

HL IB Geography



Your notes

6.2 Environmental Risks

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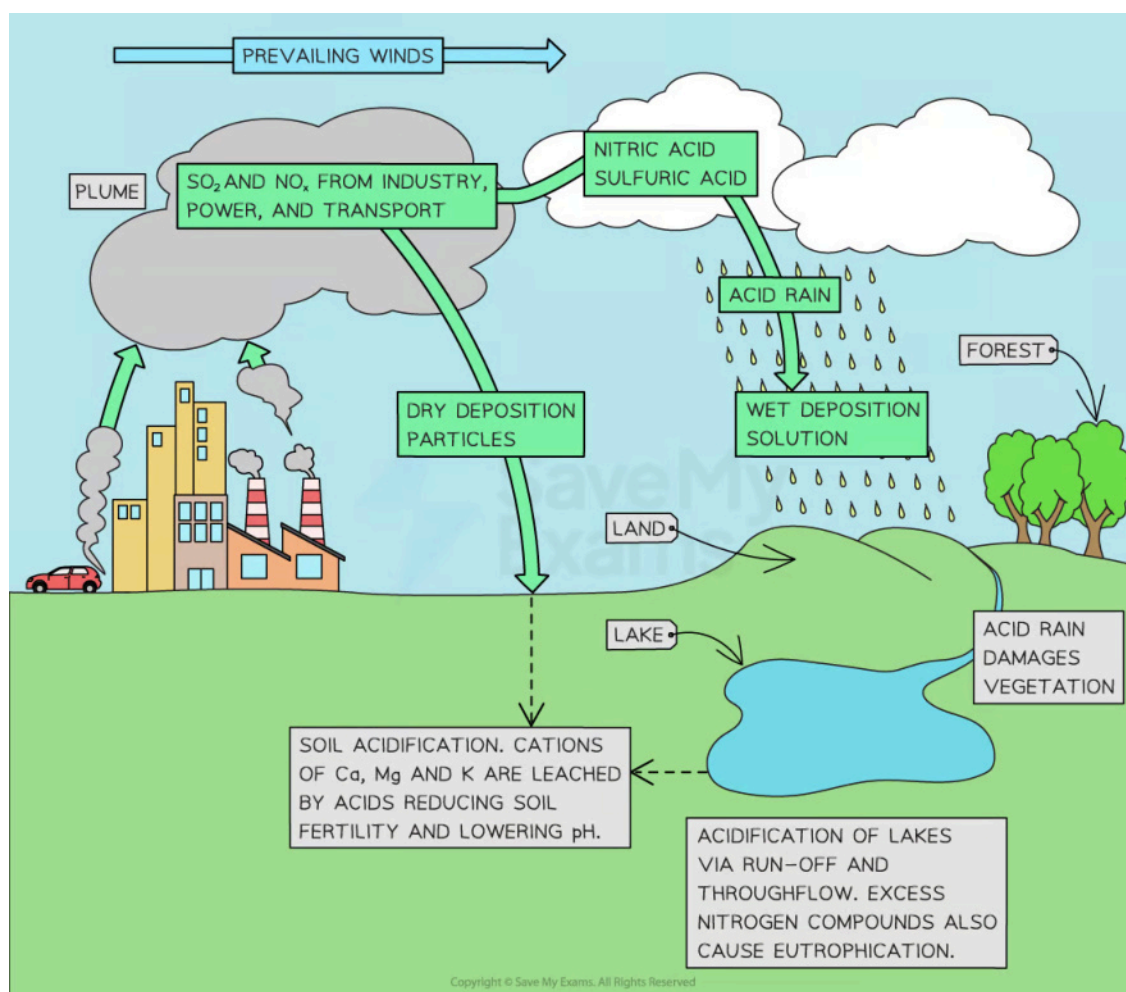


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6.2.1 Transboundary Pollution

Case Study: Acid Rain

- **Transboundary pollution (TBP)** is defined as "pollution that originates in one country but, by crossing a border through pathways of water or air, is able to cause damage to the environment in another country" (OECD)
- **Air pollution** is the release of chemical particulates into the atmosphere
- Acid deposition occurs when sulphur dioxide and nitrogen oxides are released into the atmosphere
- These gases undergo chemical reactions and transform into secondary pollutants, resulting in both **dry** and **wet** acid deposition called acid rain



Causes of dry and wet deposition of acid rain

- **Dry** deposition **occurs close** to the **source** of the **pollution** and is usually in the form of **particulate matter**
- **Wet** deposition happens when the pollutants dissolve in precipitation and fall at a distance from the source
- It is these **wet** depositions that **cross** international boundaries and, therefore, **form transboundary pollution**



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What is acid rain?

- All precipitation is naturally acidic as it absorbs carbon dioxide in the atmosphere
- This becomes a weak carbonic acid with a pH of between 5 and 6
- **Acid rain** is **precipitation** that has a **pH of less than 5.5**
 - Human activity, such as burning fossil fuels, produces oxides of nitrogen (NO_x) and sulphur dioxide (SO_2), which are released into the atmosphere
 - **Coal-fired power stations** are major contributors to SO_2 emissions, while NO_x emissions are mainly from **vehicle exhausts**
- Sulphur oxides have the greatest impact, accounting for 2/3 of the problem
- Global emissions of SO_2 are declining; however, NO_x emissions are increasing with car ownership



Examiner Tips and Tricks

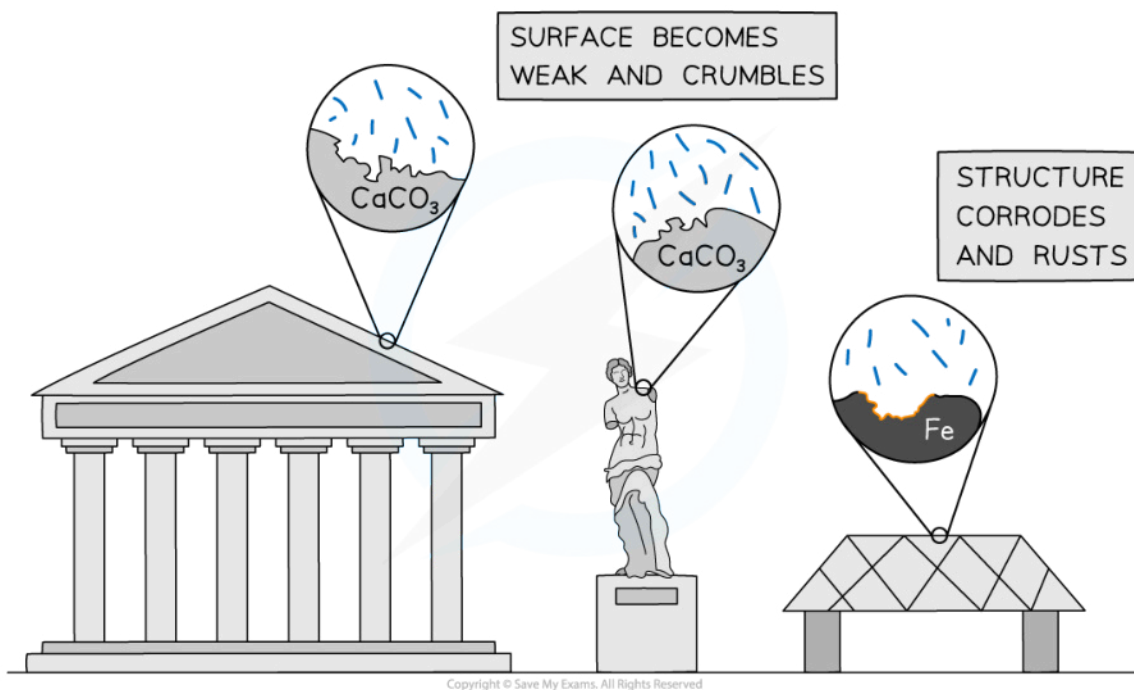
If you are going to write about acid deposition/acid rain, you must remember to write about wet and dry. Wet deposition is transboundary, but dry deposition is not usually transboundary.

Impacts of acidification

- Acid rain and the dry deposition of acidic particles contribute to the corrosion of metals, such as bronze and rocks, such as limestone
- These effects significantly reduce the societal value of buildings, bridges, and cultural objects such as statues and monuments
- Dry deposition of acidic compounds can also dirty buildings and other structures, leading to increased maintenance costs

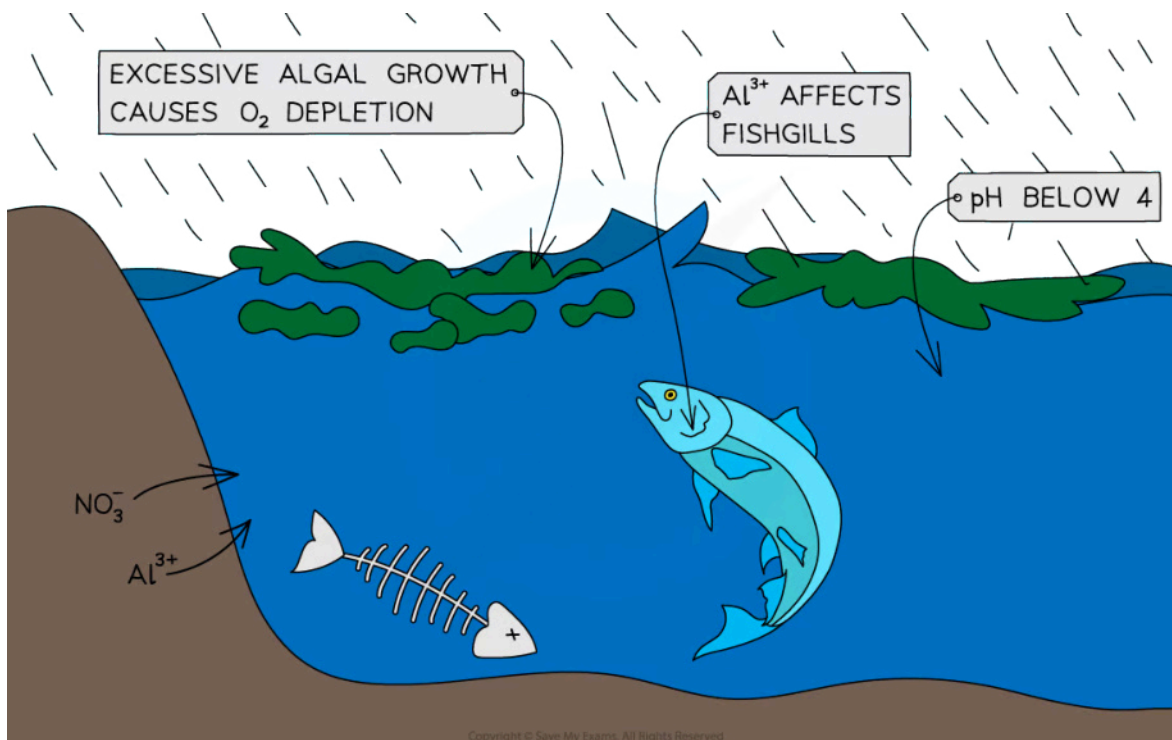


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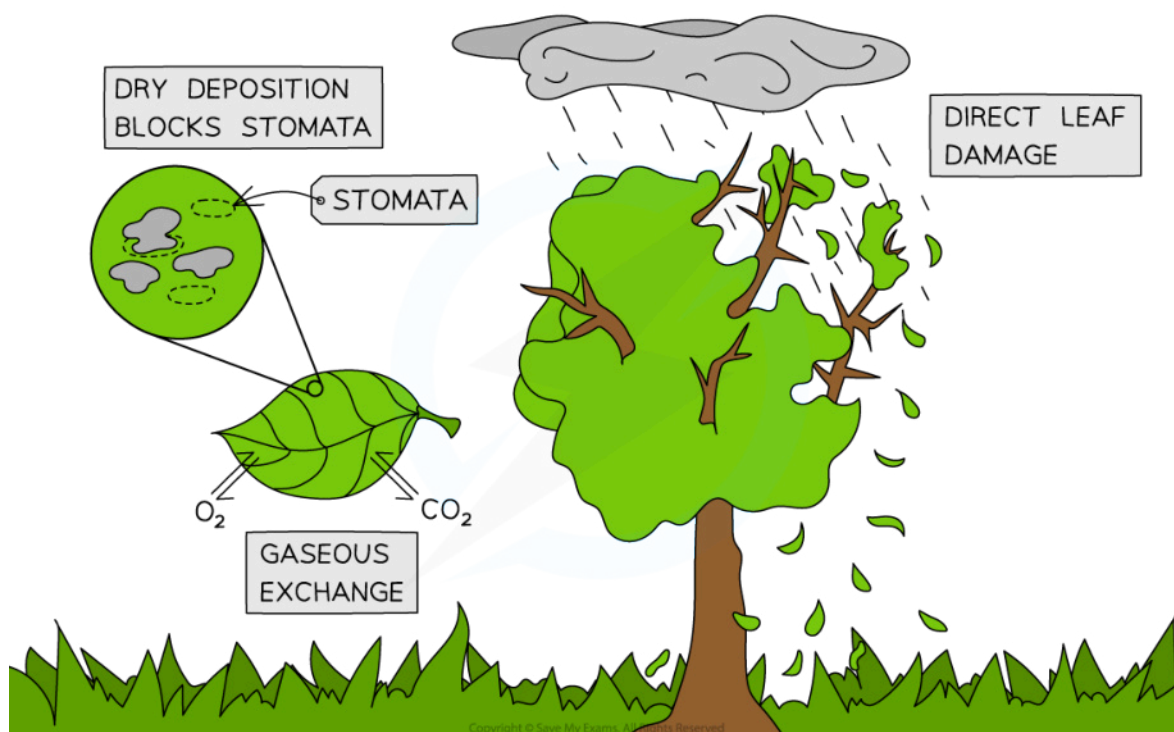
The impact of acid deposition can be seen on buildings, statues and metal structures

- Acidic deposition, particularly in bodies of water, directly affects aquatic organisms such as fish, amphibians, and invertebrates
 - Acidic deposition **lowers** the **pH** of the water, making it difficult for some species to survive and reproduce



When acid rain falls on bodies of water, pH levels fall and cannot support life. Further decreases in pH levels releases nitrates and aluminium from rocks

- Acid deposition **directly** falls on leaves, causes leaf damage and eventually kills plants
- Acid particulates can **block stomata** (plant pores), preventing gaseous exchange
- **Coniferous forests**, such as pine or spruce trees, are **particularly sensitive** to acid deposition due to their **shallow root systems** and **thin bark**
 - Acid rain also damages their foliage and inhibits nutrient absorption



The impact of acid deposition on plant life



Case Study

Acidification in Sweden

- Most acidifying pollutants deposited in Sweden have been carried on winds from other countries and international shipping
- Most soils in Sweden are poor in limestone and vulnerable to acidification
- Over 18 000 lakes in Sweden are acidified, and 4000 of them are seriously affected
- Fish stocks in about 9 000 Swedish lakes, mostly in the south and the centre of the country, are also very badly affected
- Sweden has aluminium levels of up to 1.7 mg/l, compared to the safe limit of 0.2mg/l
- High levels of mercury in fish cause health problems when eaten
- Acid rain has a negative impact on forests and trees.
- Sulphur dioxide interferes with the process of photosynthesis
- Removing a whole tree can be equivalent to the effects of 60 years of acid rain

Action taken by Sweden

- Ever since the late 1960s, Sweden has made efforts to reduce acidification and its effects



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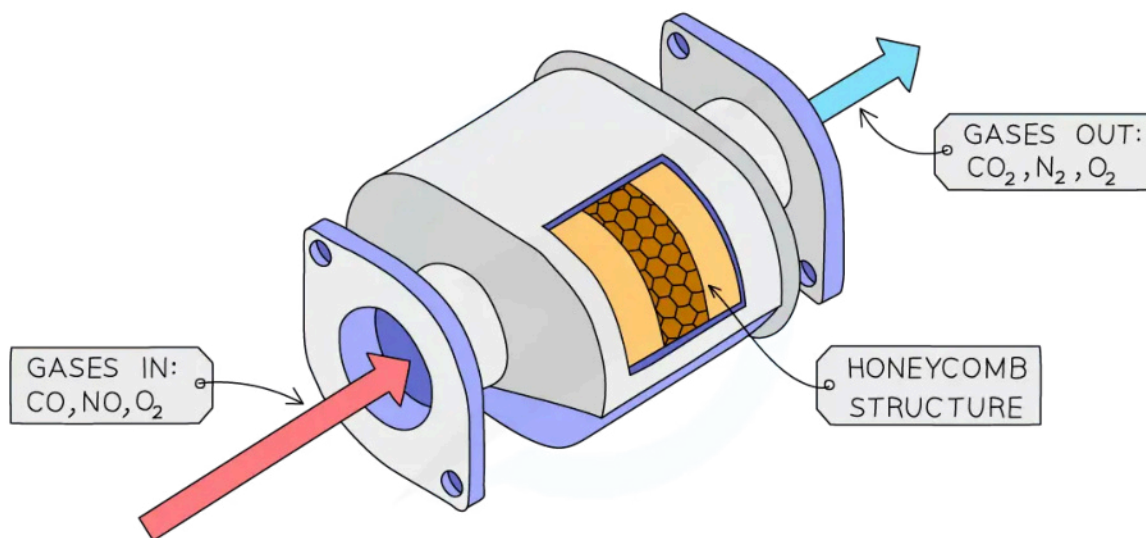
- Sweden banned the burning of high-sulphur oils in 1969, and then took a number of steps to lower sulphur emissions. Methods included:
 - More efficient energy use
 - Increasing the use of nuclear energy, which reduces the need to use fossil fuels
 - Introducing requirements for flue gas cleaning at combustion plants
- In 1991, a tax on sulphur and NO_x was imposed further reducing emissions and a few years later, NO_x emissions had almost halved
- Research by the Swedish Environmental Protection Agency has been significant for environmental protection, particularly in the context of the Convention on Long-Range Transboundary Air Pollution
- Sweden has drawn attention to the problem and encouraged other countries to take action
- The Swedish Government has spent money and resources to inform citizens and politicians of neighbouring countries about the seriousness of acidification as an environmental threat

Reducing the impacts of acid deposition

- There have been various methods to deal with the effects of acid deposition, such as fitting catalytic converters on all cars and using powdered limestone in lakes to increase the pH
- However, these are **short-term solutions**
- The most obvious **long-term methods** are:
 - **Reduce** emissions and energy consumption by industry
 - **Encourage** the production and use of renewable energies
 - **Remove** pollutants before entering the atmosphere
 - **Plant** trees to absorb polluted air
 - **Avoid** the use of sulphur-rich fuels
 - **Inform** the public on the issues of acid deposition and the importance of reducing household energy use
 - **Promote** innovation and new technologies to develop efficient and reliable renewable energies



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Catalytic converters are a short-term remedy to reduce emissions produced in car exhausts



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6.2.2 Environmental Impacts of Global Flows

Localised Pollution

- Localised pollution is confined to one particular area and is usually due to specific activities or processes
- Trade and the transportation of goods between countries have increased due to globalisation
- This flow of goods has led some countries to experience localised pollution in the form of:
 - Point-source pollution** arising from a specific, identifiable origin, such as
 - A manufacturer releases waste into nearby waters or pollutants into the air
 - Non-point source pollution** is from scattered or diffused pollution sources, making it challenging to trace to a specific origin
 - For example, runoff from agricultural land sprayed with pesticides
 - Urban centres suffer:**
 - Air pollution** due to transport congestion and industrial emissions
 - Poor water quality** from untreated sewage, industrial discharges, and storm water runoffs in overpopulated cities (particularly developing ones) is common
 - Overpopulated cities, along with high consumption patterns, generate **high levels of waste**, which are often disposed of unsustainably

Shipping Pollution

- The shipping industry is an important economic sector that has contributed to more than 80% of global trade throughout history
- Shipping is the **most energy-efficient** way to move large volumes of cargo
- Billions** of **containers** of solid, liquid and dry bulk cargo are moved **annually** across the world's oceans
- This improves the economy and availability of food, raw materials, etc. for many countries
- But the shipping industry accounts for between 2 and 3% of global CO₂ emissions and could be as much as 17% by 2050 if left unregulated

Forms of shipping pollution

- Air pollution**



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- Like all forms of transport, ships burn fossil fuels and create air pollution
- Globally, the shipping industry's total share of emissions per year is:
 - Greenhouse gases: 2.9%
 - Nitrogen oxides (NO_x): 19%
 - Sulphur oxides (SO_x): 9%
 - In comparison to Canada's total annual emissions of just 1.5%
- **Noise pollution**
 - The large propellers of ships create underwater noise that can travel long distances
 - Marine species that rely on sound for their communication, feeding and orientation can be harmed
 - Continuous on-board noise is harmful to human health
- **Discharge**
 - Shipping contributes significantly to global CO₂ emissions
 - Although individual ships are an efficient form of transport, the large numbers of vessels operating globally counteract this
 - Accidental oil leaks from tanker accidents
 - Chemical pollution from deliberate discharge of waste into the sea
 - Dumping of waste water and materials into the sea decreases water quality, negatively impacts marine environments
 - Black water contains urine and faeces, and oily bilge water
 - Bilge water is usually treated to meet international regulations for release into the environment; however, not every ship does this
 - Grey water comes from ships' accommodation areas, including the sink, shower, laundry, and galley
- **Pollution in ports**
 - Ships arriving in port may not be able to berth and have to wait at anchor
 - Ships will continue to run engines and generators, emitting pollution into the atmosphere and water and contributing to acidification of coastal waters
- **Invasive species**
 - The discharge of water into the oceans can introduce non-native marine species to an area

- Cargo can carry non-native species and transport them around the world

The impact of global flows

- The overall effect of pollution is increased along major shipping routes and concentrated locally in ports
- This has led to concentrated ocean acidification, which has consequences on marine life in general

The Carbon Footprint of Flows

- A **carbon footprint** is simply the total amount of greenhouse gases produced by individuals, organisations or countries
- It is usually **measured** in terms of the amount of CO₂ produced
- The flow of goods, people and food around the world has implications on the global carbon footprint

Flows of food

- **Modern food systems** have long supply chains that bring huge environmental impacts with them
 - The **transport** of food over long-distances increases fuel consumption and the food's carbon footprint
 - Maintaining perishable items in **chilled storage** for extended periods consumes significant energy
 - Methods like **canning or freeze-drying**, although they prolong shelf life, are energy-intensive
 - **Mechanised farming**, high fertiliser use, and large-scale monocultures increase emissions
 - **Farming**, especially cattle and rice, contributes large amounts of methane emissions, a potent greenhouse gas

Flows of goods

- From raw materials to finished products, the flow of goods usually spans continents
- Each stage of the process adds to the carbon footprint
- The stages are:
 - **Manufacturing**
 - Factories, particularly heavy industries, produce large amounts of CO₂
 - Extracting and processing raw materials, such as metals, contributes to emissions
 - **Packaging**
 - Plastic is light and durable, but it is a petroleum product with a high carbon footprint



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- Excessive packaging (particularly non-recyclable plastics) end up in landfills, contributing to environmental pollution
- **Transport**
 - Transporting goods by air has the largest carbon footprint, followed by road travel, and finally sea travel
 - The longer goods travel, the larger the carbon footprint



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Flows of people

- Globalisation has contributed to the movement of people, either as economic migrants or tourists
- This movement has increases global CO₂ emissions
- Movement usually involves **transport** and the greater the distance, the larger the footprint
 - **Tourist** hotspots suffer a rise in transport emissions
 - Tourists **consume more resources**, from water to energy, compared to local users
 - **Legal migrants** have higher carbon footprints than illegal migrants, as they move all their possessions from one place to another, whereas illegal migrants move or own very little
- Flows of people to **urban areas** increases the demand on **resources** and, therefore, the carbon footprint increases
 - **Expanding cities** need more energy-intensive infrastructure, increasing carbon emissions
 - **Densely populated** areas strain local resources, which can lead to unsustainable extraction elsewhere



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6.2.3 Global Shift of Industry

Polluting Manufacturing Industries

- The decision by HICs to relocate manufacturing to NICs and LICs has led to some serious environmental pollution in air, water and soil



Case Study

Union Carbide India Limited (UCIL)

- In 1934, Union Carbide Corporation (UCC) became **one of the first U.S.** companies to **invest in India** when it acquired 50.9% shares in UCIL
- In 1969, the **UCIL** set up a **chemical production** plant, primarily **pesticides**, in Bhopal, India
- In December 1984, 40 tons of methyl isocyanate (MIC) gas leaked from the UCIL plant, killing thousands of people and polluting soils and groundwater in the area
- At the time of the disaster, UCIL was ranked twenty-first in size among companies operating in India
- **A series of human actions** led up to one of the worst industrial disasters in history
- There was a high turn-over of staff and many of them either received **insufficient safety training** or chose to disregard it
- There were **little to no emergency plans** in place
- **Maintenance schedules** were **lengthened** and carbon steel replaced stainless steel in safety valves
- Prior to the accident, the UCC plant in Charleston, USA, also suffered a leak but **chose not to notify the UCIL** plant in India on the defects found to be the cause

Reasons for relocation of polluting industries

- **Moving closer** to emerging markets such as Asia, Africa, and Latin America, industries can reduce their transport costs and increase their market reach
- HICs impose **higher taxes** on polluting industries
- There are **stricter** environmental **laws** in HICs on polluting industries
- **LICs** have **low labour costs**, which attracts polluting industries as a cost-cutting measure to increase their profits
 - For example, in Mexico, a factory worker is paid 1/5 of an American factory worker's wages

- LIC **governments** create **deliberate** policies, such as free trade zones or export processing zones, for foreign companies to invest in
- Some LICs **encourage waste product imports** to extract valuable minerals such as gold, platinum, aluminium, etc in order to make a living
 - In Ghana, Agbogbloshie is the world's largest e-waste dump for products originating from the United States and the European Union



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Impacts of relocation

- The **underdevelopment** of pollution control systems and a **desire** for economic development makes **LICs and NICs vulnerable** to pollution from manufacturing industries
- **Urbanisation** usually come with industrialisation, which results in the loss of forests and green spaces
- **Rapid industrialisation** puts a strain on local infrastructure, leading to issues such as high levels of traffic congestion and their emissions and poor or lacking waste disposal
- The burning of fossil fuels is often the way that industries meet their increasing energy needs



Examiner Tips and Tricks

It is important to note that while manufacturers emit pollutants, sometimes it is not just the factory at fault for increased health issues. Unpaved roads and vehicles emit far more particulates than some industries.

Food Production Systems for Agribusiness

- On a global scale, **business corporations** run the **agribusiness** from the production, processing and distribution of agricultural products to the manufacture of farm machinery, equipment and suppliers
- With the **quest for cheaper food**, modern **farming methods** have become more **intense, increased efficiency** and adopted **labour-saving technologies** such as **agrochemicals and machinery**
 - Since the 1960s, wheat yields have increased from 2.6 to 8 tonnes per hectare through the use of fertilisers and pesticides
- As a result, **large petrochemical industries are linked** with agribusiness
 - These companies such as DuPont and Monsanto, are involved in the **research and production** of high-yielding seed varieties and **genetically modified (GM)** seed varieties, along with chemical inputs such as fertilisers and pesticides that support them
- Agro-industrialisation may have increased food **production** but so have energy consumption and greenhouse gas emissions



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- In the UK, air pollution and greenhouse gas emissions from agriculture account for about £12 billion in expenditures
- Intensive farming needs to use **chemicals and methods** that cause **land degradation** and **animal welfare** issues. For instance:
 - The spraying of pesticide on apples can be done up to 16 times before reaching the shops
 - Food processors (such as Nestle, Kraft and Unilever) want large quantities of uniform-quality produce or animals at specific times
 - Some agribusinesses are involved in land grabs to grow mono-cultures such as palm oil and soy. Growing one crop requires vast amounts of fertilisers and pesticides and eventually leads to soil degradation

Advantages and Disadvantages of Agribusinesses

Advantages	Disadvantages
Large-scale food production improves food security	Genetically modified seeds impacts biodiversity
It creates employment opportunities	Large land grabs by TNCs deny local people the right to cultivate food for domestic consumption
Areas that have insufficient food supplies can import from elsewhere	Food is preserved, processed, package-branded and marketed in a way that makes it difficult to link the food to an animal
They create revenue for governments through the taxes that businesses pay	Growing a single crop draws too many nutrients from the soil, leading to leaching
Agribusiness helps with the development of infrastructure in developing countries.	Chemicals such as pesticides and fertilisers are harmful to the environment
They eliminate the middleman who contributes to increasing the price of agricultural produce	The removal of hedgerows, clearance of ponds and wetlands destroys the habitats of wildlife and ecosystems, some of which may be extremely fragile