Weather, Climate and Ecosystems

Paper 2

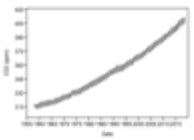
Causes of Climate Change:

Climate change is not new the world has been through a series of ice ages separated by periods of warming, called interglacial. Today, 97 per cent of scientists believe that human activity is to blame for this rise.

Physical Causes	Human Causes
• Milankovitch Cycles - The Earth's orbit can vary between being circular or more of an oval (elliptical) shape. These changes imapct how much sunlight the Earth receives and can increase or decrease temperatures. • Volcanic Eruptions - The ash and gases reach high up into the stratosphere and prevent some sunlight from reaching the Earth's surface. This means that the sunlight is reflected back into space which cools the Earth and lowers global temperatures. • Ocean Currents - The changes in the patterns of these currents can lead to periods of warming (El Nino) and cooling (La Nina) around the Pacific Ocean	• Deforestation - World-wide deforestation involves rainforest burning as well as clearing, which emits large amounts of CO2 into the atmosphere as well as reducing the amount of trees to absorb CO2. • Agriculture - The amount of land needed for crop production has increased due to world population growth. • Use of fossil fuels - The use of fossil fuels such as coal, oil and gas has been increasing as the world's population grows. The burning of these fuels for industry, transport and energy has led to a significant increase in CO2 levels across the globe.

Evidence for Climate Change:

- 20 warmest years on record since 1995
- Ice core carbon concentration is 40% higher than it was before industrial revolution.
- Increase in global rainfall as increase in evaporation
- Global sea level has risen between 10 cm and 20 cm in the past 100 years.
- Tree rings show the difference in climate each year.
- Arctic sea ice has been declining since the late 1970s, reducing by about 4 per cent,

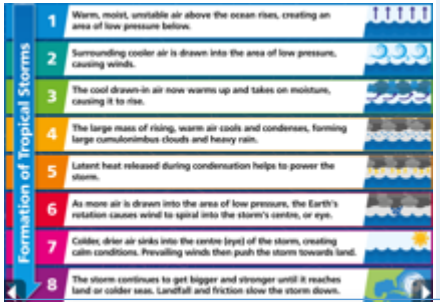


Keelings Curve – shows the increase in carbon measured in Hawaii

Cyclone:

Seasonal Events caused by the ITCZ being overhead.
LOW PRESSURE SYSTEEM
You need three things for a cyclone to form:

- Warm ocean temperatures (27°C or more)
- Deep water (50m or more)
- Trade winds



Cyclone Pam:

Date: Friday 13th March 2015
Location: Vanuatu, Australia
Impacts:

- 90% homes destroyed
- 11 killed
- 80% of coffee trees destroyed
- Habitats lost as vegetation flooded
- $2.5 billion damage
- Tourism declined for over 2 years

Responses:
Australia, Fiji, France, New Zealand, Tonga and the UK all sent emergency aid..

- 21,000 safe drinking water
- 20 foreign medical teams
- 67,000 temporary homes
- 153 temporary schools

Global Circulation Model:

1. Warm air rises from the Equator creating low pressure.
2. Condensation creates clouds and rain
3. At 30°c north and south of the equator, the cold dry air sinks, creating high pressure and clear skies.
4. When the sinking air reaches the earths surface, it moves either to the equator or towards the poles
5. At 60°c north and south of the equator, the surface air meets colder air from the poles, which causes it to rise. This creates a band of low pressure
6. The air rises and cools and moves back to the Equator or towards the poles.
7. At the poles, the cool air sinks to the earths surface creating high pressure. The air then moves back towards the Equator.

Tropical rainforest –

Centred along the Equator between the Tropic of Cancer and Capricorn.
They have huge amounts of biodiversity (1 in 10 species in the world lives).

Amazon Rainforest:

Causes of deforestation:

- Logging
- Farming
- Mineral Extraction
- HEP
- Population growth

Impacts of deforestation:

- Soil erosion
- Loss of biodiversity
- Climate change contribution
- Economic development
- Conflict

Solutions:

- Selective logging
- Conservation
- Eco-tourism
- International Agreements

Desertification:

Where land is gradually turned into desert, usually on the edge of a desert.

Causes:

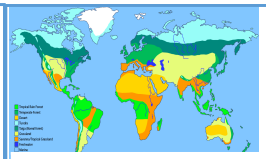
- Overgrazing
- Deforestation
- Population growth
- Climate change

Impacts:

- Soil erosion
- Changes in nutrient cycle as soil is infertile
- Lack of water

Solution: **The Great Green Wall**
11 countries signed an agreement to plant a 15km wide strip of land across Africa to prevent soil erosion in the Sahel and improve incomes. This has been successful in Niger where 11mill trees have been planted.

Biomes:



A biome is a large geographical area of distinctive plant and animal groups, which are adapted to that particular environment.

Biome	Key Characteristics
Tropical Rainforests	•Along equator (Asia, Africa / South America). •6% of earth's surface. •25°C – 30°C and over 250mm rain per month.
Tropical Grasslands (Savanna)	•Between equator and tropics. •20 – 30°C and between 500 - 1500 mm of rain per year. •Wet and dry seasons.
Deserts	•Tropics (Sahara and Australia). •Over 30°C and less than 300 mmm per year rain. •20% of land's surface.
Deciduous forests	•Higher latitudes (W Europe, N America, New Zealand). •5 – 20°C and between 500 – 1500 mm rain per year. •4 distinct seasons. •Lose leaves in the winter to cope with the cold.
Coniferous forest (Taiga)	•60°N (Scandinavia / Canada). •Cone bearing evergreen trees. •No sunlight for part of the year.
Tundra	•Above 60°N (Arctic Circle). •Less than 10°C and less than 500mm per year rain. •Cold, icy and dry means 2 month growing season.

Ecosystem:

A system made up living (biotic e.g. plants and animals) and non-living (abiotic e.g. soil and water)).

Monsoon:

A seasonal change in the direction of prevailing wind in the region of South and SE Asia during July as ITCZ moves north. LOW PRESSURE System pulls air from Indian Ocean.

1. The ground is heated by solar radiation
2. The air rises creating low pressure
3. Moist air from above the Indian Ocean is drawn into low pressure
4. The moisture condenses forming clouds.

How can we use an ecosystem to create energy?

Marine ecosystem can be used to create wind/ tidal and wave power.

Swansea Tidal Bay Lagoon –The world's first tidal lagoon power plant. It will comprise 16 hydro turbines, a 9.5km wall.

Create electricity for 155,000 homes each year
Location international sports.
Education
Tourism of 100,000 visitors per year

Cost £1.3 billion
Impact biodiversity at the mouth of two estuaries
Increase in traffic

Semi-Arid Grassland (Savanna)

The semi-arid grassland biome is located between the Tropic of Cancer and Tropic of Capricorn

Serengeti National Park:

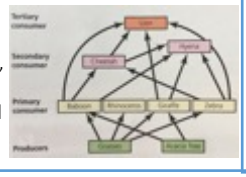
Human uses:
- Tourism
- Poaching
- Food production

Impacts:
- Land degradation by vehicles
- Impacts on biodiversity
- Demands on water
- Demands on food supply

Solutions:
- Ecotourism
- Drought resistant crops
- Education
- Conservation

Nutrient Cycle: The soil will store the nutrients. Plants take them in and herbivores eat the plants. Primary consumers then eat the herbivores and will produce dung. This then decomposes. Once animals die they will also decompose and add nutrients back to the soil.

Adaptation - Baobab can be found in the Savanna. They are adapted to the Environment as they have; Large barrel trunk stores up to 500 litres of water, shallow roots to collect water and few leaves.



Small scale ecosystem - Chasewater

Located in Burntwood, England. It is a reservoir created to feed canals. and has a wide range of flora (plants) and fauna (animals). It is a Site of Special Scientific Scientific Interest (SSSI). There is an innovation centre for education. The reservoir is also managed by natural grazing, Building boardwalks and keeping footpaths in good repair and pond management.

Drought resistant crops:

Crops that can grow when rainfall levels are low. Chickpea/ pigeonpea/ groundnut/ millet and sorghum are all examples.

Ghana-

A tropical country in West Africa. It has a drought season that can last up to 8 months. Trees are used as firewood and over-grazing occurs. Climate change is causing more crop failures.

- 37% children malnourished
- 1 in 5 children stunted growth due to malnutrition

Ghanaian government is encouraging drought resistant crops. However at the moment these are too expensive for local farmers.

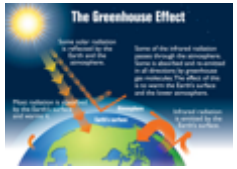
UK Uplands

Uplands have been adapted to graze sheet, different variety of grass sown and ditches dug across the waterlogged peaty soils to improve drainage.

To manage uplands:

Pumlumon Project: Help local farmers, foresters and tourism businesses to do things a little differently, to restore land back to its original state.

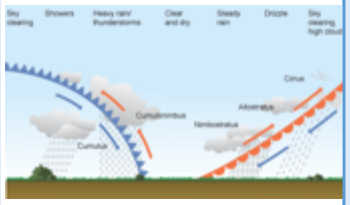
Greenhouse Effect



GG make up 1% of the atmosphere. They let the Sun's light shine onto the Earth's surface, and trap the heat that reflects back up into the atmosphere. **Without the greenhouse effect, the average temperature of the Earth would drop from 15°C to as low as –18°C.**

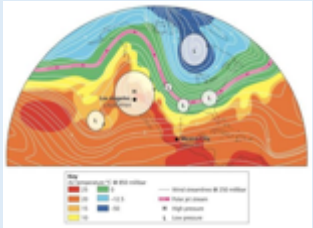
UK Weather:

Low Pressure = Depression: A depression forms as a result of the warm air mixing and rising above surrounding cold air. This mixing of air often leads to unsettled weather



High Pressure = Anticyclone: The air is sinking so there are few clouds. As the air sinks, it warms and therefore condensation doesn't take place. No condensation means no clouds and therefore no rain.

Heatwave and Drought: California.



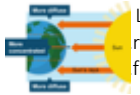
Causes of the heatwave: The weather system, being nicknamed the reluctant ridge, has seen the Jet stream position itself in the eastern Pacific. Bringing an area of intense high pressure.

Effects of heatwave:
- Most HEP dams stopped producing electricity
- One firefighter died
- 31,000 acres of habitat destroyed
- Salmon and trout died in the river
- The state government paid $687m as compensation
- Food prices increased by 6%

Responses: California has to erect controversial overland pipelines to meet the demand for water.

What factors affect the weather in the UK?

Latitude



Locations that are further north receive less concentrated energy from the Sun.

Jet Stream

A strong ribbon of wind that circles the globe. It separates the cold polar air masses to the north and the warmer, tropical air masses to the south.
North of the UK = High pressure (anticyclones)
South of the UK = Low pressure (depressions)

Ocean Currents

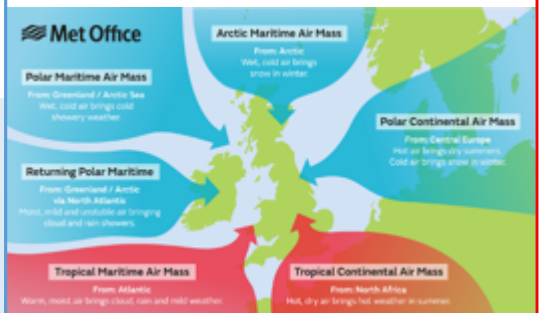
Ocean currents, transfer heat .from warm latitudes to cooler ones.

Altitude and Aspect

Altitude - Temperatures decrease with altitude.
Aspect - South facing slopes tend to be warmer than north facing slopes

Air Masses

Air masses bring different kinds if weather.



How can intensive farming affect water cycles and climate?

Lake Chad - Sahel region of Africa.

In the last 50yrs the lake has shrunk dramatically.

Causes:
- Over-abstraction
- Overgrazing
- Deforestation

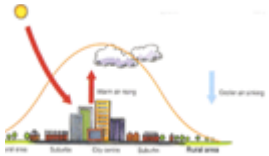
Impacts:
- Biodiversity reduced
- Poverty increased
- Salinization of soils

Solution: Transaqua Project will transfer water from DDRC to bring water to the countries near Lake Chad.

Urban Microclimate:

The small scale, local climate of a city which is influenced by its building and traffic.

- 5-15% lower sunshine
- 1-2 degrees warmer
- 5-30% more rain
- 10x more dust particles



TEST YOURSELF:

- Explain why it is unlikely the UK would experience cyclones (4)
- Justify that climate change is not just the result of human actions (8)
- Explain how the vegetation in the savanna has adapted to the climate (4)
- Use a case study of a tropical rainforest to assess the impact of deforestation (8)
- Explain why human activities lea to damage of ecosystems (6)
- Describe how one piece of evidence, other than rising temperatures, suggests that climate is changing (4)
- To what extent do tropical storms need immediate and long-term responses. Use evidence from a case study (8)
- Climate varies in different parts of the UK. Explain why (6)
- Give one reason why low-pressure systems cause high wind speeds (2)
- Explain why development is important in the development of the savanna (6)
- Give two ways the rainforest can be used sustainably (2)
- Explain how temperatures and rainfall totals differ in urban areas compared to rural areas (4)
- Describe the distribution of areas of the world that are affected by tropical storms (4)
- Explain why tropical, low pressure systems are describes as the most destructive weather hazard (6)
- Suggest how climate change may affect tropical storms (3)
- Explain why deforestation in tropical rainforests has an impact on both climate and the nutrient cycle (6)

Command Words:

Analyse - Take apart an idea, concept or statement and criticise it.
Assess - Come to a conclusion about the overall value or significance of something; discuss its positive and negative aspects to show balance.
Compare - Identify similarities and differences.
Define - State the meaning of an idea or concept.
Describe - Set out the main characteristics of something; DON'T EXPLAIN.
Discuss -Set out both sides of an argument (for and against) and come to a conclusion; there should be some evidence of balance.
Evaluate - Make a judgement about the effectiveness of something; discuss its strengths **and** weaknesses and come to a conclusion about its overall success or importance.
Explain - Give reasons why something happens.
Give - Produce an answer from recall.
Justify - Support an idea or argument with evidence; for the outcome chosen, the positives must outweigh the negatives.
State = name
To what extent - Discuss and conclude how far you agree or disagree with a statement or view.

bug it!

Box = command word
Underline = key words
Glance = back