

Learning Theme 1 – Geography in the Anthropocene

1.1 Introduction

- Geography offers a unique perspective on how human activities affect and influence ecological processes at different scales
- The **ANTHROPOCENE** – the age of man
- **Evidenced by the widespread pollution & presence of artificial radioactive particles**
- Zalasiewicz (2016) -: sufficient evidence exists to suggest that the Anthropocene is a real ecological phenomenon with potential to be formalized within the Geological Time Scale”

1.3 Meme or Geological Epoch: Introducing the Anthropocene

- Holocene -:
 - o Geological term used by environmental scientists to denote the warmer, inter-glacial period in which we now live.
 - o Began approx. 12 000 years ago around 10 000 BCE
- Paul Crutzen
 - o Found this term outdated due to the rapid change of the global environment
 - o At the base of the argument was that humans had become a **force of nature**;
 - By the ways that humans had transformed the environment
 - The ways that these transformations were increasingly expressed at a planetary level
- The term “**Anthropocene**” is made-up from the prefix “**anthropo**” (humankind) and the suffix “**cene**” (a geological epoch) and can also be referred to as “**the age of humans**”.
- The Anthropocene is marked by:
 - o Greenhouse gases reaching their highest levels for 400,000 years
 - o The ability of humans to regulate and control the flow of water through dam-building and sluice constructions
 - o Industrial emissions of sulphur dioxide reaching 160 million tons per year
 - o Increased exploitation of fisheries in the ocean
 - o Increased levels of fertilizers in soils; and
 - o High extraction rates of minerals through mining.
- Studying the Anthropocene requires a horizontal record of human-environmental relations across (and above) the surface of the planet as at the vertical record of the geological past.
- **Scientists remain uncertain as to whether the human impact on the global environment constitutes a geological level shift in planetary history.**
- Key issue: for the ‘age of humans’ to exist geologically, it is necessary to show that humans have changed the environment and illustrates that humans actually changed the ways in which the global environment operated.
- International commission on Stratigraphy has established a working group to explore this idea.
- Ecocentrists see the Anthropocene as basis for reducing the demands we place on the planet, to challenge the value of economic growth and to re-localize our economies. Techno centrists feel that the idea of humans as intelligent agents of geological power should be an incentive to deeper interventions on the planet.
- Two large trash vortexes were formed by ocean currents in the North Pacific Ocean. The floating mass of micro-plastics, cigarette lighters and syringes causes the death of approximately 1 million seabirds every year and 100,000 marine mammals.

CASE STUDY 1.1.

- A recent study on bioaccumulation found high levels of persistent organic pollutants (POPs) in amphipods (crustaceans such as sand fleas) in two of the deepest parts of the oceans. Both of these trenches are more than 10,000 meters deep and are considered as some of the most inaccessible and remote parts of the Earth.
- Plastics are already present in sufficient numbers to be considered as one of the most important types of ‘technofossil’ that will form a permanent record of human presence on Earth.

1.4 The Rough Geographies of the Anthropocene

- Debate as to when the Anthropocene began, some believe it is at the human domestication of animals and the birth of modern agricultures.
- Paul Crutzen – began in 1784 when the first steam engine & the kick-start of the industrial revolution
- Some believe it is linked to rise of nuclear technology & radioactive traces it has left
- Where is the Anthropocene?
 - o Spatial question – historic & contemporary implications
 - o Key questions:
 - In what particular places have the changes that humans have caused been felt most?

- Where have the different processes been orchestrated from?
- How and what is being done to address these impacts?
- Geographical perspectives have the potential to transform our understanding of the consequence of env. Change
- **Spaceship Earth**:- R. Buckminster Fuller – we are all already astronauts
 - A metaphor used to convey both the finite resources that humanity has at its disposal and the crucial role of env. Maintenance in ensuring the ongoing wellbeing of our shared home.
 - We need to carefully monitor and utilise the resources at our disposal in order to ensure human survival
- Spaceship Earth theory unites us under a common ecological fate
- However, we cannot look at all env. Problems with a global perspective
- The unevenness of our env. Fates is expressed clearly in the case of climate change
- Studies indicate that **South Asia and Africa are the inhabited areas that will be hit the most by impacts of Climate Change.**
 - Will bear the brunt of flooding, loss of agricultural productivity, spread of climate-related diseases
 - Also some of the least responsible for the damage
 - Least able to protect themselves from the dangers/ impacts
 - “involuntary exposures” to climate change
- Env. Geography involves the study of spatial relations, locations and systems.

Spatial relations	<p>2 interconnected & distinct forms;</p> <ol style="list-style-type: none"> 1. Routes taken by trade/ transport/ communication/ pollution which form the geographical means in and through which the world is joined together – e.g. lines on a map \ 2. The myriad of political, economic, social, cultural & env. Processes which constitute the collection of relations in and through which specific spaces (e.g. cities/ regions/ neighbourhoods/ nations) relate to other places – e.g. bank transfers/ cultural exchange etc. <ul style="list-style-type: none"> - Lines of engagement are both part of what it is, and part of its effects - Env terms: the relations that connect one place with another’s env. Are not only trans-boundary pollution (e.g. acid rain/ toxic waste disposal/ air pollution). Env. Relations are also hidden in everyday products that we buy and consume. E.g. palm oil & the clearing of the rainforests in Indonesia.
Spatial Locations	<ul style="list-style-type: none"> - Studying locations is about more than simply tracing our current environmental problems back to their roots, - Key: understanding the role of particular sites in the Anthropocene. - About understanding how certain places are both environmental relations and at the same time express the effects of those same relations. - Locating the Anthropocene provides us with an opportunity to see if our theories about nature and form are accurate, and the ways in which such general theories may apply differently in different places.
Spatial Systems	<ul style="list-style-type: none"> - Final key: the particular concern with the formation and operation of spatial systems - The spatial system exists when geographical spaces of various sizes come together to form interconnected arrangements of coordination and support. - Spatial systems: can include cities/ regional economies/ nation states/ transnational economic and political blocs. - Harvey – urbanization; combination of housing, transport, infrastructure, factories, and offices mean that cities reflect a kind of spatial logic for capitalist society - Can be seen on a neighbourhood level – home life/ schools/ working/ recreation and shopping have to be organized and negotiated on a day-to-day basis - Dominant spatial system: global market place

CASE STUDY 1.2

- Pripyat, Ukraine
- The use of nuclear power is often propagated as “safe” or “emitting less pollution”
- At 1:23am on 26/04/1986, reactor number 4 of the Chernobyl Power Plant (NPP) in northern Ukraine - experiment started
- Purpose: to investigate reactor safety in the event of failure of the main elec. Supply to the plant
- One minute later, a steam explosion blew the life of the reactor and resulted in the largest accidental release of radioactivity into the env. (historic)
- Core continued to burn for 10 days, releasing radiation continuously – radioactive plume was transported over large areas for Europe.
- Immediate result: significant ecological harm due to the spread of the radioactive ions in the env.

<ul style="list-style-type: none"> - Pripyat was evacuated and became a ghost town. - Negative health effects: cancer/ leukaemia/ circulatory diseases/ other chronic diseases - 600 000 lives claimed - Most affected area: The Chernobyl Nuclear Power Plant Zone of Alienation (The Chernobyl Exclusion Zone) - Exclusion zone extends approx. 30km in radius, covering 2600Km² of Ukraine - Deposition of radioactive iodine contaminated agricultural plants/ grazing animals/ and milk products in Belarus, Russia, Ukraine and other parts Europe - Livestock/ reindeer/ mountainous and forest regions in Norway were still affected by exposure to soil which had been affected by radioactive 137-Cs particles in 2013.

Learning Theme 2 – Population Growth and Resource Use

2.1 Introduction

<ul style="list-style-type: none"> - Population growth and increases in the use of certain resources are key factors with are constantly at play in the Anthropocene Epoch - Prominent perspectives on the population growth resource use relationship are: <ul style="list-style-type: none"> o Malthusian o Neo-Malthusian o Cornucopian o Peakiest o Marxist - Some theories complement each other, while others are opposite

2.3 The Simon-Ehrlich Wager

<ul style="list-style-type: none"> - 1980 – Julian L. Simon (prf. Business Admin.) & Paul Ehrlich (American Biologist) <ul style="list-style-type: none"> o Simon: claimed population growth provided a basis for renewed social innovation and for making more resources available o Wager: Ehrlich bet on the price of 5 commodity metals (chromium, copper, nickel, tin and tungsten), betting that by 1990 the prices would have increased (as expected should population growth increase demand for the resource) while Simon bet it would decrease (as expected if you believe population growth would lead to social innovation and the availability of alternate resources. o Simon won the bet - Most pressing challenge: the long-term availability of env. Resources

Perspective	Belief	Person
Malthusian	In the contexts of rising population levels and the increasing relative demand for resources, that finite resources will eventually be exhausted Notions of absolute environmental limits can blind us to the complex processes by which resources are distributed and used.	Ehrlich
Cornucopian	Technologies and market forces will work to ensure that in future humans will have adequate resources to meet their collective needs – Greek “horn of plenty” Recognises the role of technology/ politics/ markets in regulating and redirecting the human use of resources- however, fail to acknowledge the limits that do exist.	Simon

2.4 Changing Patterns of Resource Use

<ul style="list-style-type: none"> - Analysis outlines the major resource groups that human use, considers the geographical variations that exist in their relative levels of extraction and utilization, and outlines some of the environmental consequences associates with the exploitation of key resources <p>Mineral Fuels</p> <ul style="list-style-type: none"> - Pronounced increases during the Anthropocene - Mineral fuels include: coal, peat, dry natural gas, liquid natural gas, petroleum and uranium. - Provide energy which the Anthropocene is based. - These mineral fuels are non-renewable - Affluent nations of the OECD (Organization for Economic Co-operation and Development), such as the UK, USA and Germany, have been the dominant consumers of global energy - The OECD share of global energy use is decreasing due to the rapidly expanding economies such as China and India
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- The geography of mineral energy extraction and use is complicated by the location of oil reserves. Given the concentration of oil reserves in the Middle East, it is no surprise that the region is very significant in terms of geopolitics

Metal and non-metallic minerals

- Metal and non-metallic minerals are used to build things that we use and consume.
- Non-metallic minerals e.g. potash, phosphate, nitrogen in ammonia, salt and sulphur
- Society requires 100million tones of these minerals on an annual basis.
- Key metallic resources have shown aggregate increases in their levels of extraction since 1980's
- The physical properties of metals mean that they can be used in a wide range of contexts
- Open cast or strip mining can destroy landscapes and the ecological systems that have developed upon them.
- The removal of minerals from the ground may release pollutants into the environment
- Pollution from mining can affect the watercourses during rain/ flooding.
- **Examples of products which have caused an increase in the consumption of mineral resources:**
 - o Hydraulic cement used for buildings
 - o Iron ore used in construction and infrastructure projects
 - o Metals with high levels of conductivity (such as copper) are used in the production of electrical products
 - o The metal nickel is used in the production of stainless steel, rechargeable batteries, coins and even electric guitar strings
 - o Gold necklaces
 - o Mobile phones
 - o iPads

Water

- Air & water are the most important resources for day-to-day living
- Global average water use is 150L per person per day
- Major increases in rates of water use are because of increased food production, increased use of water to hydrate (lawns/ construction etc.)
- Water is renewable, constantly reused and recycled
- Excessive use is causing water shortages & climate change is affecting water supply

CASE STUDY 2 – unconventional oil and gas extraction in SA

- Unconventional oil and gas extraction – known as hydraulic fracturing (fracking)
- Water/ other fluids (under pressure) are injected into the gas and oil reserves beneath the earth's surface extracting the minerals
- By 2030, at least 29,000 MW of additional electricity will be required to cater to South Africa's growing energy needs; and with 10,900 MW of capacity due to be retired by then, new builds of more than 40,000 MW will be required.
- UOG – unconventional oil and gas
- The government has decided to proceed with the exploration and extraction of UOG.
- CARBON EMISSIONS – SA 12th largest producer in the world because of our energy sector being carbon-based.
- UOG are transitional fuels which can contribute to less carbon emissions therefore less greenhouse gases
- SA is also water stressed country – receives average of 497mm rain per year compared to global average of 860mm
- UOG & it's impacts are controversial
- There is an inextricable link between water availability and the energy resource development.
- UOG extraction and its related activities (vegetation clearing for well pad construction, access roads, and pipelines) may furthermore have direct impacts on vegetation, with an associated loss of biodiversity
- The scale of the impacts of UOG extraction spans both spatial and temporal dimensions and is cumulative. On a spatial scale, UOG extraction does not occur only within specific geographic boundaries, as is the case for localized mining operations, but includes an array of gas well sites that may cover vast geographic expanses.

2.5 Doomsters, Cornucopias and Everything in Between

- Many of the theories/ worldview perspectives contradict each other, collectively they help us to understand the nature and likely consequences of the resource demands that we place on the planet

PARSON MALTHUS AND THE NEO_MALTHUSIANS

- 1798 English parson, Thomas Robert Malthus
- Described a key difference in the nature of population growth and the development of new resources

- While levels of resource discovery and availability tend to increase gradually, population tended to grow at much more rapid rates.
- Exponential population growth leads to an increasing demand on key resources
- **Malthus was concerned that our ability to produce these resources could not match the demand.**
- Checks would be placed on population growth:
 - o Positive: involve people proactively addressing the problems of excessive population growth through birth control and reducing the size of their families
 - o Negative: increase in the rate of deaths
- Excessive population growth would ultimately lead to food shortages, hunger, increases in human conflict and warfare
- Criticism:
 - o Prediction have not come true
 - o Failure to account for technology
- **Neo-Malthusian:** believe that despite the proven ability of technological developments to provide resources to an expanding population, there are still real limits on the biosphere's ability to supply resources and absorb pollution
- Some Neo-Malthusians believe that a Malthusian future may already be upon us due to seeing negative checks in the world around us e.g. Robert Kaplan – hunger and conflicts over scarce resources in West Africa
- Neo-Malthusian researchers in Massachusetts, US (often referred to as the Club of Rome), published their views – that economic development would be severely restricted if levels of population growth and resource use continued to expand - in the Limits to Growth report.
- Olphus claims 2 possible futures
 - o Will see increasing conflict and associated anarchy as people scavenge for available resources
 - o Will see the emergence of an increasingly authoritarian society which will restrict the usage and economic freedoms of individuals.

CORNUCOPIANS AND THE CHICAGO BOYS

- Cornucopians DO NOT believe that humanity is heading towards environmental resource tragedy
- 2 key features:
 - A belief that increases in population lead to the discovery and development of more resources
 - Derived from **Esther Boserup's** work – aka *Boserupian*
 - A Danish economist
 - Work was seen as the biggest challenge to Malthusian understanding
 - Boserup argued that food supply was determined by population growth (Malthusian other way round)
 - Increases in population create incentive for societies to develop new practises and technologies which could produce more food output
 - The presence of more people, increases the likelihood that new ways will be discovered to increase food production
 - **“necessity is the mother of invention”**
 - Operations of the free market ca help humanity avoid serious resource shortages
 - **Neoliberalism** WWII, University of Chicago
 - Tend to emphasize the broader creative opportunities that are generated within free markets
 - Closely assoc. to work of the Chicago boys (Hayek/ Friedman & colleagues)
 - Emphasized the great benefits that can be gained by organizing societies around free markets
 - Claim that markets provide economic incentive for people to innovate
 - Recognize that through the changing prices of commodities, markets provide an efficient way of showing the greatest demand and where to invest
 - Julian Simon – neoliberal

HUBBERT'S CURVE AND THE PEAKISTS

- Theories can be traced back to the 1950's
- Hubbert predicted that oil production in the US would reach a peak during the early 1970s.
- He also predicted that the global production of oil would reach a peak around 1995, after which point the supply of oil would enter a terminal pattern of long-term decline.
- While Hubbert's prediction about the US peak oil production was accurate, his global prediction was less reliable.
- Many “peakists” have argued that Hubbert's curve could be applied to a range of other resources.

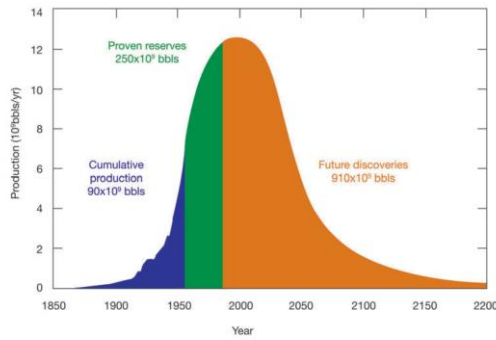


Figure 2.10 Peak oil production predictions

- Some see the curve as another interpretation of Malthusian thinking
- Doesn't represent a prediction of when we will run out, rather when supply will reach a maximum

MARXISM AND THE QUESTION OF RESOURCE DISTRIBUTION

- Work of Karl Marx – 19th C
- Marxism is concerned with the systems of ownership associated with a resource, who benefits from its exploitation, labour relations with extraction and systems of distribution.
- Critical of Malthusian and Cornucopians perspectives on resource use and availability
- Marxists claim that Malthusian concerns with resource shortages fail to recognise that there are often enough resources.
- From a Marxist perspective, resource scarcity occurs since wealthy owners of a given resource tend to overexploit them for their own gain – by selling harvests to overseas markets, or placing oil revenues in overseas bank accounts.
- Marxists are also critical of the cornucopian claim that the free market provides the basis for enhancing resource production, since they argue that it is the free market systems that are causing social and environmental problems.
- Le Billon's work illustrates that there is no simple connection between resources and conflict. Resource scarcity is not the only driver of conflict – the desire for power and wealth are strong motivators
- The type of conflict that emerges around resources is caused by the economic and political situation of a geographical region.

2.6

Water Resources in the Nile Basin

- Population growth along the Nile Basin have placed strain on the ability of the river system to deliver adequate supplies of water.
- 1950 approximately 60.5 million, 1998 X3 = 206.6 million people.
- As upstream states (Ethiopia, Sudan and South Sudan) build more dams and irrigation schemes on the Nile, downstream state Egypt is becoming concerned about its own ability to extract more water from the Nile.
- Water withdrawals governed by the 1959 Nile Waters Agreement.
 - o Limits the amount of water each state can withdraw from the river system in a year:
 - o Sudan may withdraw 18.5 billion cubic metres - would like to withdraw more
 - o And Egypt 55.5 billion cubic metres annually. – trying to prevent using force
- In 1999, the Nile Basin Initiative (NBI) was established to compile the Cooperative Framework Agreement (CFA) which involves countries along the Nile River Basin.
 - o According to the NBI (2017) "...rather than quantifying 'equitable rights' or water use allocations, the Treaty intends to establish a framework to 'promote integrated management, sustainable development, and harmonious utilization of the water resources of the Basin, as well as their conservation and protection for the benefit of present and future generations'".
 - o By 2017, only the upstream states of Ethiopia, Rwanda, Tanzania, Uganda, Kenya and Burundi had signed the agreement.
 - o These countries would like to extract water for agricultural purposes and hydroelectricity since they were prevented from extraction in the past by Egypt.
 - o Egypt has been refusing to sign the agreement which will reduce the amount of water it is allowed to extract from the Nile (Aman 2017; Mulisa 2017).
- The example of the Nile Basin appears to lend itself to a Malthusian interpretation:
 - o As population growth outstrips the supply of resources such as food and water, society will be subjected to severe limits to its development and conflicts over scarce resources.
 - o The fact that population has continued to grow so rapidly in the Nile Basin suggests that there might be merit in the cornucopian perspective.
 - o In this context, it could be argued that population growth and the pressure to withdraw more water from the Nile River system have led to the development of technological solutions, including the

	<p>construction of dams and innovative irrigation schemes that have enabled continued economic growth in the region.</p> <ul style="list-style-type: none"> ○ Marxists point out that when there are droughts in the Nile Basin, it is the poor and not the wealthy that experience water scarcity. ○ In addition, a Marxist perspective would question whether the building of dams and new irrigation systems in the Nile Basin is really solving water scarcity issues or securing water for the most powerful states (such as Egypt). <p>- The water scarcity issues in the Nile Basin reflect two key features of the Anthropocene:</p> <ul style="list-style-type: none"> ○ Problems associated with the accelerated extraction of resources from the natural environment; ○ And where humans are trying to exert technological control over the natural world through the building of dams and irrigation systems.
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Learning Theme 3 – Air pollution and Climate Change

3.1	Introduction
	<ul style="list-style-type: none"> - The atmosphere is the most transitory sphere – in a constant state of flux, a complex mix of gases and water vapour - Air pollution has many impacts - Main impact: climate change <ul style="list-style-type: none"> ○ Climate change is defined as “any natural or induced change in climate, either globally or in a particular area. Examples include the natural climate change that has caused ice ages in the past, and global warming that many believe is now being caused by rising concentrations of greenhouse gases in the atmosphere”
3.3	Thomas Midgley and the Ultraviolet Century
	<ul style="list-style-type: none"> - Certain nations have disproportionately contributed too many of the env. Challenges we face today. Individual actions can affect significant forms of ecological change appears farfetched. - Thomas Midgley had more impact on the atmosphere than any other single organism in earth’s history <ul style="list-style-type: none"> ○ First contributor: 1921, adding lead to petrol ○ While the addition of lead to petrol was beneficial for the operation of vehicles, it resulted in a spike in the levels of lead in the atmosphere. Lead, which is toxic, then entered human bloodstreams and ecological systems ○ Second: Improved the safety of fridges and cooling devices using chemical compounds of Freon – chlorofluorocarbons (CFC’s) ○ However, CFC production led to a decrease in the planet’s ozone layer. Ozone depletion has been linked to higher levels of skin cancer, plant damage and dwindling plankton populations in the oceans. - Cumulative forms of pollution are forms of pollution that gradually accumulate in the environment over long periods of time, for example the air pollution associated with leaded petrol. - Systemic forms of pollution refer to the ways in which certain pollutants can actually change the ways in which large-scale ecological systems (such as the ozone layer) operate. - In the Anthropocene, science and scientists are not only involved in generating atmospheric problems, but also in helping to identify and address them.
3.4	Air Pollution: From Mauna Loa to Mumbai
	<ul style="list-style-type: none"> - The greenhouse effect is a naturally occurring process that is responsible for regulating the Earth’s temperature. - Greenhouse gases operate like a blanket that keeps the planet warm and suitable for life. - Without greenhouse gases Earth’s average temperature would dip to -18 °Celsius - .Examples of greenhouse gases are the following: <ul style="list-style-type: none"> ○ Carbon dioxide (CO (CO₂)) ○ Methane (CH₄) ○ Water vapour (H₂O) ○ Ozone in the troposphere (O₃) ○ Nitrous oxide (NO_x) ○ Aerosols (dust & smoke) ○ Sulphur hexafluoride (SF₆) (Cook) <p>The Keeling Curve and the history of CO₂</p> <ul style="list-style-type: none"> - Charles David Keeling, an American geochemist, his scientific work contributes to our knowledge of the collective impact on the global atmosphere – took an interest in CO₂

	<ul style="list-style-type: none"> ○ Before his work, people held belief that greenhouse gases regulated the global temperature and there was nothing humans could do to decrease its impact. ○ Keeling developed the first reliable instrument to measure atmospheric carbonations ○ Keeling moved his scientific base to Mauna Loa (Hawaii) -3000m above sea level for its thin air ○ Keeling discovered & recorded the increase in CO₂ Levels (310 parts per million – 400 parts per million) ○ Keeling curve <ul style="list-style-type: none"> ▪ Shows increasing levels of carbon dioxide over time ▪ With smaller seasonal fluctuations ▪ 1. Shows that not all the additional CO₂ in the atmosphere was reabsorbed into the earth’s biosphere or hydrosphere ▪ 2. Rising global temperatures are connected to the rising levels of Carbon Dioxide (1.5deg over last 250 years) - Svante Arrhenius (Swedish chemist) <ul style="list-style-type: none"> ○ Discovered the greenhouse effect - Contributors to the increased combustion of coal & hydrogen chloride emissions: (17th C, London) <ul style="list-style-type: none"> ○ Population growth ○ The expansion of railways, textile. Steel and alkali production industries - The combustion of coal and petroleum releases sulphur dioxide (SO₂) and nitrous oxides (NO_x) into the air. - These gases react with water molecules to produce sulphuric or nitric acid. - Once produced, this acid can be transported over long distances before being deposited on ecosystems – known as acid deposition or acid precipitation. Park and Allaby (2017) explain that “acid precipitation can occur as dry deposition and as wet deposition in the form of rain, drizzle, snow, or mist. - Acid precipitation has a pH of less than 5.6, and the deposition of acidic material on the ground causes acidification of soils, water bodies, and vegetation”. - Acid rain can: <ul style="list-style-type: none"> ○ lead to biodiversity loss ○ inhibit the hatching of fish eggs ○ weaken trees by attacking their leaves and inhibiting their ability to absorb nutrients ○ deplete the soil of nutrients ○ damage tree roots ○ lead to impaired photosynthesis (Park and Allaby 2017) - Photochemical smogs are a product of sunlight reacting with NO_x and volatile organic compounds (VOCs), which are emitted from vehicular exhausts, producing ground-level ozone and airborne particles. - Photochemical smog may affect human health by increasing incidents of asthma, acute respiratory infections, cardiopulmonary disease and cancers of the lungs and trachea. - Unlike industrial cities where the cold air of winter associated with high-pressure weather systems trap air pollution, Los Angeles’s fog is a phenomenon of the late summer. - Inversion layer: <ul style="list-style-type: none"> ○ Los Angeles’s location plays a crucial role in the development of photochemical smog in the city ○ Its coastal location often means that onshore breezes return the city’s air pollution to the metropolis as part of a cooler air mass. ○ The cooler air mass pushes the warmer air it encounters in the city upwards. This process results in what meteorologists term an inversion layer. ○ This inversion layer acts like a blanket trapping air pollution at low altitudes. ○ Given that Los Angeles is surrounded by mountains, inversion layers can become very difficult to break when they settle over the urban region. ○ These relatively stable atmospheric conditions provide time for the sunlight to stimulate chemical reactions at low altitudes within the city and the production of photochemical smogs.
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3.5	<p>Reflections on the Nature of Atmospheric Science</p> <ul style="list-style-type: none"> - Modern science has two key characteristics – a commitment to objectivity, and a quest for a universal basis for the study of nature. - Taken together, the objectivity and universality of modern science are important because they enable the production of more reliable and trustworthy accounts of the real world. - A crucial factor within the production of scientific knowledge is the notion of scientific consensus. - Scientific research progresses through the development of consensus, in and through which particular ways of understanding the world become accepted wisdom, whereas other theories are rejected. - A paradigm is a scientific model that explains how a certain process works.
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	<ul style="list-style-type: none"> - Paradigm shifts occur when two incompatible theories of scientific knowledge contest each other to be the accepted way of explaining how the world works. E.g. when theories of a flat Earth were rejected. - - The objectivity of smoke inspectors in London was compromised due to limited visibility, local terrain issues and interference by factory owners. - In addition, the decision to locate the majority of the UK's sulphur dioxide monitoring stations in urban areas led to gaps in scientific knowledge concerning the extent of acid deposition in rural areas. - Recent trends in the scientific knowledge of the atmosphere indicate how scientific knowledge can be deliberately manipulated. - While an estimated 97% of scientists have reached the consensus that the human enhancement of the greenhouse gas effect is responsible for current climate changes, a range of institutions and individuals are trying to cast doubt on the scientific consensus on climate change (Cook 2017). - Lewandowsky et al. (2015: 1) argue that "opponents of the scientific consensus on climate change...have often emphasized scientific uncertainty in order to forestall mitigative action. Those arguments often exaggerate, for political or ideological reasons, the actual degree of uncertainty in the scientific community or imply that uncertainty justifies inaction". - It has been established that the opponents of the scientific consensus on climate change have received funding from ExxonMobil, the world's largest oil corporation. - In 2001 Danish academic Bjørn Lomborg published a book <i>The Skeptical Environmentalist</i> wherein he cast doubt on various scientific predictions that climate change would lead to serious socio-ecological problems in the future. - The Danish Committees on Scientific Dishonesty felt that the dishonesty in the book was a product of Lomborg's lack of scientific expertise the field of climate change.
3.6	Climate Change in Africa
	<p>Case Study 3.1- Climate change in Africa</p> <ul style="list-style-type: none"> - Africa is warming duster than the global average, with projections of a rise of 3-4deg C this Century. - Climate Change = a considerable health and economic challenge for the continent - Climate-sensitive diseases e.g. cholera/ meningitis/ malaria/ rift-valley fever are likely to spread faster. - The warming is likely to reduce crop yields and livestock productivity, and cause water scarcity. - Extreme weather and climate events e.g. droughts/ floods are expected to be more frequent with negative impacts on human life and health. - Climate change will also lead to wildlife migration due to habitat loss. - Sea level is expected to rise by 2100, approx. 10% higher than the global mean - These situations can be exacerbated by the increase in population growth and urbanisation along coastal regions of Africa.
3.7	Adaption to Climate Change
	<p>Case Study 3.2 – climate resistance in Rwanda</p> <ul style="list-style-type: none"> - Most vulnerable countries in the world: Burundi/ DRC/ Rwanda/ Ethiopia - RWANDA <ul style="list-style-type: none"> o Mountainous country in Great Lake region – known as the land of 1000 hills, terrain is characterised by steep slopes and green hills o Predominantly rural population relies on substance agriculture for livelihoods o About 45% of the land in Rwanda is arable, 22%forested, 18% pastureland o Significant economic growth averaging 7.1% in recent years, driven by high agriculture o Rwanda has a commitment to a strong green economy o Rwanda's national climate and environment fund – known as FONERWA is ground breaking and envisaged to become the engine for the country's growth in the next 50 years o Mitigation strategies: <ul style="list-style-type: none"> ▪ Attempts to stabilise and reduce the human production of greenhouse gases ▪ May include the establishment of carbon taxes, international climate change agreements, carbon markets and trading schemes, carbon offsetting programmes ▪ Development of low carbon technologies o Adaption involves & includes : <ul style="list-style-type: none"> ▪ Individuals/ communities/ states working to try and ensure that people are able to cope with the effects of climate change ▪ flood protection ▪ changes in agricultural production techniques ▪ freshwater conservation

	<ul style="list-style-type: none"> ▪ the construction of sea defences ▪ responses to extreme weather events ▪ treatment of climate sensitive health issues (e.g. cholera/ malaria/ meningitis/ rift valley fever) <ul style="list-style-type: none"> - although various international efforts to address climate change have been adopted, the Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) is widely regarded as the most important instrument in adapting to climate change - The Paris Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2deg C, above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5deg C.
3.8	<u>Fugitive Emissions and Louisiana's Cancer Alley</u>
	<ul style="list-style-type: none"> - Scientists have struggled to assess and monitor the air pollution in Diamond, Louisiana. - The large scale of air pollution in the region means that it is impossible for scientists and regulators to monitor all air pollution events. - The work of scientists is also hindered by the activities of corporations who use the cover of mist, fog and darkness to hide their air polluting activities. - While corporations are expected to keep their own inventories of toxic air pollution releases, the leaks and associated forms of fugitive air pollution tend to go unrecorded and unmonitored. - Estimates suggest that in Diamond some 80 million pounds of VOC emissions go unreported due to leaks every year.

Learning Theme 4 – Soil Degradation

4.1	<u>Introduction</u>
	<ul style="list-style-type: none"> - Soil is “the naturally occurring, unconsolidated, upper layer of the ground, made of humus and weathered rock. - Major factors affecting soil formation are; <ul style="list-style-type: none"> o Climate o Relief o Parent material o Vegetation o Time - Purposes of soil: <ul style="list-style-type: none"> o Soil is the medium on which we produce 99% of our food, o a major store of carbon – holds 2-3 times more carbon than the atmosphere o Regulator of climate o Regulator & purifier of water sources - - Population growth and agricultural activities have had a significant impact on soil resources
4.3	<u>Getting Under the Planet's Skin</u>
	<ul style="list-style-type: none"> - The flat relief and fertile soils of the Great Plains of North America (also known as Prairie in Canada) are very beneficial to a range of agricultural activities. - During the 1930s a vast dust bowl developed in the southern section of the plains. - In the pursuit of the great profits that could be made from wheat cultivation, farmers engaged in ploughing up vast swathes of the natural grasslands found in the Prairies. - The so-called “Great Plow Up” left the soils of the southern Great Plains exposed to soil erosion. - Soil erosion made it very difficult to produce agricultural crops, leading to poverty and famine. - Big dust storms started blocking out sunlight and resulted in the migration of people away from the plains.
4.4	<u>Soil and Environmental Transformations</u>
	<ul style="list-style-type: none"> - During the Neolithic Revolution humans gradually moved away from a nomadic society that was based on hunting and gathering food and resources to an agricultural type of society. - Agricultural techniques enabled humans to settle in specific regions. - This resulted in population growth and an increased demand for food and thereby an increased demand for soil. - The increasing demand for soil led to deforestation and the application of inorganic fertilizers after the Industrial Revolution. - Between the 1950s and early years of the 2000s, it is claimed that inorganic fertilizer use rose 20-fold, with approximately 100 billion kilograms of nitrogen fertilizers being added to soils every year. - The use of inorganic fertilizers has been associated with the rapid increase of crop yields and global food supply. The Haber- Bosch process enabled the production of ammonia from hydrogen and nitrogen. - Various compounds of ammonia could then be added to soils in order to improve their fertility.

	<ul style="list-style-type: none"> - Soil degradation involves a loss of organic matter, nutrients and water from land, can be from: <ul style="list-style-type: none"> o mostly due to overgrazing of pastures o over cultivation o forest clearances o bad agricultural management - Soil degradation leads to <ul style="list-style-type: none"> o biodiversity loss, o climate change o And the onset of human poverty. - Soil pollution occurs through the addition of toxic chemicals (such as lead, mercury and cyanide) or organic pesticides (such as DDT) to soil. - Rachel Carson documented how dichlorodiphenyltrichloroethane (DDT) was rapidly absorbed through soils into plants and animals. - Carson’s work would ultimately lead to tighter regulations on the use of pesticides throughout the world.
4.5	Interpreting the Transformation of Soil: A Political Ecology Perspective
	<ul style="list-style-type: none"> - Before the emergence of political ecology, soil erosion was predominantly understood in three broad ways. <ol style="list-style-type: none"> 1. Soil erosion was interpreted as a natural phenomenon that – even when exacerbated by human activity – was largely driven by physical processes (drought and exposure to winds). 2. From a Malthusian perspective, soil erosion was associated with the pressures of overpopulation that forced farmers and landholders to overwork their land in order to feed the growing population. 3. Soil erosion was seen as the product of bad decision-making on the part of farmers and landholders. - Thus, soil degradation was interpreted as the outcome of farmers either being unaware of sustainable agricultural practices or deliberately overexploiting soil in the pursuit of profit. - The political ecology perspective developed by Blaikie and his colleagues challenged each of the established understandings of soil degradation. - Blaikie recognised that drought conditions did not always result in soil erosion. - In societies that are more affluent, droughts are routinely endured without significant forms of soil erosion. - In terms of Malthusian arguments, political ecologists claimed that advances in agriculture had over time enabled farmers to produce more food from the land without the degradation of soil. - In addition, Blaikie’s work in Nepal and Africa exposed a strong link between poverty and land degradation. - It appeared that the poorest farmers often only had access to the lowest quality soils.
4.6	Soil Degradation and restoration in China
	<ul style="list-style-type: none"> - Soil erosion is now affecting 17 per cent of China’s total land cover. - The eroded 4.5 billion tons of additional soil sediments are clogging up the country’s 80 000 reservoirs, reducing water storage capacity and increasing the threat of water scarcity. - China’s expanding economy and population growth have placed pressure on the country’s agricultural sector. - These pressures have contributed to the overuse and mismanagement of soil resources. In addition, a significant part of China consists of sloping land. - On sloping land, gravity accelerates soil erosion rates. - The greater the angle of slope of land, the more severe soil erosion processes are. China’s state-run farms were formed from the properties of wealthy landowners following the communist revolution in China. - These farmers were tasked with increasing food production. Outside the state farm system, peasant farmers worked within communal farms. - These communal farms were designed to help peasant farmers escape poverty and the yoke of unjust landowners. - However, many of these communal farms are located on marginal, sloping land. - Moreover, the Chinese government also sanctioned large-scale deforestation to increase timber exports. - This enabled the freeing up of more land for agricultural food production. - Deforestation increased the exposure of vulnerable soils to erosion and nutrient loss. - The Loess Plateau is located in northwest China and is characterised by large deposits of fine-grained wind-blown soil (loess). Over time, sloped land, fine-grained soil and unsustainable agricultural practices generated a desert-like landscape that was unable to support the 50 million people who lived on the Plateau. - During the 1990s, the first Loess Plateau Project saw \$252 million invested in the region. - The Loess Plateau Project has transformed the landscape of the Plateau into a complex network of terraces. - These terraces slow the rates at which soil and nutrients are removed from the land, increase agricultural outputs, and facilitate the regeneration of the landscape when trees, grass and shrubs are planted.

Case Study 4.1 - Soil degradation in Africa

- About 500 000 square kilometres of land in Africa is estimated to be degraded due to soil erosion, salinization, pollution and desertification
- "Deforestation, forest fires, over-cultivation, inefficient irrigation practices, overgrazing, overexploitation of resources and uncontrolled mining activities, as well as climate change and variability are blamed for the degradation.
- The impacts of land degradation include
 - o reduced agricultural productivity,
 - o With concomitant effects on food availability, nutrition and human health.
 - o Fuelling social, economic and political tensions that can lead to migration
- Between 1960 and 1980, almost 10 million people in the sub-Sahara African region had to move because of drought.
- Land degradation and desertification contribute to human mobility, and to worsening living conditions for both those who leave and those who remain.
- Cultivation in much of Africa encroaches on environmentally fragile areas such as steep slopes, riverbanks, shallow soils and wetlands, often without appropriate conservation measures in place, leading to increased soil erosion.
- Due to small landholdings, farmers are forced to use their land continuously with no rotation, resulting in declining crop yields and the loosening and washing away of soil exposed to natural forces such as wind and water.
- The offsite impacts of soil erosion include sedimentation of water bodies and loss of breeding grounds for fish, and destruction of infrastructure such as roads and bridges, among others.
- Land degradation in drylands can result in desertification.
- The desert lands of the Sahara, Namib and Kalahari, as well as the drylands of northern Kenya, southern Ethiopia and most of Somalia, cover around 40 per cent of the land surface of Africa.
- Coupled with climate change, increasing numbers of cattle and other livestock accelerate desertification.
- In some parts of Africa, such as in Botswana and Namibia, there has been an ongoing trend in livestock numbers exceeding the carrying capacity of the land

Case Study 4.2 – Soil restoration in Africa

- Historically the mountainous areas of East Africa has had a general marginalization of traditional natural resource management systems, evolving from human-environment interactions, knowledge and experience.
- These important traditional approaches and practices were abandoned in favour of modern approaches, instead of integrating the two to provide more appropriate and sustainable management systems.
- E.g. Kigezi, Mount Rwenzori and Elgon regions in Uganda and on the slopes of Mount Kilimanjaro in Tanzania where traditional agroforestry systems – the traditional blend of crops and trees of different species – have been used throughout the different ecological areas.
- The national forest policies in East Africa have been revised to incorporate the promotion of agroforestry practices and to integrate them with modern approaches as a strategy to protect existing natural reserves and improve livelihoods.
- The kihamba agroforestry system, practised on 120,000 hectares on the southern slopes of Mount Kilimanjaro in Tanzania, is an example of best practice.
 - o It is considered to be one of the most sustainable forms of upland farming and provides livelihoods for an estimated one million people.
 - o The kihamba agroforestry system maximizes the use of limited land.
 - o Based on a multi-layered vegetation structure similar to that of a tropical mountain forest, the system provides a large variety of food and substantial environmental services beyond the area where it is practised.
 - o With the large quantities of biomass it produces and its capacity to recycle organic matter on farms, the kihamba system also contributes significantly to carbon sequestration.
- Mountain farming communities have evolved over centuries and have practised a range of soil conservation technologies to safeguard their soil resources.
- These have improved over time, especially through the integration of modern technologies and government extension services.

- This wealth of knowledge and experience will play a key role in enabling communities to be resilient and to adapt to the impacts of climate change in this naturally fragile environment.
 - o Examples of soil conservation technologies include **Konso terracing** practised in Ethiopia; fanya juu terracing in Machakos, Kenya; and contour terracing in Tigray in the Ethiopian Highlands and the Kigezi region in south-western Uganda.
 - o In the **Kigezi region**, for example, farmers have hundreds of years of experience of bunding and terracing systems which enable them to cultivate steep slopes and utilize marginal land without substantially degrading it.
 - o Today, the whole highland region is patterned by a myriad of impressive contour bunds and raised terraces, a practice that has protected the area against soil erosion”.

- “Bench terracing is a well-known soil conservation practice and is one of the oldest practises in Africa.
- It is practised throughout the Ethiopia highlands.
- Experience shows that bench terracing provides a multipurpose structure for enhancing agriculture on steep slopes by controlling soil and water loss.
- It also creates new cultivable land suitable for irrigation by diversion of perennial rivers, spate irrigation and earthen dam farming (Hagos, 2014).

- Bunding and terracing, common in most other mountainous communities, have been adapted and modelled for different local conditions.
- Examples include the fanya juu terracing system used in the Kenya Highlands, which is now being up-scaled in other areas such as Mount Elgon.
- These practices offer a viable option for conserving mountain soil resources and developing community resilience and adaptation to climate change.

- Mountainous areas the world over are under heavy population pressure, both from upland and lowland communities.
- This has resulted in the widespread clearance of vegetation cover and subsequent land degradation.
- The African highlands are an example of areas of large-scale deforestation, although efforts have been made to restore the forest cover on many mountain slopes.
- The desire to restore on-site productivity for the benefit of local communities and the recognition that restored forests provide downstream benefits – improved stream flow and reduced sedimentation – have resulted in some semblance of forest restoration.
- In areas such as the **Kigezi** region of Uganda, reforestation has been widely adopted as a means of providing a source of income from the sale of forest products.
- This has largely been driven by local communities, with little government intervention, which makes the practice more sustainable.
- Phase II of the WWF Rwenzori Mountains Conservation and Environmental Management Project (2010-2012) provides an example of best practice for the restoration of degraded landscapes.
 - o The impacts of the project included capacity building for integrated ecosystem management, community restoration of degraded ecosystems, and improved and sustainable livelihoods for mountain communities.
 - o Furthermore, the role that the millions of individuals and households play in landscape restoration – planting tree seedlings on their degraded and marginal lands – should not be underestimated.
- These initiatives often escape attention, as opposed to the large-scale initiatives by governments and other institutions.
- The benefits to local communities derived from restoration are undeniable: an increase in the availability of forest products and improved on-site productivity, as well as improvements in general ecosystem productivity and services.

- In many areas, communities have abandoned their land due to severe degradation, but after many years these lands have been able to recover.
- Consequently, many communities are beginning to adopt initiatives to restore degraded land. It is important for the government and other institutions to identify and collaborate with such communities to achieve a faster rate of a landscape recovery and restoration, especially in mountainous areas.
 - o The **Humbo community** in south-western Ethiopia, for example, obtains restored degraded grazing areas and farmlands by setting aside land for natural regeneration.
 - o The community is part of the Natural Regeneration Project, registered with the Clean Development Mechanism, which supports forest regeneration by using a variety of tree species through the Farmer-Managed Natural Forest Regeneration technique.

	<ul style="list-style-type: none"> ○ As a result, more than 90 per cent of the area devoted to the Humbo community has been reforested. The initiative has resulted in the recovery of 2,728 ha of land” (EAC et al. 2016: 68-71).
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Learning Theme 5 – Biodiversity Loss

5.3	Transforming Forests: Reflections on the Long Anthropocene
	<ul style="list-style-type: none"> - The human clearance of forests may represent an important historical marker in the history of the Anthropocene. - According to Ruddiman’s long Anthropocene hypothesis, the reason that the current inter-glacial period has seen a long-term trend in rising levels of greenhouse gases can only be attributed to the rise of agricultural society. - The large-scale forest clearances associated with the emergence of agriculture have resulted in a significant reduction in the Earth’s natural capacity to absorb and store carbon dioxide. - In addition to this, Ruddiman connects the emergence of rice cultivation some 5 000 years ago with rapid increases in global levels of methane. - The current rate of deforestation, especially in the tropical rainforest biome, is accelerating. - Key drivers of deforestation are <ul style="list-style-type: none"> ○ logging, ○ high demand for timber supplies, ○ agricultural practices such as ranching ○ And palm oil plantations. - Tropical rainforests absorb over 1 billion tons of carbon from the atmosphere on an annual basis. - Deforestation contributes to the release of around one fifth of humanly produced carbon dioxide, thereby disturbing the local, regional and global climate. - The monitoring of the trade patterns of medium-density fibreboard (MDF) in the UK and China has revealed that a growing consumer market for wood products (mostly for household furniture and shelving) is associated with an increase in deforestation rates.
5.4	Globalising the Forest and Multinational Forest Corporations
	<ul style="list-style-type: none"> - Globalisation is associated with increasing levels of integration and connection between economic activities throughout the world. - Globalisation can be seen to increase the field of competition of those making and supplying goods and services - Moreover, globalisation expands the market place within which successful entrepreneurs can sell their products and services. - Globalisation streamlines the flow of investments to successful economic enterprises in diverse geographical locations making it easier for enterprises to grow. - Joseph Stiglitz - potential for globalisation to enhance the lives of people throughout the world, the present form is detrimental to freedoms and lifestyles of many throughout the world. - Multinational corporations (MNCs) come in a range of forms and sizes, but they have one thing in common. - What connects MNCs is their ability to organise their economic activity at an international scale, and to be able to move these activities between a ranges of different countries. - While MNCs are diverse, their significance as agents within the Anthropocene should not be underestimated. - Of the one hundred most wealthy global organisations (including nation states), 66 are now corporations. In environmental terms, critics of MNCs argue that the geographical freedoms of MNCs have made it easy for them to exploit locations where environmental standards are lower and expensive anti-pollution measures and waste treatment can be avoided. - Globalisation has now made it much easier for large timber and paper MNCs to exploit the rich timber resources within the tropics. - While some 80% of global forests are publically owned, many less economically developed countries are keen to grant logging permits to MNCs as a basis for securing investment and employment opportunities within their countries. - The impact of globalisation on forest resources stretches beyond the actions of the international timber industry. - In many parts of the world the clearance of tropical woodlands has been driven by agricultural interests who are keen to exploit the agricultural lands that are found beneath the canopies of rainforests. - As with multi-national timber operations, these agricultural practices are often coordinated by global food corporations who are eager to exploit tropical climates in order to produce high profit-yielding commodities such as beef and bananas.

	<ul style="list-style-type: none"> - The extent of current illegal logging activities is clearly the product of the great profits that can be made within the global timber markets. - The processes of globalisation also make it much easier to traffic illegal timber throughout the world. - As illegal timber is transported throughout the world its association with illegal points of origin can be easily obscured. - The Chainsaw Project is a partnership between INTERPOL and the World Bank that was initiated in 2007. <ul style="list-style-type: none"> o The idea behind the project was to connect environmentally-oriented research on the long-term ecological impacts of illegal logging to discussions of international criminal justice. o INTERPOL now estimates that a forested area equivalent to the size of Austria is lost to illegal logging every year. o This means that the amount of illegally produced timber represents somewhere between 20 and 50% of the total global timber market.
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5.5	Jungle Capitalism: The Case of the United Fruit Company
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	<ul style="list-style-type: none"> - The United Fruit Company (UFC) was officially established on the 30th of March 1899. - Already owned land in Costa Rica, Panama, Columbia, Cuba, Jamaica and the Dominican Republic, approx. 50 000 acres. - UFC – dominant player in international fruit trade, total monopoly on production and transportation of banana’s - UFC expanded its corporate interests and started to buy up radio-broadcasting companies, postal services and established sugar and palm oil plantations. - Mid-twentieth century, UFC was one of the largest employers in the whole of Central America and acquired significant political influence in all the countries within which it operated. - The term “banana republic” was coined to describe a weak and possibly corrupt state that becomes the servant of corporate interests (MNCs). - This term was coined to describe the impacts that the operations of corporations like UFC were having in places like Central America. - Following the Guatemalan election of President Jacobo Árbenz in 1951, the UFC became concerned about the incoming president’s proposed land reforms. - Guatemala’s banana plantations accounted for a quarter of all of UFC landholdings in South America. - UFC consequently utilised its connections with the US Central Intelligence Agency (CIA) in order to orchestrate a coup d’état in Guatemala. - In 1954 Árbenz was ousted from power and his government replaced with a military junta that was much more sympathetic to the needs of UFC. - UFC was able to use its unchallenged power to acquire large parts of Central America’s rainforests. - These forests were either cleared to make way for large banana or sugar plantations, or simply left unused. - UFC would often take ownership of large tracts of land, which it had no intention of using in order to prevent its competitors from acquiring productive land. - This meant that communities who had previously relied on forests to secure precious food and resources had to move elsewhere. - In the UFC plantations emphasis was placed on high levels of agricultural production with little regard for ecological sustainability. - The emphasis that UFC placed on high-yielding agricultural output resulted in it concentrating most of its plantation activities on the growing of one particular type of banana: the Gros Michel, or Big Mike. - In concentrating its efforts on the growth of the Big Mike, UFC created a monoculture plantation system throughout Central America. - Subsequently, Panama disease swept through UFC plantations and decimated its banana harvest. - Given its unchallenged power in Central America, and its access to large swathes of forested land, UFC’s solution to the problem was to move its activities around. - UFC’s response when the disease had taken hold was to move on to new land, to a new country if needed, and to carve out another part of Central America’s “infinite” jungle. - The example of UFC also indicates how, in the age of globalisation, the fate of forests becomes dislocated from the places in which they are located, and is instead connected to economic decisions that are made in distant corporate boardrooms.
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5.6	Big Box Retail and the Global Timber Supply Chain
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	<ul style="list-style-type: none"> - Through the combination of low prices and marketing, big box retailers are clearly contributing to the escalating demands that are placed on the world’s forests to supply timber to the market.
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	<ul style="list-style-type: none"> - Manufacturers & timber producers find creative and illegal ways to lower prices for big buyer's e.g. <ul style="list-style-type: none"> o Lower employee wages o Less health and safety measures o Purchasing illegal timber o Adopting destructive forest practises. o E.g. UK Environmental Investigation Agency – Walmart Baby Cribs made of timber harvested in Russian areas with high rates of illegal logging & carried out in Tiger breeding season. o Therefore EIA concluded it was likely that Walmart products contained illegal timber, effecting the forest ecosystem and biodiversity. - Economic practices and associated global supply chains create the incentives and opportunities that lead to the exploitation of forests. o Many retailers are trying to take greater responsibility for precisely where their wood is coming from. - In order to support such corporate greening activities, there are now official forest certification processes. These initiatives are often led by environmental non-governmental organisations (NGOs) such as the Forest Stewardship Council, and provide an official labelling system for timber products that have been produced in socially and environmentally just ways.
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5.7	Illegal Exploitation of resources: a Case Study on Elephant Populations
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	<p><i>Case Study 5.1 – Elephants in the dust: the African elephant Crisis.</i></p> <ul style="list-style-type: none"> - A pronounced upward trend in both the poaching of African elephants and the illicit trade in ivory is particularly evident from 2007 onwards. - it is clear that African elephants are facing the most serious conservation crisis since the species was moved from the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix II to Appendix I in 1989, and a ban on commercial trade in ivory and other elephant specimens came into effect - Poaching is spreading primarily as a result of a rising demand for illegal ivory in the rapidly growing economies of Asia, particularly China and Thailand, which are the two major end uses markets globally. - The high levels of poaching are: <ul style="list-style-type: none"> o Facilitated by conflicts that, through lawlessness and ensuing abundance of small arms, provide optimal conditions for illegal killing of elephants. o Further exacerbated in many countries due to weak governance and collusive corruption, at all levels. o Poverty facilitates the ability of organized criminals to recruit, bribe or threaten locals and underpaid police, military personnel and wildlife rangers. - Much of the elephant population of West Africa had been decimated before the turn of the 20th century. - Ultimately, the illegal trade in ivory is driven and sustained by consumers who are willing to pay high prices for the commodity, regardless of its origin or legality. - Demand for ivory in China lay dormant for much of the 20th century, but has in recent years made a remarkable resurgence, to the extent that China is now the world's largest destination market for illegal ivory.... While the illicit trade is ultimately driven by demand, the easy availability of illegal ivory exacerbates it. - At the national level, poor law enforcement, weak governance structures and political and military conflicts are some of the main drivers that facilitate poaching and allow illicit trade in ivory to grow. - Weak governance is likely to play an important role at all points of the illegal ivory trade chain, from poaching on the ground to the smuggling and marketing of illegal ivory. - Armed conflict in some source countries facilitates poaching and is often also associated with illegal mineral resource extraction. - Locally, poaching levels are associated with a wide variety of complex socio-economic factors and cultural attitudes. Poaching and hunting for bushmeat, for example, are exacerbated by poverty, and recent studies suggest that the killing of elephants for their meat will grow as other kinds of bushmeat and protein sources become scarcer. - African elephants are thought to be a keystone species, because in small numbers, they have lasting impacts. They often are labelled as bioengineers. For example, their destruction or altering of trees positively influences herpetofaunal diversity, as they create more three dimensional habitat diversity for these herps (- The two countries most heavily implicated as destinations for illicit trade in ivory are China and Thailand. - Moving to source countries and exit points for large amounts of ivory leaving the African continent, Kenya, Tanzania and South Africa are presently the countries of greatest concern - Following a decision at CITES COP 14 held in the Hague in 2007, the African Elephant Action Plan was developed by the 38 African Elephant range States. The Action Plan was adopted by all range States in 2010 at COP 15 in Qatar, with the vision to ensure a secure future for African Elephants and their habitat to realize their full potential as a component of land use for the benefit of the human kind. - The Action Plan seeks to address “the situation on the ground” and has identified eight priority objectives: <ol style="list-style-type: none"> 1. Reduce the illegal killing of elephants and the illegal trade in elephant products;
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2. Maintain elephant habitats and restore their connectivity;
 3. Reduce human-elephant conflict;
 4. Increase awareness among key stakeholders about elephant conservation and management;
 5. Strengthen range States' knowledge about African elephant management;
 6. Strengthen cooperation and understanding among range States;
 7. Improve local communities' cooperation and collaboration on elephant conservation;
 8. and
 9. Effectively implement the African Elephant Action Plan.
- In order to achieve these eight objectives, a list of necessary activities has been laid out.
 - Among some of the listed activities proposed by the Action Plan, range States have identified the need to strengthen the capacity of law enforcement authorities and agencies to combat poaching and illegal trade, and to harmonize and strengthen national policies and laws relevant to conservation and management of elephants
 - To implement all activities in the African elephant action plan for a period of three years, an estimated USD 100 million will be required. The activities of the Action Plan are supported by the multi donor African Elephant Fund which was established in 2011.

5.8 Biodiversity Hotspots

Case Study 5.2- Biodiversity Hotspots

- A number of international conventions have been adopted to address biodiversity issues.

CONVENTIONS	Convention on Biological Diversity
	The International Plant Protection Convention
	The Ramsar Convention on Wetlands of International Importance,
	the Convention on the Conservation of Migratory Species of Wild Fauna and Flora
	the World Heritage Convention
	the International Treaty on Plant Genetic Resources for Food and Agriculture
	CITES (CBD Secretariat 2017).

- **Provided structure for Regional and local efforts to protect biodiversity, biodiversity hotspots were established to streamline biodiversity conservation efforts.**
- Marchese (2015:298) defines biodiversity hotspots as “areas with high concentrations of endemic species (species that are found nowhere else on Earth) and with high habitat loss”.
- **The aim of identifying biodiversity hotspots is to improve conservation efforts by concentrating financial aid and legislation to specific geographic areas** (Hopper et al. 2015).
- “Global biodiversity hotspots were identified originally as the 25 terrestrial regions on Earth richest in endemic species under threat. Subsequent revisions now list 35 terrestrial, and 10 marine biodiversity hotspots.
- Prior to extensive habitat conversion by humans, the 35 terrestrial hotspots covered 16 % of the Earth’s surface.
- Now, with more than **85% of their habitat destroyed**, only 3.4 million km², or 2.3% of the Earth’s land surface, is occupied by wild biodiversity in these hotspots.
- Yet an extraordinary 150,000 vascular plant (38% of the global total) and 22,940 vertebrate species (77%) occur on this 2.3% of the Earth’s land area, with more than 130,000 endemic plant species” (Hopper et al. 2015:167-168).
- According to UNEP (2016:73), **eight biodiversity hotspots are located on the African continent**, hosting an estimated 5 015 endemic species.

Table indicating the names and locations of the eight African biodiversity hotspots	
Name	Location
Cape Floristic Region	South Africa
Coastal Forests (Mangroves) of Eastern Africa	Kenya, Mozambique, Somalia and Tanzania
Eastern Afromontane	Burundi, Democratic Republic of Congo, Ethiopia, Eritrea, Kenya, Malawi, Mozambique, Rwanda, Saudi Arabia, Tanzania, Uganda, Yemen and Zimbabwe
Guinean Forest of West Africa	Benin, Côte d'Ivoire, Equatorial Guinea, Ghana, Guinea, Liberia, Nigeria, São Tomé and Príncipe, Sierra Leone and Togo
Madagascar and Indian Ocean Islands	Comoros, Madagascar, Mauritius and Seychelles
Maputaland–Pondoland–Albany	Mozambique, South Africa and Swaziland
Succulent Karoo	Namibia and South Africa

	<ul style="list-style-type: none"> - Even though climate change poses a significant threat to all the biodiversity hotspots in Africa, it is important to mention an example from the arid Succulent Karoo hotspot in Namibia and South Africa. - Young et al. (2016) contend that plant species from the genus Conophytum – considered to be extremely drought tolerant, may become extinct. - Moreover, habitat loss and fragmentation together with invasive alien species, agriculture, urbanisation and fires have endangered a large amount of biodiversity in the Cape Floristic Region (CFR), which have led to the city of Cape Town being declared a biodiversity “mega-disaster” area. - It is estimated that the Cape Floristic Region (CFR) is home to 9 000 plant species, of which 70% are endemic (West et al. 2016:184). - The International Union for Conservation of Nature (IUCN) (2015) estimates that approximately 10 million hectares of the Guinean Forest of West Africa were lost prior to the year 2000. - In addition to agricultural activities, urbanisation and the construction of roads and establishment of industries were the main drivers contributing to the deforestation in this biodiversity hotspot (IUCN 2015). - Arcilla et al. (2015:41;47) points out that “over 80% of Ghana’s Upper Guinea forests have been cleared, mainly for agriculture and settlement, and remaining forest is highly fragmented”. - Furthermore, as the amount of logging activities increased in Ghana “...understory bird communities declined >50% in abundance and did not show any indication of recovery”. - However, measures have been taken to promote the sustainable use of forest resources. - “These include the promotion of forest law enforcement, governance and trade (FLEGT), through bilateral and multilateral initiatives, such as the EU’s Voluntary Partnership Agreements (VPAs), which are currently being implemented with Cameroon, Ghana and Liberia and negotiated with Côte d’Ivoire” (IUCN 2015:191). - In addition, significant progress has been made in forest certification in Ghana and Cameroon (IUCN 2015). - Marchese (2015) argues that although biodiversity hotspots have attracted financial and institutional support, it can easily become a panacea to addressing biodiversity loss and the conservation of biodiversity. - This is due to the exclusion of invertebrates (such as insects and worms) and coldspots (such as coral reefs).
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Learning Theme 6 – Urbanisation and the environment

6.1	<u>Introduction</u>
	<ul style="list-style-type: none"> - According to the UN, 50million people are added to the population of the planet’s cities and suburbs every year - Migration is pushing populations upward and boundaries outward e.g. Nairobi - Impacts of migration: <ul style="list-style-type: none"> o Mirrors economic advancement o Socio-economic challenges o Environmental challenges o Rapid urban growth strains existing infrastructure o Discourages preservation of natural habitat in favour of development
6.3	<u>A Brief History of Urbanisation: From Mesopotamia to the Mega-Region</u>
	<ul style="list-style-type: none"> - The United Nations Environment Programme (UNEP) estimates that 80 per cent of all anthropogenic carbon dioxide emissions are a product of “urban-based activities”. - Metropocene - a period defined by the dynamics and demands of urbanisation. - If urbanisation reflects the relatively large-scale concentration of people, resources and infrastructures into one place, the first incidence of urban areas dates back to the Neolithic age around 4 000 BCE, when small cities started to emerge in the fertile plains between the Tigris and Euphrates rivers. <ul style="list-style-type: none"> o In the modern state of Iraq, was known at the time as Mesopotamia – meaning “land between two rivers”. o Experienced a nearly 7 fold increase in population in the space of 91 years – mostly due to industrialisation - Unlike its densely packed European counterpart, the American city of the twentieth century was a city that was defined by the spatial expansion of the city. <ul style="list-style-type: none"> o This new urbanisation process was facilitated by the rise of mass transit systems (including both public transport and the motorcar), and led to the creation of a new urban phenomenon: sprawl. o Los Angeles and Las Vegas are examples of the new form of urbanisation. - While some of these megacities are industrial (the Rheine- Ruhr agglomeration) and suburban (Los Angeles) cities, which have expanded to megacity status over a relatively long time period, many megacities of the present and future are still going through rapid episodes of urban growth.

	<ul style="list-style-type: none"> - In China, the cities of Hong Kong, Shenzhen and Guangzhou are beginning to amalgamate. This so-called “endless city” has a combined population of approximately 120 million people. - “Africa’s population reached 1 billion in 2009, with estimates that it will double by 2050. - Between 2000 and 2100, Africa’s share of the world’s population is expected to rise from 13.1 to 24.9 per cent. Africa’s population is not only the fastest growing in the world, but also the most youthful” (UNEP 2016:16). - “In both Africa and Asia, more than half of the population lived in rural areas in 2016, but that share is declining. - A rapidly growing population stressed ecosystems by increasing demand for food, energy, medicines and water, and distorting land tenure arrangements and accelerating environmental degradation through soil erosion, deforestation and biodiversity loss. - In extreme cases, competition over scarce resources leads to conflict. - Rapidly growing populations present financial and logistical challenges in service provision – especially, education, health, safe drinking water and sanitation.
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6.4	Urbanisation and the Environment
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	<p>Case Study 6 - Efficiency of parks in mitigating urban heat island effect: An example from Addis Ababa</p> <ul style="list-style-type: none"> - During urbanization land cover changes - Natural surfaces are replaced by urban fabric with higher temperatures than the surrounding environment – urban warming - Studies show, thermal, optical and geometric properties of urban surfaces affect heat absorptive and radiative properties and lead to “urban heat island” effect (UHI) <ul style="list-style-type: none"> o Global issue threatening the operation and habitability of cities and urban environments o Characterised by the development of noticeably higher temperatures in our cities compared with the countryside that surrounds them. o UHI effect can increase air temperature in an urban city by 2-15deg C o UHI arises due to: <ul style="list-style-type: none"> ▪ the changing nature of our cities, ▪ and is the result of the reduction in vegetation and evapotranspiration, ▪ a higher prevalence of dark surfaces with low albedo (whiteness/ reflectiveness) ▪ And increased anthropogenic heat production. o High temperatures affect: <ul style="list-style-type: none"> ▪ Health ▪ Economy ▪ Leisure activities ▪ Wellbeing of dwellers ▪ Enhance air pollution ▪ May be enhanced and intensified as a consequence of global warming o Particularly the health of old and poor people - Strategies for improvement: <ul style="list-style-type: none"> o Indoor air conditioners to efficiently eliminate thermal stress – can add to UHI by releasing additional heat to the environment <ul style="list-style-type: none"> ▪ The increased energy use for cooling may therefore cause other environmental problems such as increased carbon emission. o Aim to lower energy use in buildings, also lowering carbon emissions. o Urban Green Space e.g. parks – mitigates the effect <ul style="list-style-type: none"> ▪ The green vegetation can improve both indoor and outdoor thermal comfort, while at the same time providing multiple environmental services, such as carbon storage, reduced air pollution and act as urban biodiversity hotspots. ▪ Contributes to improving the quality of life ▪ Enhancing human wellbeing through exposure to nature ▪ Vegetation cools the environment through evaporative cooling, shading effects and thermal and optical properties ▪ Has low thermal storage, emits less thermal radiation ▪ Low albedo (reflectiveness) in plants reduces the amount and intensity of thermal radiation. ▪ Cooling efficiency of urban parks is mostly influenced by leaf colour and foliage density ▪ Specific plant species have different adaptations and moisture conservation mechanisms; hence the thermal impact of different species on the environment is likely to vary. - Addis Ababa <ul style="list-style-type: none"> o Is one of the most rapidly expanding cities in the country.
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- The city was among the fastest growing cities in Africa with an average annual growth rate of 4.1% between 1990 and 2006.
- The city is located at altitudes ranging from 2025 to 3028 m.
- The mean annual temperature range is 16–18°C. In this study we used ground-based air temperature measurements and satellite thermal remote sensing to evaluate cooling effects of parks and examined the relationships between park characteristics and temperature.
- We conclude that, within the same city, the cooling efficiency of urban tree vegetation varied with park-specific characteristics including species composition, canopy intensity, size and shape of the parks.
 - Moreover, intra-urban variation in altitude also played a significant role in determining thermal variation among parks.
 - Irregular and elongated parks were shown to have lower Park Cooling Intensity (PCI) and higher Park Cooling Distance (PCD) compared to regularly shaped, compact parks.
 - Both PCI and PCD were shown to increase with park size.
- This study provides insight regarding the importance of evaluating the effectiveness of urban green spaces in mitigating the heat island effect.
 - **Understanding differences in cooling effects among parks may help urban planners and greening designers to make appropriate decisions regarding species choice, and size and shape of green spaces.**
 - The main recommendations are to:
 - increase tree vegetation canopy cover,
 - optimize park size and shape,
 - And prioritize the choice of species for greening.
 - Our results suggest that Eucalyptus, Olea and to some extent Acacia are more effective in cooling the urban environment than Cupressus and Grevillea.
 - However, apart from cooling there are a number of other environmental and social services that are provided by urban green spaces and which need to be considered carefully before deciding about the choice of species.
 - In many instances, urban greening seems to emphasize the aesthetic values of parks and other green spaces and tends to overlook the local climatic influence of vegetation.
 - Hence, urban greening efforts in Addis Ababa and areas with similar environments may need to integrate and optimize the multiple environmental and social values of green spaces.
- This study was done on 21 green spaces, 9 monitored parks for 15days – further studies would be needed to better understand the cooling effect of parks.
- The unhelpful divide between urban research and environmental studies has been gradually bridged by a series of studies that have explored the ways in which cities are deeply connected to environmental systems at a range of different scales.
- Chicago’s location meant that it was ideally placed to exploit the environmental resources that were to be found in the heartland of the North American continent – woodlands, fertile prairies and lush rangeland pasture.
- The growth of Chicago into a major metropolis was deeply interconnected with the transformation of the soils and ecosystems of the American Midwest.
- The environmental **Kuznets Curve** offers a helpful starting point when trying to understand urban-environment relations.
 - The general trend suggested by this curve is that early forms of urbanisation tend to be characterised by increasing rates of environmental degradation at a local scale (such as air pollution, resource use, water quality).
 - At some point, the curve suggests that cities pass through a transitional zone, after which, and following a period of economic growth, the levels of local environmental degradation associated with urbanisation tend to decline.
 - As they develop, cities become adept at outsourcing polluting industrial activities, which characterised their early phases of development, to lower cost locations in other parts of the world.
 - A controversial example of globalised environmental pollution is evident in the practices of toxic colonialism.
 - **Toxic colonialism** is a term that is used to refer to the transport to and disposal of hazardous waste products in less economically developed countries.
 - These toxic substances involved in this process include nuclear waste, dioxins, poisonous metals, persistent organic pollutants (POPs) and sanitary waste, which can all have harmful effects on both ecological systems and human health

	<ul style="list-style-type: none"> ▪ E.g. Largest e-waste dump site -: Accra, Ghana called Agbogbloshie At Agbogbloshie, toxic elements arising from the electronic items that are processed, including (but not limited to) arsenic, lead, mercury and copper, have been found in soil, water, ash, sediment and dust collected from the site” ▪ E.g. dumping 500 tons of toxic waste around Abidjan, Cote d’Ivoire – 20016 <ul style="list-style-type: none"> - Transportation of waste to less developed countries (LDC) is not a recent phenomenon <ul style="list-style-type: none"> o The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal came into effect in 1992 following the discovery of imported waste in LDCs (Basel Convention 2011). o Since the main emphasis of the Basel Convention is on regulating the trade of wastes, the Bamako Convention was adopted by several African countries in 1998 to prohibit (ban) “...the import into Africa of any hazardous (including radioactive) waste” - When the environmental Kuznets Curve is combined with an appreciation of the increasingly globalised nature of urban-environment relations it becomes possible to see how just as cities become more prosperous, clean and verdant, their global ecological footprints may actually be increasing. - While Chicago’s early development was based upon the exploitation of its surrounding hinterland, it appears that within the Anthropocene the hinterlands upon which cities depend are becoming increasingly global in nature. - The complex nature of the urban-environment relationship is depicted in the “urban” Kuznets Curve. - Urban environmental optimists argue that the high concentrations of people and infrastructure that characterise cities mean that they provide an ideal spatial template for developing a low-energy context for human activity. - In contrast, urban environmental pessimists are critical of the capacity of cities to provide low-energy and sustainable forms of development. - Different types of the cities (industrial, low-rise suburban, megacities or global financial centres) have different types of environmental relations. - For example, while global financial centres may support carbon-reduction strategies, they may not oppose the airport expansions. - Likewise, property-based urban development planners may find it beneficial to promote urban greening and the improvement of urban air quality, but they find it more difficult to promote less car use and reduce levels of carbon dioxide emissions. - In the context of shortages in the availability of non-renewable resources, and the threats of climate change, we may be entering a new period in the history of urbanisation – urban ecological security. In many ways urban ecological security is about the search for competitive advantage in the Anthropocene
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Learning Theme 7 - Governing the Environment

7.3	<u>Protecting People from Nature or Protecting Nature from People</u>
	<ul style="list-style-type: none"> - Hurricane Katrina was one of the 5 most deadly hurricanes to strike the US - The problems that Katrina generated were as much a product of human (in)action as acts of nature - The floods that followed Katrina were a result of a failed levee system - Many effects of Katrina were not from the physical impact of the hurricane but were related to technological and political failures in local, national and state government.
7.4	<u>Brief Environmental History: of the Nation State</u>
	<ul style="list-style-type: none"> - Sovereign state -: political community with a clearly demarcated territory which can determine its own internal affairs - National state -: a differentiated set of institutions and political relations radiating outwards from a centre to cover the territorially demarcated area over which it exercises a monopoly of authoritative rule making - For Foucault, governing involves a sense of care within the operation of states; a care that is directed at national populations, and seeks to ensure that society is ordered in such a way that it can function effectively in relation to the economic production of wealth. - Foucault also recognises that the goal of government means that nation states must carefully regulate the relationship between people and the environment, to ensure that the welfare of the population is not compromised in the long term. - Karl Wittfogel (1957) argues that the emergence of early civilisations in places like Egypt and Mesopotamia was based on the control and management of water resources. <ul style="list-style-type: none"> o It was the management of water in arid areas, in the forms of flood defences, irrigation systems and domestic supply that necessitated the formation of largescale political bureaucracies.

	<ul style="list-style-type: none"> ○ Given the limited sources of available water in such areas, and the need to distribute water over large tracts of land, effective water management could not be achieved at a local level. - During the 18th century, forest resources were a vital source of fuel and building material (used both in the construction of houses and ships) for early state systems. - Forests also represented an important source of fiscal wealth: A product that could be taxed and traded to consolidate a nation's wealth. - Scientific forestry enabled state systems to centralise knowledge about forest resources and to predict likely shortfalls and overproductions of timber. - Scott - the establishment of nation states went hand-in-hand with the simplification and standardisation of the natural world. - These processes of standardisation and simplification did not apply only to forests but also to water resources, agricultural land and mineral deposits. - Governments consolidated their territorial power by developing sophisticated maps of their environmental resources.
7.5	Thinking about State – Environment Relations: Green Arbiters and Ecological Leviathans
	<ul style="list-style-type: none"> - Anarchism is a movement that seeks to oppose the formation hierarchies of power, such as those found within organised religion, science and the nation state. - With regards to human environment relations, anarchists argue that the formation of modern states has resulted in the following three processes: <ul style="list-style-type: none"> ○ The environmental dispossession of people who effectively lose access to once commonly shared resources that are now controlled by the state (including woodlands and water courses) ○ A general decline in the ecological knowledge and capacities of people whose previous engagements with the natural world are now administered by state officials and experts ○ The general alienation of people from the natural world - Although humans may be responsible for more of what goes on in the global environment, their actual awareness and sense of responsibility for such actions may be diminishing. - The ecological leviathan theory may have a more positive influence on human-environment relations - The state plays a crucial role in protecting the collective interests of society – which may include the sustainable use of natural resources or the preservation of clean air and water. - These resources are regarded as common goods that would be neglected if individuals were allowed to simply follow their own selfish interests. - It is in this context that states can regulate environmental externalities such as air and water pollution, to ensure that those who economically benefit from causing environmental harm are held accountable. - The central environmental message of Marx's work is that capitalism leads to the subordination of environmental values to those of commercial interest. - Marxism tends to see the state less as a referee when it comes to environmental issues and more as an instrument of the ruling economic class. - Since wealth creation in capitalist societies is based upon the transformation of nature from its primary forms (wood, minerals, crude oil) into tradeable commodities (furniture, aluminium foil, petroleum), Marxists argue that states tend to do two things, namely: <ul style="list-style-type: none"> ○ Enable the corporate control and transformation of the natural environment into commodities ○ Prevent the development and/or enforcement of rules, laws and regulations that would hinder the corporate exploitation of natural resources
7.6	Governing the air: The Case of the London Fog Disaster
	<ul style="list-style-type: none"> - Since the 1307 Royal Proclamation, which forbade the burning of sea coal, state authorities have been involved in a constant struggle to regulate the air quality in London. - During the 19th century, the situation deteriorated. - Chemical emissions produced by the alkali industry mixed with the soot and sulphur produced by the burning of coal in industries and residences to create what came to be known as 'pea-soupers' (black fogs). - Despite the various forms of national and local legislation that were enacted to regulate air pollution during the 19th and early 20th centuries, such actions only achieved limited success. - The problems of governing air pollution came to a head in London in December 1952 when a thick fog settled over the city. - On 5 December, these high concentrations of soot and sulphur dioxide combined with the cold weather conditions, perpetuating and deepening the fog.

	<ul style="list-style-type: none"> - These climatic conditions persisted for five days. - While London was no stranger to fog, the following three features made this pollution incident particularly problematic: <ul style="list-style-type: none"> o The unusual length of its duration o The thickness of the fog, with naturally produced fog combining with emissions of smoke to produce a dense smog o The large geographical area that was affected by the fog - These conditions conspired to generate social and economic chaos within the city of London. - Early analyses claimed that 4 000 deaths could be directly attributed to the fog disaster, but this figure has recently been revised to almost 12 000. - British state established an expert Committee on Air Pollution in 1953. - The various recommendations of the Committee on Air Pollution led to the 1956 Clean Air Act. <ul style="list-style-type: none"> o The 1956 Act banned the emission of dark smoke from industrial and domestic chimneys. o It also created smokeless zones and smoke control areas in many cities. o Finally, it established long-term provisions for the relocation of power stations away from urban centres. o These actions reveal the ability of states, when freed from the influence of narrow class interest, to take authoritarian action on environmental issues that can be applied in a uniform way right across a national territory. - Despite the success of the 1956 Act in addressing dark smoke pollution, it is important to note that air pollution continues to be a major problem in Britain today.
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7.7	<u>Rivers of Grass: The US State and the Florida Everglades</u>
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	<ul style="list-style-type: none"> - The Everglades are at the same time one of the most environmentally important and severely threatened ecosystems in North America. - The Everglades provide an important case study in state environmental relations, - Throughout the 19th and 20th centuries, government supported the reclamation and drainage of wetlands and the construction of levees and a dam around Lake Okeechobee for sugarcane plantations and urban expansion. - The first attempts to actively protect the Everglades came in 1947, when the southern section of the wetlands was dedicated a national park (the Everglades National Park). - While protecting a segment of the Everglades from commercial encroachment, the National Park has no jurisdictional power to control the upstream processes that ultimately threaten the sustainability of the wetlands – namely the water flow from Lake Okeechobee. - During the second half of the 20th century, preventing the continued destruction of the Everglades became a primary concern of American environmental movements. - These environmental interest groups were central to the formation of the Comprehensive Everglades Restoration Plan (CERP). - The main problem is that simply allowing the natural hydrological system to return to the Everglades would have flooded large areas of productive agricultural land and generated heightened flood risks in large cities such as Miami and Fort Lauderdale. - CERP thus attempts to achieve a complex system of managed flooding, in and through which flooding in some areas of the Everglades is counterbalanced by flood control and water channelling in others. - In this context, CERP is less a restoration project and more a watershed management plan. - In many ways, the case of the Everglades serves to illustrate that neither Marxist theories of the state (where the state serves narrowly defined class interests) nor visions of the state as a neutral referee (policing competing economic and environmental interests) effectively capture the nature of the relationships between government systems and the environment.
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7.8	<u>Beyond the State: The Rise of International Systems Government</u>
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	<ul style="list-style-type: none"> - While nation states continue to be prominent actors in the regulation of human environmental relations in the Anthropocene, it is important to acknowledge that environmental government capacity is increasingly being developed at international levels - In the context of the forms of large-scale environmental issues that cross national stat boundaries – such as climate change/ ozone depletion/ acid rain – it has become increasingly apparent that multilateral action is required to effectively address these challenges
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Case Study 7 – regional and global cooperation in environmental governance

- 17 Sustainable development Goals (SDG's) to assist with overcoming the difference between less developed and more developed countries.
- These goals were developed on the concept of sustainable development
- According to UNDP the goals "...are a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity".
- **The 17 SDGs are:**
 1. No poverty
 2. Zero hunger
 3. Good health and well-being
 4. Quality education
 5. Gender equality
 6. Clean water and sanitation
 7. Affordable and clean energy
 8. Decent work and economic growth
 9. Industry, innovation and infrastructure
 10. Reduced inequalities
 11. Sustainable cities and communities
 12. Responsible consumption and production
 13. Climate action
 14. Life below water
 15. Life on land
 16. Peace, justice and strong institutions
 17. Partnerships for the goals
- Land is the main base for other environmental and natural resources.
- **African's are more reliant on land therefore sustainable use and management is NB!**
- The selected land-related Global Environmental Goals (GEGs), are contained in:
 - o • Agenda 21; General Assembly Resolution 62–98 of 31 January 2008; the Millennium Development Goals (MDGs);
 - o • the Ramsar Convention on Wetlands; and
 - o • The United Nations Convention to Combat Desertification (UNCCD).
- The land GEGs are complemented by SDG 15 adopted along with 16 other SDGs at the end of 2015.
- SDG 15 highlights both the importance of land to development and the enduring concern that unless remedial action is urgently taken, the resource faces the risk of irreversible degradation.
- **The Goal, which seeks to "protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss," is further broken down into 10 Targets.**
- Commendably, the Targets provide a roadmap for implementation of SDG 15 by stipulating that the Goal should be incorporated into national policies through local planning, development processes, poverty reduction strategies and accounts by 2020.
- Food and Agriculture Organization of the United Nations (FAO) - the rate of deforestation has slowed around the world over the last five years, including in Africa,
- Moreover, Africa reported the highest annual increase in the area of conserved forest over the same period.
- Why – improved measuring and monitoring of forest resources & greater involvement of communities
- Forest degradation remains a challenge because forest erosion is gradual and more difficult to detect,
- Both deforestation and forest degradation are largely driven by accelerated urbanization and industrialization, agricultural expansion, commercial logging, and increased fuelwood collection.
- The latter is a reflection of the region's growing energy deficit – populations without access to energy
- Africa is part of the United Nations Convention to Combat Desertification (UNCCD).
- Forty-two countries have submitted National Action Programmes (NAPs), 6 have aligned to their 10 year strategy.
- African Union created the TerrAfrica partnership to scale up investment, knowledge sharing and coalition building for sustainable land and water management in 24 countries.
- The Great Green Wall for the Sahara and the Sahel Initiative was formed under TerrAfrica to address desertification and land degradation in the Sahel and Sahara, boost food security, and build communities' resilience to climate change.

- **To the extent that desertification is both human and climate induced, efforts should be made to address climate change** (SDG 13).
- Many African countries have enacted national policies on climate change mitigation and adaptation and are aggressively promoting programmes such as reducing emissions from deforestation and forest degradation in developing countries (REDD+) and its derivatives.
- As an affirmation of the importance of both Agenda 2063 and Agenda 2030 as defined by the Sustainable Development Goals (SDGs), Africa's future will contain common elements for a development trajectory that will provide the region with a healthy living environment while ensuring good health and quality of life for her people
- Four scenarios were developed by the World Wildlife Fund (WWF)/African Development Bank (AfDB) 2015 African Ecological Futures report (2015 as cited in UNEP 2016:111).
- "After a process of developing sectoral scenarios with various stakeholders on the continent, this final set of scenarios was developed at the 15th African Ministerial Conference on the Environment (AMCEN) in Cairo in March 2015 and published in May 2015, making it the most recent set of regionally-applicable participatory scenarios for the continent, which provide a legitimate, credible set of future pathways...
- The scenarios outline a future Africa in which governance is more centralized and planned or more decentralized, and where trade is more regionally focused on the continent or looks more to global exports"
- **Good Neighbours scenario**
- "A difficult but ultimately largely successful transition to centralized planning forms the core of Africa's governance structure by 2030 and beyond, backed by increased intra- Africa trade over global exports.
- There is major investment in infrastructure for energy supply, water, food security, and transport and trade.
- This leads to the region partially achieving energy security goals under the SDGs by 2030, and more fully by 2063, while also increasing food security and working towards an end to hunger and malnutrition.
- However, the large-scale investments in infrastructure and the heavy dependence on the region's abundant natural resources take a heavy toll on biodiversity and ecosystems, and resulting feedbacks on ecosystem services counteract the achievements toward the SDGs to some degree.
- While centralized planning systems increase efforts to minimize impacts through implementation of environmental regulatory measures, transboundary agreements and protected areas, the risks of environmental degradation persist due to large regional
- Infrastructure expansion into previously inaccessible areas coupled with the development of trade corridors.
- In the Good Neighbours scenario, there is strong political will for sustainable development and environmental governance, providing many opportunities that can be leveraged; challenges and responses revolve mainly around capacity to enforce, manage and stimulate good governance of natural resources while supporting socio-economic development"
- **All in Together scenario**
- "This scenario is characterized by national sovereignty and action at local levels, where there is widespread community action towards more sustainable resource use, more climate-smart agricultural practices and more integrated conservation efforts, supported by international funding from donor countries, social entrepreneurs and other funding sources.
- Also characterized by a failure to take this diversity of social and technical innovations to a higher scale.
- Africa's efforts to manage its natural capital sustainably are hampered by pockets of conflict, with regional efforts playing a leadership role in conflict resolution through Regional Economic Communities...
- Subregional communities become more integrated as a way of bringing peace.
- Eventually, pockets of ecosystems flourish in well-managed agricultural areas and community-supported protected areas.
- Transboundary natural resources such as freshwater and fish stocks are most affected by the lack of effective governance at the international level.
- Strong risk of leaving behind those who are not able to access the social, knowledge and financial capital to join the 'new Africa' of sustainable local innovation.
- Natural environments and resources also risk degradation and fragmentation outside these sustainable innovation hotspots.
- Africa's vulnerabilities to shocks have to do mainly with the focus on local resilience to relatively local stressors. Large-scale shocks such as prolonged droughts, migrations, conflicts, and shocks because of mismanagement of transboundary resources (such as sudden changes to river systems) are difficult to deal with at the local level.
- In All In Together, the main challenge, and the main opportunity, is to complement the flurry of local-level innovations and community action with higher-level support, legislation, monitoring and enforcement by state and nonstate actors, while providing leadership in the face of larger scale challenges" (UNEP 2016:115; 118; 129).

Learning Theme 8 – Greening the Brain

8.1 Introduction

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8.3 Human Psychology in the Anthropocene

- Researchers content that a portion of human behaviour is driven by irrational emotional prompts to action
- Climate change:
 - o Those in the poorest parts will be effected the worst
 - o Without a direct, emotional connection to the consequences, it will remain difficult to motivate people in more developed countries (MDC) – the main emitters of greenhouse gases

8.4 Changing Patterns of Human Behaviour and their Environmental Consequences

- The Great Acceleration represents a key stage in the history of human-environment relations, during which significant increases in the rates of human-induced environmental change occurred. The three proxies of the Great Acceleration are:
 - o Rising levels of carbon dioxide in the atmosphere, which has increased from 310 ppm in 1950 to 406 ppm in 2017 (Tenenbaum et al 2017)
 - o Rising levels of nitrogen (from fertilizers) in the oceans
 - o Increases in sulphur dioxide concentrations in the atmosphere
- **Fordism**:- associated with the rise of mass production, which made it possible to produce commodities in ever-increasing quantities and at ever-decreasing cost.
- Fordism societies recognise that it was only through the provision of reasonable incomes for workers that a mass market could be produced that would be able to consume goods
- Fordism helped to create homes that required much higher levels of energy to sustain it and thus placed a much greater demand on environmental resources.
- The modern tendency towards the **overconsumption** of goods has had social and environmental consequences.
- Social consequences are related to the emergence of the "**affluenza virus**" within the western world.
- **Affluenza** is a form of social illness, in and through which we tend to judge ourselves – and those around us – based on what we have and own, and pursue happiness through the continued purchase of goods.
- In environmental terms, **our contemporary patterns of overconsumption place significant pressure on the environmental resources that are used to produce these goods.**
- At the same time, the rapid rate at which products become obsolete means that society is producing over greater amounts of waste products that must be disposed of.
- Huxley's novel Brave New World explore the potential future that lay in wait for a society that was dedicated to mass production and consumption.
 - o Huxley's Fordist future is a place where drugs are used to ensure the population remains obedient and dedicated to continued mass consumption.
 - o The reuse and repair of old goods, as a barrier to consumption, is discouraged (with activities such as knitting and sewing becoming crimes).
- The **Voluntary Simplicity Movement (VSM)** is a movement that emphasises the value of simplifying our complex and increasingly stressful lives.
 - o The principles of the movement rely on the concept that "everything you own, owns you; you have to care for it and store it".
 - o Voluntary simplicity encourages individuals to avoid the burdens associated with overconsumption and re-evaluate the things that are of real importance in their lives.

CASE STUDY 8.1 Conscientious consumption

- "Green economy", "sustainability" and "green growth" are all concepts that have been introduced to promote economic welfare while taking into consideration aspects other than economic progression.
- Promote a more holistic approach in the quest for "green growth"
- Unfortunately, this approach is often refuted by the fact that society has, through social pressure, created a culture where consumption beyond a point of actual need is acceptable and repeated in the pursuit of success and happiness
- This overconsumption may even be justified and excused in an emerging economy such as South Africa, since it is viewed as a reflection of economic progress, poverty alleviation and the country's overall development as mirrored in the Gross Domestic Product (GDP)

	<ul style="list-style-type: none"> - South Africa's GDP has in recent years benefitted in particular from vast increases in the spending patterns and consumption of a newly emergent middle-class consumer segment - The GDP was never meant to be used as an exclusive indicator for a country's well-being, since it focuses solely on national income and omits social and environmental indicators - Globally, consumption patterns (that contribute to GDP growth) have already reached unsustainable levels. - South Africa has the alarming potential to further increase the global environmental footprint - Even though a rapid surge in the consumption patterns of South African citizens indicates growth on a certain level, negative consequences - since current consumption practices cannot be maintained - This adds to pressure placed on the country and the world's natural resources and if these resources are depleted, it will hold severe consequences for current and future generations. - Overconsumption contributes to climate change and widespread resource depletion, e.g. the current water shortage in South Africa is another clear-cut example - Many SA Citizens are increasing their consumption to ultimately better their well-being – increased spending = increased happiness - Consumption of objects do not translate to greater levels of happiness, these lead to an unsustainable addiction to economic prosperity and affluenza - SA has a highly skewed consumption pattern of the population, in SA the minority is responsible for more than half the over consumption of the country. - Governments can put policies and programmes into place to curb overconsumption, but this problem should be addressed on an individual level as well - The concept of sustainability requires a more encompassing approach. - To date, poverty eradication has been focussed on rather than the unsustainable practises of the affluent. - Sustainable development is defined by Talberth et al (2007) as the "non-declining level of well-being for future generations". - Moreover, sustainability as a need of consumers may have three underlying dimensions, namely, <ul style="list-style-type: none"> o economic, which is long-term financial commitments for the household o environmental, meaning resources required that have an impact on the environment o social, meaning consumption decisions that shape and maintain a person's self-identity and social status - These three components must be met in equilibrium to achieve sustainable consumption in the long term - One of the major areas of wasteful and overconsumption practices & one of the fastest growing industries in South Africa, is the household appliance industry (whitegoods industry). - With the country's increasing middle-class consumer, came the escalation of the consumption of white goods. "keeping up with the Joneses" - Furthermore, the technological advancements of the appliance industry are rendering appliances outdated much sooner than previously experienced - Growth has led to excessive consumption of resources – national energy predicament/ water scarcity- shortages - Environmentally friendly white goods have in most industries and in most product categories been priced at a premium over the conventional product offerings, especially in the major household appliance category - By rather opting for the more expensive "greener" appliance, the consumer's ecological footprint is reduced and increased individual well-being is accomplished - This is in line with the Sustainable Development Goals. Goal number 12's purpose is to ensure sustainable consumption and production patterns. - It also aims to produce goods and services that improve the quality of human life by not only increasing net welfare gains from the economic activities, but also by minimising the consumption of resources and emission of pollution throughout the entire lifecycle
8.5	<u>Understanding Human Behaviour: Religion, Science and Ideology</u>
	<ul style="list-style-type: none"> - A number of perspectives or frameworks tries to explain human behaviour towards the environment. - These perspectives attempt to understand how affluent societies could create mass production and consumption systems. - The biological perspective suggests that by the very nature of human evolution as a species – competing with other species and exploiting environmental resources as best we can – we tend to be "by nature aggressive, materialistic, utilitarian and self-interested". - American Economist Rifkin - Humans are a naturally emphatic species.

- Claims that the emergence of **organised religion** – particularly in the Judeo-Christian– lies at the centre of our exploitative environmental conducts.
- Lynn White Jnr claims that Christianity has generated a situation where humans believe that they are superior to the rest of nature and that scientific and technological interference with the environment is justified.
- Neil Smith claims **capitalism** that has laid the foundations for current patterns of environmental exploitation.
- Capitalism has made it much easier for people to accept the large-scale transformation of resources since long commodity chains and complex market place exchanges obscure the environmental consequences of these actions.

8.6 Changing Human Environmental Behaviour: Beyond Homo Economicus

- The figure of Homo economicus is a type of 'economic person' who lives out life as a rational market actor.
- The term Homo economicus was coined on the belief in rational human action.
- In a market economy, the efficient distribution of goods and services requires humans to respond to price signals in a rational way: Buying the things they want at the most competitive prices.
- There are different ways to shape decision-making without having to revert to the coercive powers of law and legislation

<u>Policy instrument</u>	<u>Policy example</u>
Creation of market	Carbon trading/pollution permits
Information provision	Green marketing/smart energy meters
Tax/ financial penalty	Carbon tax/ pollution fees
Subsidy	Tax breaks for micro-energy generation schemes

- Australia and the European Union have established carbon markets in and through which companies can trade greenhouse gas emission permits with each other.
- By giving GHG emissions a price, a rational incentive is provided for companies to reduce their emissions and enhance their profits.
- Research in economics, behavioural psychology and neuroscience has started to cast serious doubts on the rationality assumptions associated with Homo Economicus.
- At the heart of these studies has been recognition of the significant role that emotions and irrationality play in human decision making and behaviour.

8.7 Policy Perspectives on Pro-Environmental Behaviour Change

- **Disclosure** -: how impacts of products and services have on the environment. E.g. Toxic Release Inventory
- Places awareness on the public as the actions of products/ services
- Disclosure can be combined with **peer pressure** – e.g. comparisons of energy use.
- **Future bias** exists when we prioritise present needs or desires over longer-term benefits. Is a major barrier when it comes to domestic investment in renewable technologies i.e. costs & recoupment over a longer time.
- These new policy initiatives have become subject to numerous critiques – exploiting emotional responses/ manipulation
- The Common Cause report argues that many environmental behaviour change policies use short-term psychological strategies to shift behaviour, while not addressing our deeper socio-cultural values. This report suggests that policies should devote more attention to the adoption of non-materialistic, egalitarian and biocentric values by humans.

8.8 Misanthropy, Adaptation and Safe Operating Spaces

- There are dangers to an anthropocentric perspective;
 - o Humans are in charge of the biosphere and can address ecological problems.
 - o Humans are still only one part of the planetary system.
 - o Failing to acknowledge the natural limits that exist to human development could have devastating consequences for both the environment and human wellbeing.
- Discussions of the Anthropocene can create a fertile breeding ground for **misanthropy** – the hatred of humans.
- Supporters of the **deep green perspective** argue that the response to the imbalances in the global ecosystem should prioritise the needs of the environment over those of humans.
- Campaigns aimed at changing human behaviour towards the environment:
 - o Earth Hour -: The purpose of Earth Hour is to raise awareness about climate change.
 - It encourages participants to switch off the lights at their homes, offices and landmarks for one hour
 - o Earth Overshoot Day-: marks the date when humanity's demand for ecological resources and services in a given year exceeds what Earth can regenerate in that year.
 - In 2017, 2 August was marked as Earth Overshoot Day.

Case Study 8.2 – renewable energy policies in Morocco

- Morocco, officially the Kingdom of Morocco, is a country in the Maghreb region of North Africa.
- Prediction of climatic change and global warming studies demonstrated that Morocco is among the countries that are more likely threatened by climatic change.
- According to the International Energy Agency (IEA), Morocco's GHG emissions from fuel combustion were estimated at about 42.1Mt CO₂ in 2008, and are expected to rise quickly (more than double by the year 2020).
- This increase is mainly due to the growth of the residential sector and the energy sector.
- To contribute to reducing climate change impacts, Morocco signed the UNFCCC during the Earth Summit in Rio de Janeiro in June 1992, ratified it in December 1995 and set it into force on 27th March.
- In the same spirit, the country setup a National
- The Kyoto Protocol was ratified on 25th January 2002 and has been entered into force on 16th February 2005.
- A CDM is a key approach to support climate change protection efforts on a global level.
- Energy
 - o Dominated by fossil fuels,
 - o Morocco imports approx. 96% of its supplies of energy sources
 - o Energy consumption has risen
 - o This dependency on energy imports makes Morocco highly vulnerable to increases in international fuel prices, putting a heavy fiscal burden on the national budget
- The ministry of Energy, Mines, Water and Environment (MEMEE) estimates two scenarios for the electricity demand growth rate by 2020.
 - o The first scenario is the "base" scenario; the electricity growth rate is 6.9% per year and that almost double the demand load in 2010.
 - o The second scenario is the "disruptive" scenario with a 8.7% annual growth rate, this means that the electricity demand will increase by a factor of 2.3 by 2020 which makes the peak load for average day rising from less than 4000 MW in 2010 to about 9 000 MW by 2020.
- Hence, Morocco will face in future possibly huge energy costs if prices continue to increase.
- The main underlying energy challenges for Morocco are how it can achieve secure and stable supply and reduce the country's energy bill, which has an extremely negative impact on its trade deficit.
- The national strategies currently underway are the National Energy Strategy (NES) of Morocco and the related National Plan of Priority Actions (PNAP).
- The PNAP rests on four strategic axes:
 - o Security of supply with diversification of fuel types and origins.
 - o Access to energy for all segments of society at competitive prices.
 - o The promotion of renewable energy and energy efficiency.
 - o Regional energy integration among the euro-Mediterranean markets
- The national energy strategy aims to develop renewable energy to meet 20% of the country's domestic energy needs and increase the use of energy efficiency to meet 12% by 2020 and 15% by 2030