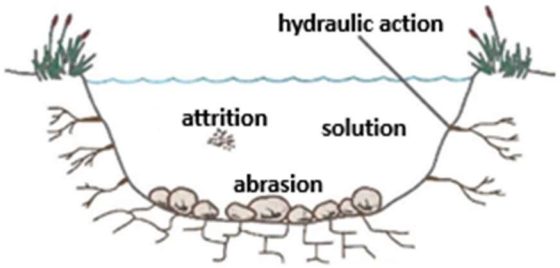
Fluvial processes: Transportation - where eroded material is carried by the river downstream.

- **traction -** Boulders and pebbles roll along the river bed.
- **saltation -** Material carried by the river bounces along the river bed.
- **suspension -** Rocks carried along by the river wear down the river bed and banks.
- **solution -** Soluble material is dissolved and carried by the river water.



Fluvial processes: Erosion - where rocks are worn away and the land changes shape.

- **hydraulic action -** The force of the river against the banks can cause air to be trapped in cracks and crevices. The pressure weakens the banks and gradually wears it away.
- **abrasion -** Rocks carried along by the river wear down the river bed and banks.
- **attrition -** Rocks carried by the river smash together and break into smaller, smoother and rounder particles.
- **solution** –-Soluble particles are dissolved into the river.



↓ **Vertical erosion** deepens the river, forming a v-shaped valley/channel. High turbulence carries material which wears away the river bed, especially in the upper course.

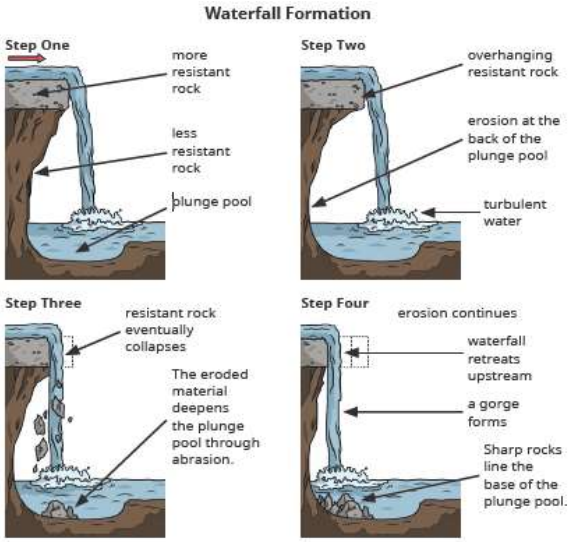
↔ **Lateral erosion** widens the river valley/channel, especially in the middle/lower course.

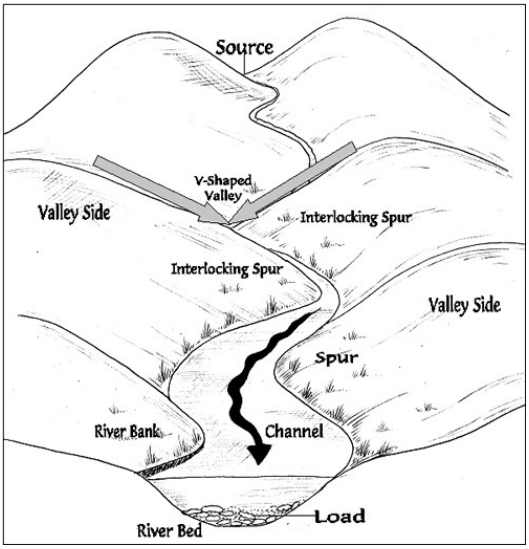
Fluvial processes: Deposition - where transported material is dropped when the river loses energy, such as when it enters the sea. Rivers deposit eroded material as they lose speed (velocity) when:

- the river becomes shallower;
- the discharge (volume of water) is reduced;
- the amount of transported material increases;
- the river reaches the mouth.

Upper course landforms

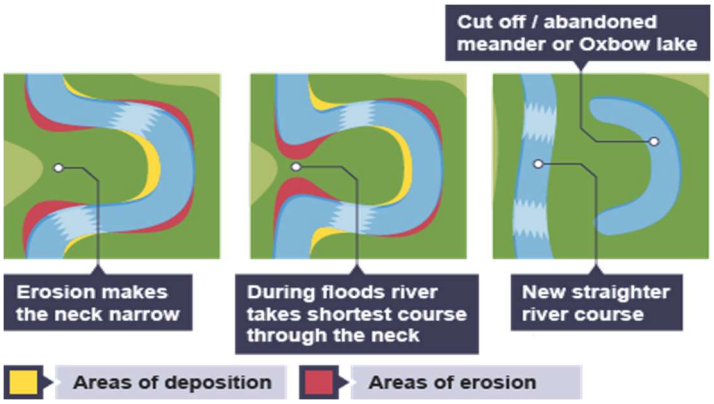
- **Interlocking spurs** form where vertical erosion creates steep-sided V-shaped valleys. The river winds and bends; avoiding areas of hard rock creating interlocking spurs.
- **Waterfalls** form where a layer of hard rock overlays a layer of soft rock. The soft rock erodes at a faster rate than the hard rock. This leads to the hard rock overhanging the soft rock. Eventually the hard rock overhang becomes too heavy and collapses causing the river to retreat upstream.

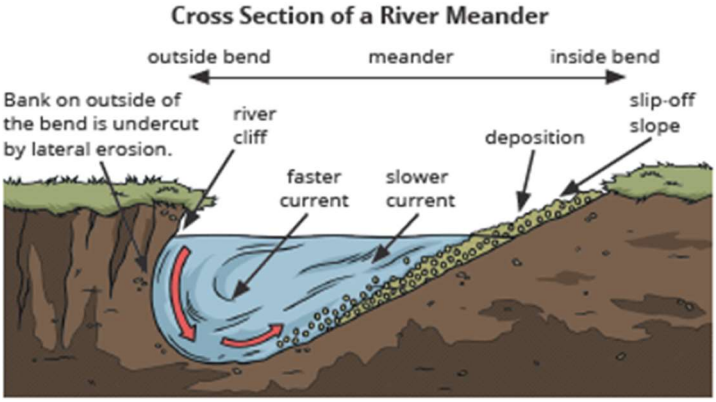




Middle course landforms

- **Meanders** form in the middle and lower course where lateral erosion causes the river to widen. As a river goes around a bend, most of the water is pushed towards the outside. This causes increased speed and therefore increased erosion. The water on the inside bend of the river is much shallower and slower. As a result, material is deposited (forming a slip-off slope).
- **Ox-bow lakes** form where meanders have become so enlarged that the river breaks through the narrow 'neck'. The river will flow along this new route as it is the shortest course. Deposition will eventually completely cut the old meander loop off from the river channel creating an ox-bow lake.

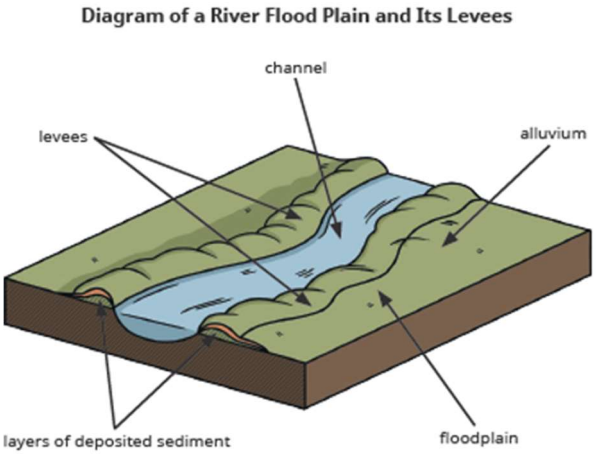




Lower course landforms

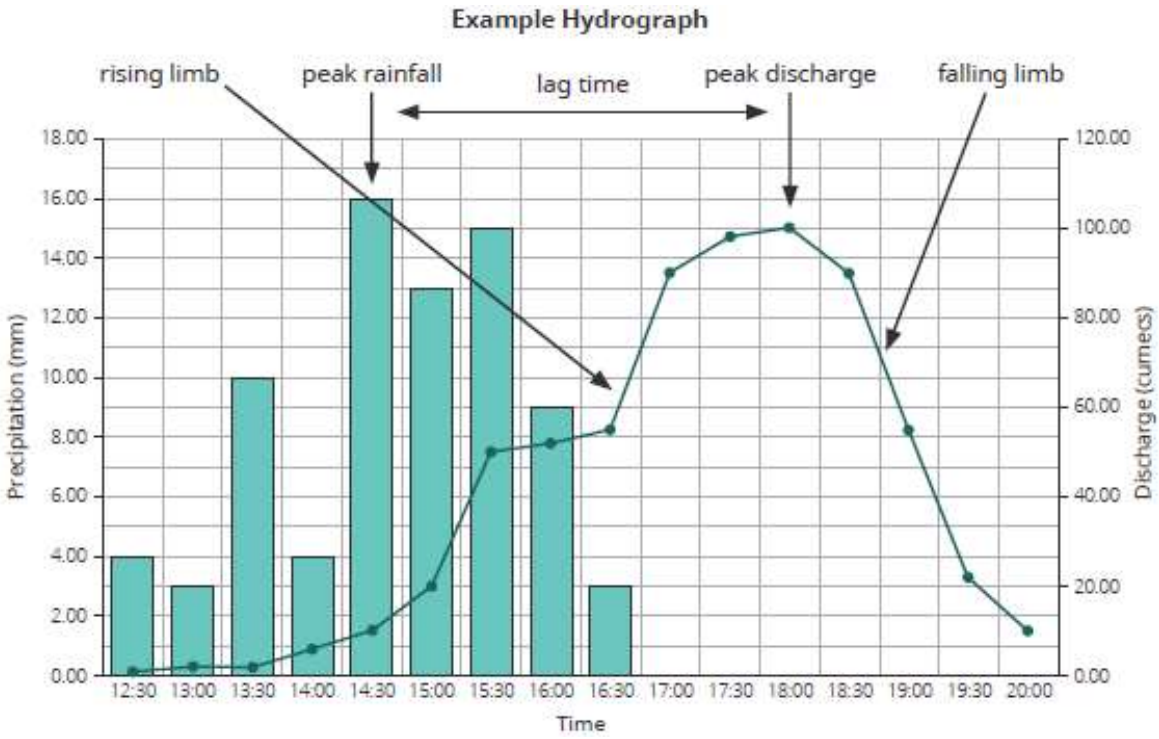
- **Floodplains** are the wide valley floor on either side of the river in the lower course. When the river floods and overflows its levees the water loses energy once it hits the land. This sudden loss of energy leads to deposition of river sediment on the land close to the river channel.

- **Levees** form in the lower course of a river along the river banks due to repeated flooding. As water overflows the main channel, it loses energy, depositing material creating natural embankments.
- **Estuaries** are located in the tidal zone at the mouth of a river where the river meets the sea. The water level in the estuary rises and falls with the tide. During high tide, large areas of valley floor will be flooded. As the tide falls, material will be deposited, creating mudflats which will be exposed during low tide.



<u>The use of hydrographs to show the relationship between precipitation and discharge</u>

- **hydrograph -** A graph which shows the rainfall (bar graph) and river discharge (line graph) of a river over a period of time.
- **discharge -** The volume of water which passes a given point in the river over a set amount of time. It is measured in cubic measures per second (cumecs).
- **Peak discharge -** the point on a flood hydrograph when river discharge is at its greatest.



- **lag time -** The time between the peak rainfall and the peak discharge.
- **rising limb -** The part of a hydrograph which shows the increase in discharge as rain enters the river channel. A steep rising limb indicates an increased flood risk as water quickly enters the channel. The lag time occurs because most rain water does not land in the river and has to travel to the river overland (surface runoff) or slowly underground (after infiltration). The lag time can be sped up by steep slopes, saturated ground and impermeable surfaces.
- **falling limb -** The part of a hydrograph which shows the decrease in discharge as the river returns to its usual level.

How physical and human factors affect the flood risk

Precipitation - The amount and duration of precipitation can affect flood risk.

- Heavy precipitation will cause flooding as there is too much water to infiltrate into the ground causing water to run over the land (increased surface runoff).
- Prolonged precipitation will cause the soil to become saturated preventing further infiltration. Precipitation will therefore run over the land (increased surface runoff).
- If surface runoff is increased the discharge of the river will increase, increasing the likelihood of a flood.

Geology

Impermeable rocks (e.g. marble and granite) and clay soils do not allow precipitation to infiltrate; increasing surface runoff. If surface runoff is increased the discharge of the river will increase, increasing the likelihood of a flood. ***Permeable rocks*** allow precipitation to infiltrate through to the water table and decreases surface runoff rates.

Relief - Steep slopes will cause surface runoff to enter the river more quickly, less water will infiltrate and as a result more water will end up in the river. If the discharge of the river is increased, increasing the likelihood of a flood.

Land Use - Buildings and roads are often impermeable (e.g. concrete and tarmac) and can increase the likelihood of a flood in two ways:

- less water will infiltrate and more water will end up in the river;
- drains are designed to remove rainwater quickly from urban areas (reducing the lag time). This rainwater is normally directed towards rivers, increasing river discharge.

Deforestation

Trees help to reduce the discharge of a river in two ways:

- trees intercept rainwater which can then evaporate;
- trees can soak up groundwater.

If trees are cut down, more water will end up in the river.

The costs and benefits of management strategies

Hard engineering strategies

1. **Dams and reservoirs -** Reservoirs (artificial lakes) are formed behind a dam (a wall across a river) usually in the upper course.

Pros - reservoirs store water and provide a reliable water source. Hydroelectric power (HEP) can be generated. Flood risk is reduced.

Cons -they are expensive to build. Settlements and habitats are often flooded. Alters the river course downstream as land no longer floods, resulting in less fertile land as silt is no longer deposited. Eroded material is trapped behind the dam, which alters river processes and landforms downstream.

2. **Channel straightening -** Rivers are artificially straightened.

Pros - the flood risk is reduced as water is transported away from the area quickly.

Cons - water is carried downstream quicker. As a result, flooding and erosion is more likely downstream.

3. **Embankments -** Raised walls along the river banks.

Pros - flooding will be less frequent as the river channel can hold more water.

Cons - if the river floods severely, flood waters will be trapped on the floodplain. Can be expensive.

4. **Flood relief channels -** Water is diverted from areas that are being protected.

Pros - water can be controlled by opening and closing flood gates.

Cons - they are expensive to build. Water is carried downstream quicker, which means that flooding and erosion is more likely downstream.

Soft engineering strategies

1. **Flood Warnings and Preparations -** The Environment Agency alert the public with apps, radio and TV broadcasts.

Pros - These reduce the impact of flooding by giving people time to prepare (e.g. evacuate and protect their homes/belongings).

Cons - Flooding can still occur. Some people might not be alerted.

2. **Flood Plain Zoning -** Building is restricted in parts of the flood plain to reduce the impact of a flood. Hard surfaces would increase the likelihood of a flood.

Pros - The impact of flooding is reduced. Floodplain retains its natural function.

Cons - The development/economic growth of an area could be restricted. This offers limited help to areas already built on.

3. **Planting Trees -** Trees intercept precipitation, increasing the lag time and reducing discharge.

Pros - This is a cheap management strategy. Soil erosion is reduced. Habitat creation increases biodiversity of the area.

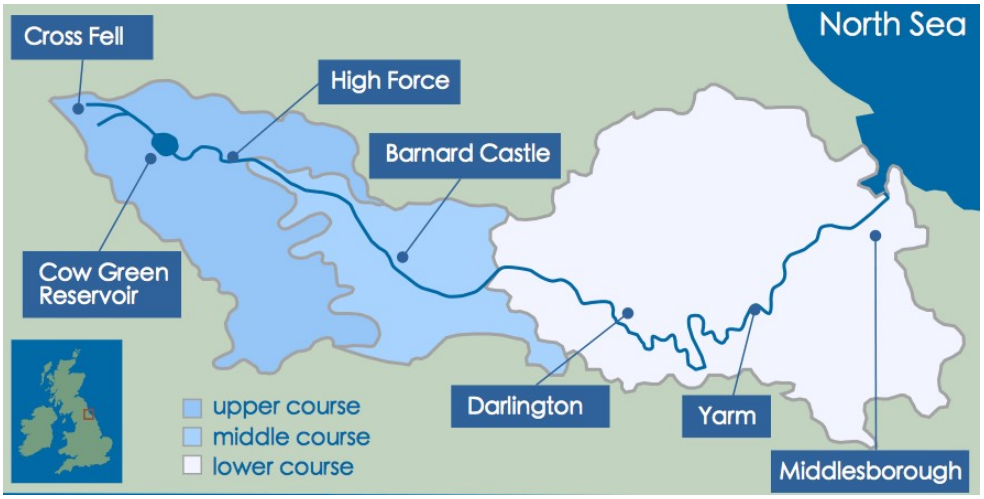
Cons - Less farmland is available.

4. **River Restoration -** Making the river more natural and allowing natural river processes to happen.

Pros - This reduces flood risk downstream. Increases wildlife through habitat creation.

Cons - Local flood risk is increased.

Case Study of UK River Valley - The River Tees



The River Tees is located in the north of England. It flows 137 km (85 miles) east from its source in the Pennines to its mouth on the North Sea coast (Tees estuary) at Red Car.

Upper course landforms - The source of the River Tees is Cross Fell in the Pennines. The River Tees flows over hard, impermeable rocks in its upper course. Vertical erosion has formed classic V-shaped valleys.

The UK's largest waterfall, High Force, is located in the upper course of the River Tees and drops 22m. An area of hard rock, called Whin Sill (or Whinstone), is located above a layer of soft rocks (sandstone and shale), and together they create the waterfall. An impressive 700m gorge has formed in front of the falls.

Middle course landforms - As the River Tees reaches its middle course, lateral erosion overtakes vertical erosion, evidenced by winding meanders. Here the gradient becomes more moderate and the valley widens. lateral erosion and deposition. The meander near Yarm encloses the town.

Lower course landforms - Meanders in the lower course are much larger. Oxbow lakes have formed in some areas. Evidence of past flooding can be seen in the naturally formed levees. Greater deposition creates features such as floodplains & levees near Darlington. Mudflats form due to deposition at the river's estuary. Some areas of the estuary are designated SSSI's (Site of Special Scientific Interest) but there is also plenty of industry at the mouth of the river.

Case Study – River Tees Flood Barrage

Why was the flood management scheme required?

There is a long history of flooding along the River Tees, especially in its lower course. There are towns such as Yarm, Stockton and Middlesbrough. The area is densely populated.

What is the flood management strategy?

The Tees barrage has been designed to preserve the environment. It was officially opened in 1995 and stops the tidal flows upstream and has opened 2.5km of clean navigable waterway for leisure. The barrage cost £54 million and links the north and south banks of the Tees at Stockton. The gates regulate the flow of river water and act as a barrier to prevent tidal flooding moving upstream.

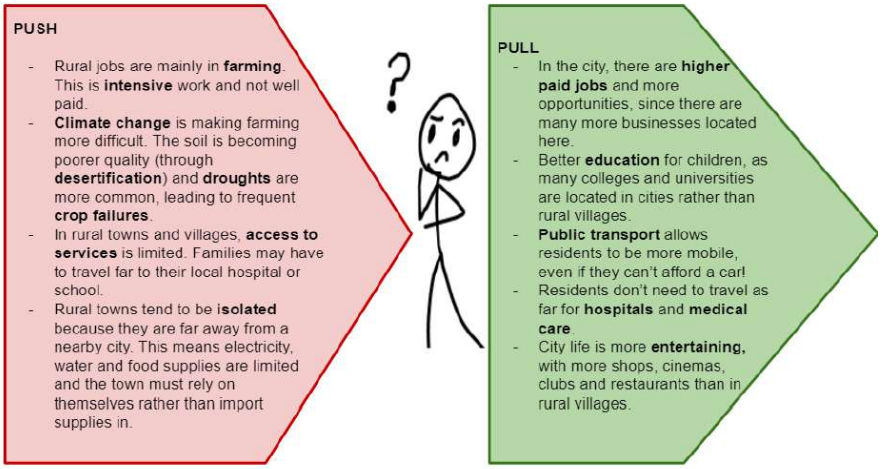
The key features of the scheme included:

- Includes a lock that allows boats to pass through as well as a fish pass, a road bridge and Britain's finest white-water course
- The barrage is 70m wide and 32m long and around the barrage are car parks, a camping and caravan site, restaurants, shops and woodland.

Urban issues and challenges

A growing percentage of the world's population lives in urban areas

More of the world's population is living in urban areas – cities are expanding and the urban population is growing. Many HICs have large urban populations. In comparison, in LICs and NEEs, over half of the population live in urban areas. This is less than in HICs, but these urban populations are rapidly growing.



Urban growth creates opportunities and challenges for cities in LICs and NEEs – Rio

Location: Rio de Janeiro, Brazil, South America

Importance:
- **Regional**: provides schools, hospitals, and universities, important for its art and culture scene, transport hub.
- **National**: a significant centre for clothing, processed food, chemicals and pharmaceuticals, universities and labs located in the city,5% of the country's GDP is produced here.
- **International**: Hosted the 2016 Olympic and Paralympic Games and the World Cup, iconic landmarks, the Statue of Christ the Redeemer, a central international transport hub with three airports and five ports.

Causes of growth:
- **International migration**: In recent decades, the city has attracted skilled workers from countries such as the USA and the UK.
- **Internal migration**: Today, most migrants to Rio come from other regions of Brazil, especially rural areas. Many migrants are drawn to Rio by the city's economic opportunities and improved services.
- **Natural Increase**: The city had a predominantly youthful population, with many residents in their 20s and 30s, contributing to a higher birth rate and a relatively low death rate.

Opportunities:
- **Social**:
  - **Health care**: free health care, better access to hospitals, particularly rural areas, more medical professionals per person than the Brazilian average.
  - **Education**: Higher quality of education in comparison to rural regions of Brazil, many primary and secondary school which have enabled 97% of people to be literate.
  - **Water supply**: access has increased significantly since the world cup and Olympics, 96% of the population have access to the main water supply
  - **Energy**: significantly better access to electricity compared to those living in rural areas, approximately 99% of the city's population has a reliable electricity connection.
- **Economic**: economic development in Rio de Janeiro has led to significant improvements in infrastructure, including roads, transport, services, and environmental initiatives.

Challenges:

- **Managing urban growth**: Millions of people have been forced to build homes on land they don't own due to the lack of affordable housing.
- **Providing energy, clean water and sanitation**: 12% of Rio's population lacks access to clean running water, with over a third of water lost due to leaky pipes, fraud, and illegal connections. Rio's sewage pipes and treatment facilities are insufficient to handle the city's waste, leading to widespread environmental and health issues.
- **Providing access to services – Health and education**: Residents in favelas face severe health challenges. On average, they live 13 years less than people in wealthier districts, and healthcare facilities are extremely limited. There is a significant lack of schools in favelas.
- **Reducing unemployment and crime**: Unemployment rates are especially high in favelas, highlighting stark inequalities across the city. Rio experiences high rates of robbery and violent crime,
- **Managing environmental issues**: Rio generates 3.5 million tonnes of waste annually, but less than 2% is recycled, highlighting a significant gap in sustainable waste management. Rio is the most congested city in South America.

Urban planning: Before 1980, Rio's authorities did not officially recognise the existence of favelas, and they were absent from city maps.

- **Favela Bairro Project**: The Favela Bairro Project is a site and service project where the local authority provides land and essential services, and residents construct their own houses. The favela Complexo do Alemão in the north of Rio de Janeiro is home to 26,000 people. Access to fresh water and sanitation has been provided, along with paved roads. Schools and health centres have been built along with a cable car to transport workers to the commercial centre of Ipanema. Access to credit has been provided to the residents to help them buy materials to improve their homes.

Resource management

How are food, water and energy significant to our well-being?

A regular supply of food, water, and energy is essential for us to be healthy, live a good life, have good social relations and security. Where food, water, and energy are abundant, there are significant economic and social benefits. If people have regular support, their quality of life and economic well-being will improve.

An overview of global inequalities in the supply and consumption of resources

High-income countries (HICs) typically consume more than low-income countries (LICs). The main challenge is insufficient resources, but the existing resources are unevenly distributed. As a LIC develops, so too does its demand for resources. This growth in demand, along with population growth, leads to a shortage of resources.

How has the demand for food in the UK changed?

Before supermarkets, most food eaten in the UK was from the UK and seasonal. There has been an increase in food being imported because some food cannot be grown all year round and some foods are not native to the UK. Demand for non-seasonal products has brought challenges and benefits for low-income countries. There has been an increasing demand for organic food in the UK. The further food travels, the greater the food miles and carbon footprint. When a farm is run like a large industrial business, they are known as an agribusiness. Agribusiness has harmed the environment through the increased use of chemical fertilisers and pesticides. Also, as farms have become more mechanised, agricultural employment has declined as fewer people are needed to work on farms.

How has the demand for water in the UK changed?

Water use in the UK has increased significantly over time because of the increases in appliances, improvements in personal hygiene and more food grown in greenhouses. Polluted or low-quality water reduces the amount available for use. Water pollution has both environmental and social impact such as pesticides damaging aquatic wildlife and drinking sources becoming contaminated. There is a range of strategies in place to support improving quality. This includes introducing regulations on the amount and type of pesticides and fertilisers that can be used. The southeast of England has low levels of rainfall. However, population density is high. The area experiences a water deficit. This means it does not have enough water to meet the population's needs. One way to deal with the water supply and demand problem in the UK is to transfer water from surplus areas to deficit areas. The UK Government has been considering developing a national water grid similar to the national electricity grid. This would involve water being transferred through a network of pipes.

How is the demand for energy changing in the UK?

The UK once produced enough energy to be self-sufficient. A decline in reserves of oil and gas now means the UK is reliant on imported fossil fuels. The use of shale gas from underground is being considered in the UK, as a way of adding to energy resources and reducing reliance on importing energy from other countries. It's extracted using a process called fracking. Renewable energies, such as wind and solar, are growing in significance in the UK, however, they still only make up a small percentage of energy produced.

Fossil Fuels: economic opportunities - jobs are created in supporting industries, economic challenges - The remaining coal in the UK is mostly deep underground in hard to reach areas, environmental opportunities - Fossil fuels are very stable, environmental challenges - burning fossil fuels contributes to the enhanced greenhouse effect.

Renewables: economic opportunities - Many jobs have been created in research, development and manufacturing, economic challenges - set up costs for renewable sources of energy are very expensive, environmental opportunities - carbon emissions associated with the development of renewable energy are much lower than fossil fuels, environmental challenges - wind turbines have proven to have a negative impact on bird migration patterns.

Resource management - food

What are the differences in global calorie intake and food supply?

Many people are suffering from undernourishment and do not have food security. The overwhelming majority of the countries suffering the lowest intake of all are in sub-Saharan Africa. In HICs one-quarter of diets is made up eggs, milk, cheese, meat and fish. However, in LICs suffering the worst insecurity, cereals make up over half of the diet with a further twenty per cent from tubers such as yams.

Why is demand for food growing?

With increasing population growth and the industrial and economic development of LICs and NEEs the demand for different food products has also increased.

What affects the amount of food we have?

Climate, technology, pests and disease, water stress, conflict and poverty all contribute to the amount of food we have available to us.

How does food insecurity affect people and the environment?

Food insecurity affects people in a number of ways including famine (widespread scarcity of food) and undernutrition (insufficient intake of energy and nutrients), soil erosion, rising prices and conflict and social unrest.

How can we increase the amount of food produced globally?

- **Irrigation**: Irrigation involves providing extra water to agricultural areas where water supply is unreliable or limited.
- **Aeroponics and hydroponics**: Aeroponics involves growing plants in the air, rather than soil. Hydroponics involves growing plants in a nutrient-rich water bath.
- **New green revolution**: During the 1960s scientists developed new strains of seeds known as high-yielding varieties (HYVs) which produced higher yields of crops such as maize and rice.
- **Biotechnology**: Biotechnology involves genetically modifying animals, plants and fish.

Large scale agricultural development – Almeria, Spain

Over the last 35 years, the area has developed the largest concentration of greenhouses in the world. The greenhouses are owned and operated by a combination of large businesses and individual farmers. The scheme delivers over half of Europe's fruit and vegetables, and brings over US$1.5 billion a year in income to the area.

What is a sustainable food supply?

A sustainable food supply involves producing food but protects land, energy and water resources, to maintain supplies for future generations. Strategies include; organic farming, permaculture, urban farming initiatives, fish and meat from sustainable sources, seasonal food consumption, reduced waste and losses.

Local scheme in an LIC/NEE – Makueni, Kenya

When it comes to agricultural production in Makueni, the primary crops cultivated include maize, beans, millet, sorghum, cassava, and sweet potatoes. In April 2014, Just a Drop, a charity organization, collaborated with the African Sand Dam Foundation to extend direct assistance to two

compact villages and a primary school. The initiative included; facilitating access to clean, safe water by constructing sand dams for each village, installation of a rainwater harvesting tank atop the school building, implementation of a training program aimed at assisting local farmers and Encouraging tree plantations to curb soil erosion, boost biodiversity, and generate medicinal products. The project has witnessed significant success, as evidenced by: Improved crop yields and increased food security, decline in the occurrence of water-borne diseases and decreased time spent fetching water, freeing up time for work or education.