

SL IB Geography



Your notes

2.3 Responding to Global Climate Change

Contents

- * 2.3.1 Risk & Vulnerability
- * 2.3.2 Case Studies: Contrasting Vulnerabilities to Climate Change
- * 2.3.3 Government Led Strategies
- * 2.3.4 Civil & Corporate Strategies

2.3.1 Risk & Vulnerability



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Exposure & Vulnerability

- The effects of climate change will vary due to location, wealth, age, gender, and education
- Vulnerability will depend on people's level of exposure, potential harm, and mitigation strategies
- Some groups are more vulnerable, such as:
 - Mothers and babies
 - Infants and toddlers
 - School-age and older children
 - The elderly
 - People with disabilities
 - The poor
 - Members of minority groups, refugees, and Indigenous people
- Other at-risk groups include:
 - Caregivers are caring for at-risk people
 - Single-parent households
 - Establishments like hospitals, schools, transport services, agriculture, tourism and businesses
- Low-lying islands and coastal areas are particularly at risk
- Risks include:
 - Damaged coral reefs
 - Increased coastal erosion
 - Outward migration
 - Saltwater infiltration
- Indigenous populations are vulnerable because:
 - They usually live, and have already adapted to, fragile areas
 - Have restricted resource access and low incomes
 - Any change to their environment places them at greater risk
- Climate change will also affect middle- and upper-income people
- This can happen either directly or indirectly, through:
 - Increased food prices
 - Increases in food scarcity
 - Increased insurance premiums
 - Reduced water availability but increased costs, etc.

2.3.2 Case Studies: Contrasting Vulnerabilities to Climate Change



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Case Study: Bangladesh

- Bangladesh is mostly a low-lying, flat delta
- It is **vulnerable to any changes in sea levels and flooding** because:
 - 75% of the country is less than 10 m above sea level
 - The Ganges, Brahmaputra and Meghna rivers converge in Bangladesh
 - 80% of the country sits on the low-lying floodplains of the delta
 - The country is already prone to flooding and tropical monsoon conditions
- Seasonal flooding is normal and necessary to provide fertile soil and irrigation
- But the size, intensity, and frequency of these events have increased
- The monsoon rainfall is predicted to rise by 40% by 2030
 - In 1998, 75% of Bangladesh was flooded, making 30 million people homeless
 - Over 1,000 people died
 - 700,000 hectares of crops were destroyed
- Bangladesh's Flood Action Plan, 1988, aimed to protect the country from future flooding
- It was funded by the World Bank and a number of HICs
- Measures included:
 - Monitoring of flood levels
 - Effective flood warning systems
 - Construction of levees and embankments, which also provide protection from flooding by tidal waves and storm surges
 - Building 200 flood shelters on stilts for evacuated people
 - Creating flood water storage systems
 - Diverting flood water from buildings with 5000 km of drainage channels
 - Reducing deforestation
- The FAP was not considered a success because:
 - Many parts of the project were never completed, including the dams and floodwater storage areas, due to inadequate funding and corruption
 - There was later a recognition that some flooding was necessary to maintain agriculture in many areas
 - 8 million people were forced to move to accommodate the FAP constructions
 - Changing the channel upstream meant that areas downstream suffered more
 - The government cannot afford the maintenance costs



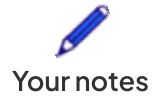
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Case Study: Ghana

- Ghana is one of Africa's fastest-growing economies
- But 45% of the workforce is still employed in agriculture
- Ghana is **vulnerable to drought and reduced rainfall**, which threaten food and energy security
 - Rainfall is expected to decrease 4% by 2040
- Ghana is also expected to become **hotter and drier in the future**
 - Mean annual temperatures have increased by 1°C from 1960
 - Projected to increase by a further 1–3°C by the 2060s
- 25% of the population live in rapidly developing urban areas along the coast
 - Sea-level rise is expected to be 75–190 mm by 2100

Key Climate Change Impacts

Industry	Impact
Agriculture	Increased loss and failure of crops Shorter growing season Loss of fertile land and desertification Increased pest and crop diseases
Fisheries	Reduced productivity Reduced fish stocks Loss of food source Loss of income
Energy	Reduced hydropower production Increased costs and price rises Intermittent services
Water	Decline in water quality Sea water ingress and contamination of groundwater Drought Political tension between surrounding countries



Human Health	<p>Increased vector- and waterborne diseases</p> <p>Increased respiratory diseases</p> <p>Increased burden on healthcare systems</p>
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- The National Adaptation Plan (NAP) aims to address climate change impacts in an "integrated, coordinated and sustainable manner"
- Adaptations have included:
 - Infrastructure development of dams, levees and seawalls
 - Preserving and restoring natural habitats, such as mangrove swamps, to provide ecosystem-based services
 - Capacity development through teaching people new techniques and how to empower themselves

Comparison of Contrasting Vulnerabilities to Climate Change

Factor	Bangladesh	Ghana
Geographical	<p>Low-lying coastal</p> <p>Tropical monsoon climate</p>	<p>2 ecological zones: southern forest (30%) and the northern savannah</p> <p>Tropical climate influenced by the West African monsoon winds</p>
Social	<p>High population density on low-lying floodplains</p> <p>Inadequate housing and infrastructure</p> <p>Lack of awareness and education</p>	<p>Over 55% of the population resides in urban areas, of which 25% are along low-lying coastal regions</p> <p>Increased rural-urban migration</p>
Economic	<p>Lower middle-income, developing country with high and growing levels of income and wealth inequality</p> <p>Services sector contribution to GDP: 54.6%</p> <p>Agriculture contribution to GDP: 12.6% But largest employer at 37.7%</p>	<p>Lower middle-income, developing country with a stable and democratic government</p> <p>70% of the country's land area is dedicated to agriculture</p> <p>Early transition to an industry- and service-based economy. Fuelled by newly discovered offshore oil resources</p>



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		<p>45% of the workforce is dependent on rainfed agriculture</p> <p>Fisheries sector contribution to GDP: 4.5%</p>
Policy and Governance	<p>Bangladesh Climate Change Strategy and Action Plan (BCCSAP) and the National Adaptation Program of Action (NAPA)</p>	<p>National Adaptation Planning (NAP) by government through education, sector-specific and local-level planning</p>
Adaptive Capacity	<p>Hindered by limited resources, economic constraints, and lack of technology</p>	<p>Government supported climate-smart agriculture and alternative livelihood systems</p>
Vulnerability to	<p>More intense rain</p> <p>Increased intensity and frequency of cyclones and storms</p> <p>Increased mean sea levels</p> <p>Food insecurity</p>	<p>Higher temperatures</p> <p>Decrease in precipitation</p> <p>Increased rates of drought</p> <p>Food insecurity</p> <p>Water stress</p> <p>Increased stresses on health</p>



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2.3.3 Government Led Strategies

Global Geopolitical Efforts

- Global warming and climate change require an international response because it affects the entire globe
- Responses involve:
 - **Mitigation** - actions that reduce emissions that contribute to global warming and climate change
 - **Adaptation** - actions which minimise or prevent the negative impacts of global warming and climate change

Mitigation

- One form of mitigation is through **international agreements**:
 - In 1988 the **Intergovernmental Panel on Climate Change (IPCC)** was set up to assess the 'risks of human-induced climate change
 - This was followed by several international agreements:
- **Earth Summit, Rio 1992**
 - Set out aims to stabilise greenhouse gas levels
- **Kyoto Protocol 1997**
 - Delegates from 150 countries agreed to reduce greenhouse gas emissions
 - It stated that industrialised countries would reduce emissions to below the levels in 1990
 - Developing countries including China and India were exempt from the agreement
 - The USA did not sign up for the treaty
 - Canada withdrew in 2011 stating that without China and USA, the treaty would not work
- **Paris Agreement 2015**
 - Global agreement to limit global warming to 2°C (preferably 1.5°C) above pre-industrial levels
 - The agreement also includes reducing CO₂ emissions by at least 60% by 2050
 - Signed by 196 countries including the USA and China (the USA withdrew in 2020 and later, re-joined in 2021)
- **Conference of the Parties (COP)**
 - The United Nations (UN) holds an annual (every year) meeting to discuss climate change.
 - COP26 was held in Glasgow, UK in 2021, COP27 in Sharm El Sheikh, Egypt in 2022 and COP28 in Dubai, UAE in 2023
 - All nations agreed to take actions to further reduce greenhouse gas emissions

Adaptation

- These are ways in which people can adapt to the impacts through:
 - Change in agricultural systems
 - Managing water supplies
 - Reducing risks from rising sea levels

Change in agricultural systems

- Agricultural systems will need to adapt to changing weather patterns, different pests and diseases
- Changing crops or the livestock raised to suit the climatic conditions

- More irrigation may be required which will need careful management of water supplies
- Development of drought-resistant crops
- Floating gardens where crops are planted on platforms which rise with the level of water

Managing water supplies

- Reducing demand through the use of water-efficient appliances and devices (shower heads, dual flush toilets)
- Increasing supply through desalination
- Water storage facilities
- Improved irrigation systems which waste/use less water

Reducing risks from rising sea levels

- Construction of sea walls as in the Maldives
- Mangrove forest restoration which protects the land from coastal flooding
- Raised homes on stilts to allow waters to flow underneath
- Construction of artificial islands up to 3m high
- Flood barriers such as the Thames Barrier in London

Examiner Tip

It is important to be clear about the difference between mitigation and adaptation. Adaptation is the actions taken to adjust to natural events to reduce potential damage or deal with the consequences such as building homes on stilts to adapt to increased flooding. Mitigation is the actions taken to reduce or eliminate the long-term risk to human life and property from climate change such as international agreements to reduce carbon emissions.



Your notes



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Carbon Offsetting & Trade

- **Carbon offsetting** is about **reducing, avoiding or removing CO₂** emissions in **one part of the world** to compensate for emissions in another
- Carbon offset schemes allow for investments in environmental projects around the world so that individuals or companies can balance their own carbon footprints
- The projects are usually based in LICs and are designed to reduce future emissions
- Critics argue that carbon offsetting does not change the behaviour of individuals or companies but acts as a 'greenwashing' substitute for making direct emission cuts

Carbon capture and sequestration (CCS)

- This is the use of technology to capture, remove and store CO₂ from industrial facilities, power plants, and other large-scale sources
- There are two methods:
 - **Captured at the site** - CO₂ is captured before atmospheric release, compressed and stored underground or utilised for industrial purposes
 - There are **3 methods to remove** or 'scrub' CO₂:
 - **Pre-combustion** - CO₂ is scrubbed before burning the fossil fuel
 - **Post-combustion** - CO₂ is removed after burning the fossil fuel. CO₂ is captured ('scrubbed') from the exhaust (or 'flue') gases
 - **Oxyfuel combustion** - fossil fuel is burned in oxygen instead of air and the exhaust gas are mainly CO₂ and water vapour. The water vapour is condensed and the remaining CO₂ (which is almost pure) is then transported and stored
 - **Direct air carbon capture (DASC)** - CO₂ is allowed to enter the atmosphere, but is then captured using specially designed removal processes
 - A large fan draws air from the atmosphere, through a carbon-capturing filter, which is then heated to release CO₂ which is either stored or reused
- Captured carbon can be used to manufacture fuels, make concrete building materials, and carbonate (fizzy) soft drinks
- This is an expensive process and is not yet economically viable
- It is unknown whether CO₂ can be stored long term

Carbon taxes

- This is a tax paid by businesses and industries that produce excessive GHG emissions through burning fossil fuels (coal, oil, and gas)
- The tax is designed to encourage businesses to move to renewal energy by making fossil fuels more expensive and encouraging companies to become more energy-efficient, and save money
- 35 countries to date have implemented the tax, although the USA (as one of the largest emitters) has no carbon taxes

Carbon trading

- This is a way of monetising GHG emissions through the buying and selling of 'credits or permits', which allow the owner to emit a certain amount of GHGs



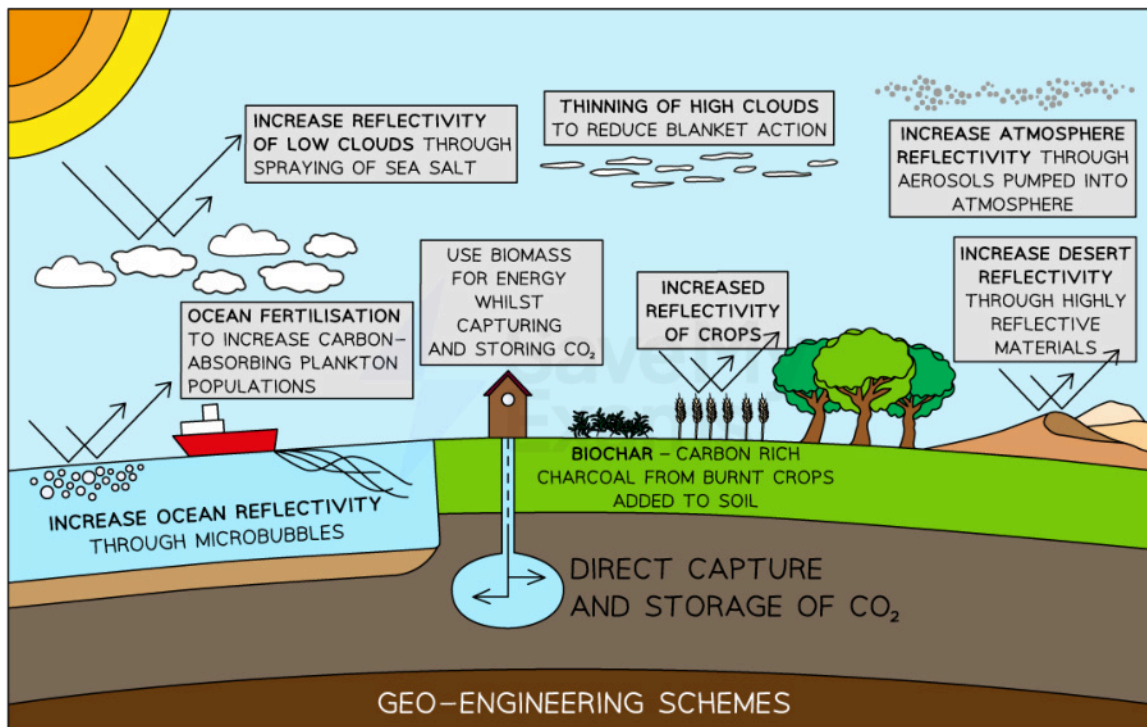
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- The credits and trading are agreed between governments with the aim of gradually reducing overall emissions and mitigating their contribution to global warming and climate change
- In Europe, carbon credits/permits are traded through the Emissions Trading System (ETS)
- Industries that exceed the limits set, must buy permits from others that have not
- Carbon trading has led to carbon accountability which measures the impact made by governments, companies, and individuals

Technology & Geo-Engineering

- Technology and geoengineering are large scale schemes that aim to alter natural processes
 - Using sulphate aerosols in the air could cool the planet by reducing insolation
 - Using giant mirrors in space to deflect more sunlight back into space
 - Seeding clouds to reflect more rays into space
- In principle, these ideas work, but practically, they are unworkable and far too expensive
- More accessible strategies include:
 - Reforesting large areas of land to absorb more carbon
 - Painting rooftops white to be more reflective
 - Fertilising the ocean with nitrogen, iron, and phosphorus to grow more plankton and absorb more carbon

Geo-engineering schemes



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2.3.4 Civil & Corporate Strategies

Role of Civil Society

- Civil societies are not-for-profit, voluntary community-based groups, including non-governmental organizations (NGOs)
- They cover a wide range of interests, including:
 - Environmental groups such as World Wide Fund for Nature (WWF)
 - Women's rights are advanced with the UN Women group
 - Amnesty International cares for human rights
 - The Red Cross is a humanitarian group
 - Climate change groups include Greenpeace, WWF and Friends of the Earth
- Civil societies play an important role in pushing for new laws, programmes, policies, or strategies on climate change
- They hold governments accountable for their
 - Commitments to reducing CO₂ emissions
 - Lack of coordinated responses to climate change
 - National policymaking includes the poor and vulnerable
- The WWF uses numerous strategies to help combat climate change. They:
 - Urge people to adopt a more eco-friendly lifestyle and use modern energy-saving technology
 - Pressure developed and developing countries to cut their CO₂ emissions
 - Urge nations to ratify global agreements to cut fossil fuel use
 - Encourage 100% reliance on renewable energy sources by the year 2050

One-in-Five Challenge - WWF and the UK

- Aim - to reduce business travel and improve their environmental impact by:
 - Saving time and money
 - Improving productivity
 - Improving work-life balance
 - Maintaining higher staff retention

Vodafone and One-in-Five Challenge

Company	Initiative	Outcome
Vodafone UK	£600,000 spent on video conferencing equipment in 2010	In the first 5 months they spent 3,600 hours on video conferencing and travelled 320,000 km less In 1 year , Vodafone cut business flights by 3,749

		Reduced CO ₂ emissions by 617 tonnes
		Reduced business flights by 2.5 million kilometres
		Reduced travel costs by 1/3



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Corporate Change

- Many US corporations are becoming interested in climate change mitigation plans
- Chrysler, General Electric, General Motors, Rio Tinto, Shell, and Siemens are among 28 companies that formed the US Climate Action Partnership (USCAP) in 2007
- The USCAP has pressed the government to make legally binding agreements that reduce CO₂ emissions of 80% by 2050
- Levi Strauss, Nike, Starbucks, and other companies formed the Business for Innovation, Climate, and Energy Policy as part of the Coalition for Environmentally Responsible Economies (CERES) in 2008
- BICEP proposes a decrease in greenhouse gas emissions of 25% below 1990 levels by 2020 and 80% by 2050
- But many US firms urge the government to block these restrictions
- Many US citizens fear that such policies will lead to job losses and decline of economic competitiveness

Case Study – WWF & Ikea

- Ikea and WWF are working on 6 climate projects together



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Project	Outcome
Climate Positive	Blanket project for all the climate projects that IKEA and WWF are working on It identifies and maps opportunities where IKEA can make positive climate impacts in its own emissions and how it can improve its impacts on others
Promoting A Sustainable Life at Home	This aims to help customers change their behaviour through smart products that encourage a sustainable home lifestyle which reduces their own CO ₂ emissions
Improving the IKEA food range	The project's goal is to develop ways to reduce CO ₂ emissions from the food IKEA sells in its restaurants and food markets. Along with providing nutritious and appealing meals
Closing the Loops	This looks at the impacts of full recycling and how the systems can save resources, reduce CO ₂ emissions, and positively impact the environment Strategies to use recycled materials in new products and how to source products that can be reused, recycled or be returned to nature
Sustainable Transportation of People (SToP)	Looks at ways to reduce the carbon footprint of customers and employees travelling to and from stores and the delivery of purchased products Encourages co-workers to commute together Own fleet and delivery services with electric vehicles Smart shopping uses the company website to check products and stock before driving to the store Improve availability for home shopping and click and collect

Developing Climate Positive Opportunities for Suppliers	Aim is to improve energy efficiency at IKEA stores and its suppliers by removing barriers and promoting a low carbon supply chain
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