Land Cover Change – An Overview

Geography ATAR 2017 // Mark Weldon

DEFINITIONS

environment: the living and non-living elements of the earth's surfaces and atmosphere, including human changes such as cropland, planted forests and buildings.

natural biome: a major ecological community with distinct climate, animals and plants; a community of life forms adapted to a large natural area.

anthropogenic biome: biomes showing patterns of human activity that have been created as a result of sustained, direct human interactions – urban areas are an example of anthromes.

land cover change: physical/biological change that have taken place to natural environments due to a variety of natural and/or anthropogenic causes.

ecosystem: an interacting community of abiotic and biotic elements.

ecosystem dynamics: the network of interactions in ecosystems, such as nutrient cycles + energy flow.

ecosystem structure: the abiotic and biotic factors involved an ecosystem's trophic levels (ie. producer → consumer(s) → decomposer).

biodiversity loss: a decrease in the type, number and variety of ecosystems, species or genes.

climate change: the long-term, permanent shift in some or all aspects of weather conditions such as rainfall, temperature and atmospheric composition and conditions.

sustainability: meeting the needs of current and future generations through simultaneous environmental, social and economic adaptation and improvement.

EXTENDED NOTES

▪ Important components of an **ecosystem** include the soil, air, radiation from the sun, water and living organisms present in the environment.

▪ The Earth is composed of four spheres: the **atmosphere**, **hydrosphere**, **lithosphere** which make up the **biosphere**.

▪ A **biome** is a large area made of similar ecosystems.

▪ Climate is a significant factor that influences the location of biomes, therefore, climate change will alter the location and occurrence of these biomes.

▪ Biomes are most commonly identified by their dominant vegetation type, examples include: equatorial rainforests, grasslands and sclerophyll forests.

▪ Humans influence natural biomes; we have reshaped Earth's ecological patterns/ processes.

▪ Human activities have change biomes significantly; it can be argued that "natural biomes" do not exist.

▪ The distribution of biomes and vegetation are linked to temperatures and the amount of rainfall – a small change in temperature means a change in biodiversity and biome distribution.

▪ Biomes occur as 'broad belts' across the continents, corresponding to lines of latitude.

→ Desert biomes are usually distributed in the interior-western margins of a continent.

→ Tropical rainforests are located near equatorial regions (10^{o}N/S), this can be linked with the significant amount of heat and moisture in these regions.

[ECOLOGY] ECOSYSTEMS

▪ Ecosystems, more clinically defined, refer to a system through which incoming solar energy is captured and moved through a hierarchy of life forms.

▪ Ecosystems are characterised by complex interactions between abiotic and biological elements.

▪ An ecosystem features a set of processes by which nutrients are retained and recycled.

▪ The zone of transition between ecosystems is called an **ecotone**.

▪ All of the world's ecosystems are called the **ecosphere**.

▪ The **functioning of an ecosystem** refers to the ecosystem's ability to capture, store and transfer energy, water and nutrients.
▪ An ecosystem's functioning ability depends of two processes: energy flow and the nutrient cycle.
▪ No organism exists in isolation; organisms live together in an ecosystem and depend on each other for survival.
▪ Interactions can be localised such as the interrelationships between plants, animals, soils, topography and climate.

[ECOLOGY] ENERGY FLOW

autotroph/producer: an organism that makes its own food
consumer: an organism that cannot make its own food and relies on producers for energy
herbivore: a consumer that eats only plants
carnivore: a consumer that eats only flesh (ie. other animals)
decomposers: fungi and bacteria that break complex organic material into smaller molecules
trophic levels: the hierarchical levels of the food chain through which energy flows from primary producers to primary consumers, secondary consumers and so on
food chain: a community of organisms where each member is eaten in turn, by another
food web: a community of organisms where they are several interrelated food chains
biomass: a measure of the total dry mass of organisms within a particular region
▪ The sun is the principle source of energy for biological systems.
▪ Plants are producers and autotrophs; they absorb energy from the sun through photosynthesis.
▪ Energy flows in ecosystems through food chains or, more complex, food webs.
▪ Consumers are heterotrophs; these organisms obtain nutrients from other organisms.
▪ A food chain models the movement of energy through an ecosystem.

(sun → grass → grasshopper → mouse → owl)

▪ Less energy flows through trophic levels as it is lost through other processes (these include: respiration, growth, reproduction, defecation and non-predatory death).
▪ Higher order consumers have less numbers in a food chain because there is not enough energy to sustain a large population.

[ECOLOGY] BIODIVERSITY

keystone species: a species that influences the survival of many other species in an ecosystem
critical number: the minimum base population needed for a species to continue to exist
threatened: a species that could become endangered in the near future
endangered: a species at risk of extinction
extinct: a species that no longer has any known living individuals
▪ Biodiversity refers to the type, number and variety of living organisms within a given environment.
▪ There exists three levels of biodiversity: **genetic**, **species**, and **ecosystem** diversity.
→ Genetic diversity refers to the variety of genetic information contain within all plants and animals.
→ Species diversity refers to the variety of living organisms in an ecosystem.
→ Ecosystem diversity refers to the variety of habitats, communities and ecological processes.
▪ Ecological hotspots refer to areas with immense biodiversity.
▪ Biodiversity constantly changes: increased genetic variation, extinction rates and habitat degradation are examples of ways in which biodiversity may change.
▪ The concept of biodiversity emphasises the interconnections within the living world.
▪ Species diversity varies with longitude and latitude, altitude and depth.
▪ Biodiversity loss comes from fossil evidence in geological strata and fossil pollens contained in cores.
▪ The introduction of alien species can be detrimental to ecosystems (with economic costs) and can be classed as intentional or unintentional.
→ The introduction of foxes and rabbits in Australia was intentional.
→ The release of the North Pacific Sea-Star was unintentional.

▪ Natural climate change does exist; evidence can be found in ice cores.
▪ Interest in biodiversity has grown with the concern of nature conservation, a consequence of the accelerating rates of: natural habitat loss; habitat fragmentation and degradation; and extinction of species.
▪ Extinction can be natural (e.g. drought), or can be caused by anthropogenic reasons.
▪ Biodiversity losses occurs at various scales:
→ On a global scale, tropical rainforests;
→ The South-West of WA (considered one of the world's biodiversity hot spots);
→ Local biodiversity could be illustrated from the South-West (e.g. Carnaby's Cockatoo).

[ADVANCED GEOGRAPHY] ECOLOGICAL SERVICES

▪ Ecosystems provide ecological services include water, food, soil and shelter.

PROVISIONING	REGULATING	CULTURAL	SUPPORTING
▪ food ▪ medicine ▪ building materials ▪ timber ▪ fibre ▪ bioenergy	▪ filter water ▪ crop pollination ▪ waste decomposition ▪ regulation of climate and human disease	▪ recreation ▪ aesthetic ▪ spiritual	▪ photosynthesis ▪ nutrient cycles

EXTENDED DEFINITIONS

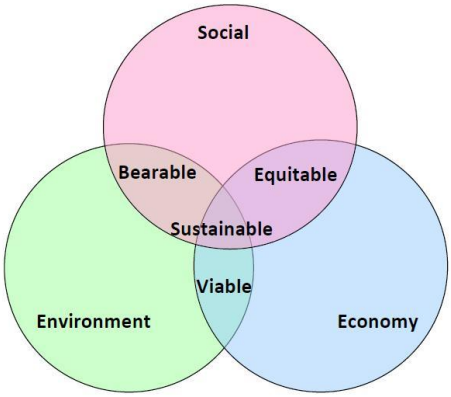
ecosystem balance: the state of dynamic equilibrium within an ecosystem in which genetic, species and ecosystem diversity remain relatively stable
▪ Pollution, migratory patterns and the rise of human population can disrupt this balance.
biota: the animal and plant life of a particular region, habitat, or geological period.
fire-climax ecosystem: ecosystems that are dependent on fire for reproduction and regeneration
net primary production: the energy/biomass available for consumption by heterotrophs
climate: the overall weather conditions in an area over a long period of time
microclimate: a climate within a small area that differs from the climate of its surrounds
landscape: a region that include several interacting ecosystems
biosphere: all life on Earth and where they exist, including land, water and the atmosphere
ecology: the scientific study of interactions among/between organisms and their environment
climax: the final stage of succession in which a community remains relatively unchanged (until destroyed by an event)
succession: a direction, non-seasonal cumulative change in the type of plant species occupying an area through time
bio-geochemical cycles: the flow of chemical elements and compounds between living organisms and the physical environment

SUSTAINABILITY

▪ Sustainability recognises the need to conserve and improve the Earth's resources:

i. have less impact on earth's ecological system;
ii. use resources effectively;
iii. promote the development of equitable societies.

▪ Sustainability is achieved by sustainable development.
▪ The triple bottom line (shown right) outlines the aspects for a sustainable development; to make situations bearable, equitable and viable are the three main goals of a sustainable practice.



COMPARING LAND COVER WITH LAND USE

Land cover refers to physical characteristics of the land's surface captured in the distribution of vegetation, water, soils etc. – including those created by human activities.

Land use refers to the way in which land is used by humans including its functional role of land for economic activities.

The concept of change is about explaining geographical phenomena by investigating how they have developed over time.

Land cover change falls into two categories: conversation and modification. Conservation is the preservation or efficient use of resources. Modification is the process in which a land cover changes (ie. is modified).

Land use change refers to a shift to different use or intensification of the existing one.

GLOBAL LAND COVER CHANGE

▪ People have changed all areas of the earth's surface.
▪ Land cover change occurs as a result of population growth and the need for food and shelter.

GLOBAL FORESTS

▪ Forests cover ~30% of the Earth's surface.
▪ Global forests are continuously being deforested.
→ the United Nation's Food and Agriculture Organisation estimates that 7.3 million hectares of forest is being loss per year.
→ projections forecast almost 50% of the Amazon could be lost by 2030.
▪ Global forest land cover has an important role on Earth:
→ provide oxygen;
→ absorb carbon dioxide;
→ regulate the Earth's temperature and weather patterns;
→ provide habitat for up to 80% of the world's terrestrial species.
▪ Loss in global forests could mean a loss in biodiversity, medicine and climate regulation.

[SYLLABUS] Identify and classify land cover change with reference to global forests.

Forests cover around 30 percent of the Earth's surface. However, forests are continuously being deforested at a rapid rate. Deforestation refers to the removal or clearing of forests, generally for other uses such as urban and agricultural development. Types of deforestation include fires, clear cutting, unstable logging (for timber) and degradation. It is estimated that 7.3 million hectares of forest is lost annually, which is set to increase.

URBAN LAND COVER

▪ Estimations of the amount of global urban land cover varies from <1% to 3%:
→ this variation occurs due to different definitions and interpretations of **urban land cover**;
→ the Global Rural Urban Mapping Project estimated total cover was 3% (2010);
→ US researchers estimated it is only 0.5 – 0.65% (2010).

▪ Though this is small, land required to support urban areas undergo total transformation, therefore, have a great influence on environmental change.
▪ 70% of people are expected to live in urban areas by 2050 (currently, it is 54%):
→ urban land cover is to triple by 2030 with an emphasis in LDCs (e.g. India and China).

AGRICULTURAL LAND COVER
▪ Agriculture can be categorised as either commercial (for profit) or subsistence (self-sufficiency).
▪ Agriculture involves the growing of crops and/or raising of livestock.
▪ Conversion of land for agriculture is common and is of concern:
→ 38% of the world's (54% in Australia) land is used for agricultural purposes;
→ ~18% more of the world's land is projected to convert for agricultural use (via deforestation).
▪ Changes in the nature of existing agricultural land have occurred:
→ intensification of agriculture occurs in Europe, North America, India and China;
→ vertical farming occurs in Singapore's "Sky Greens".

SPATIAL MODELLING
▪ Spatial modelling is used to predict future spatial relationships, based on past and present trends.
▪ Predictions are key to understanding potential impacts on ecological processes and human activities.
▪ Spatial modelling is used to project changes in land cover and incorporates environmental and socioeconomic variables.
→ environmentally, local biomes and ecological processes are taken into account as well as wider earth systems such as the heat budget, carbon cycle and climate systems.
→ socioeconomically, population growth and density, energy production and demand plus economic activity (local) as well as globalisation and economic interdependence (globally) are taken into account.
▪ **Scenario-based projections** aim to take into account many of the processes and factors driving land cover change:
→ the more complex and number of factors, the less certainty can be placed on predictions;
→ if many predicted scenarios exist, they are assigned a value indicating its likelihood of occurring at a given time (**quantitative measure**).
▪ Land use change models are often based on data from remote sensing and GIS (Geographical Information Systems).
▪ Maps, qualitative and quantitative measure are other ways to base a land use change model.

WORLD POPULATION, AFFLUENCE AND ADVANCES IN TECHNOLOGY
▪ World population growth can be predicted for the future:
→ currently, we grow at 140/minute;
→ world population is to increase to 9 billion (2050), whilst fertility rates will decrease.
▪ In 2007, the global urban population became larger than the rural population:
→ rural to urban migration;
→ reclassification of rural areas to urban areas (due to growth);
→ growth and expansion of urban areas.
▪ Three factors influence world population growth: longer life expectancy; declining fertility rates; and increasing population growth developing nations.
▪ Fertility rates decrease in countries when they become **affluent** (wealthy):
→ improved health care (ie. lower infant mortality rates)
→ increasing costs of raising children in wealthier countries;
→ increase education and workforce participation rates of women.
▪ Global wealth is not evenly distributed.
▪ The higher the level of wealth in a country, the higher the demand for resources and technologies:
→ diets in affluent countries demand for the expansion and intensification of agriculture (diary, meat);

→ **global displacement land use** trends mean wealthy countries rely on less wealth countries for production;
→ affluent countries can afford to reforest.
▪ The introduction and development of technology and machinery (ie. the Industrial Revolution) allowed for large scale production.

[SYLLABUS] Explain how world population growth, affluence and technology have had an impact on land cover change and a loss of biodiversity.

From the rise of industrialization, accelerated population growth and the consequent urban expansion in developed countries, a pattern emerged where affluence and 'technology hungry' populations worsened environmental quality. Word population growth, growing affluence and advances in technology impact on the nature, rate and extent of land cover change and potential biodiversity loss. For example, the human demand for biologically productive land will increase with the growth in population. The demand for fossil energy nitrogen and phosphorous as well as fresh water will impact on the use of land. Arable land is lost through desertification and or the encroachment of human settlement due to poor land management and climate change.

PROCESSES OF LAND COVER CHANGE

process	definition	reason/factors	examples
growth of urban settlement and urbanisation	the proportion of people living in urban areas.	▪ urban areas change the colour + smoothness of land, affecting climate (e.g. heat budget and water cycle). ▪ wind flow + air quality are affected and monitored by satellite technology.	
deforestation	the removal/clearing of forests for agriculture and development.	▪ due to exploitation to fuel economic growth and income.	primarily S-E Asia (lacking laws in environmental protection are the 'norm').
land reclamation	land is gained or created from the sea, wetlands or riverbeds		reclaimed land in Singapore and japan are used for industrial and port facilities
expansion and intensification of agriculture		▪ expansion of agriculture involves deforestation of valuable land. ▪ intensification of agriculture occurs by maximising output by adjusting labour, pesticides, technology etc. ▪ cheap land allows for farm expansion ▪ intensifying agricultural production allows for more land to be utilised.	palm oil production in Indonesia
land and soil degradation	the decline in the quality and health of natural land resources	▪ often due to deforestation, extensive agriculture. the rising water table, road construction, urbanisation. ▪ desertification occurs if continuous degradation in dryland ecosystems	
rangeland modification	lands where the native vegetation is predominantly grasses + shrubs	▪ introduction of weeds/exotic pests cause a threat to these ecosystems. ▪ modification occurs to aid agricultural purposes	Australian outback is example of rangelands

industry and mining		▪ mining is an important industry in Australia and is regulated ▪ land is cleared (expensive/expansive) ▪ threaten to river systems due to erosion (through extensive mining and mercury waste) ▪ land is cleared and not rehabilitated	Rio Tinto open up extensive mining sites, illegal gold mining occurs in Venezuela
irrigation	artificial method of watering plants for agriculture	▪ diversion of stream water and flooding areas occur ▪ issues of water rights	extensive irrigation occurs in Asia, India and Pakistan along Ganges + Indus rivers

FACTORS AFFECTING LAND COVER CHANGE – CHINA AND AUSTRALIA

▪ The type, rate and extent of land cover change will vary from country to country due to cultural, economic and governmental differences.

▪ Australia is described as a more developed country; China is a developing country.

AUSTRALIA	CHINA
Population size and density ▪ 7.7 million km^2 (6^{th} largest) ▪ population of 24 million: → 88.9% in urban areas.	**Population size and density** ▪ 9.6 million km2 (4^{th} largest) ▪ population of 1.4 billion → 57% in urban areas.
Economic world standing ▪ 12^{th} largest economy: → GDP/capita of $67458 USD (2013). ▪ reliant on agriculture and mining exports for income and job opportunities.	**Economic world standing** ▪ 2^{nd} largest economy: → low GDP/capita of $6807 USD (2013) ▪ property boom increase individual wealth, facilitating land use change for development.
Types of government and economy ▪ three types of government (local, state and federal) vary in their levels of responsibility: → prohibit further clearing of land; → must agree on change depending on scale. ▪ mixed market economy (ie. a mixture of capitalism and socialism). ▪ dominated by the services sector and mining + agricultural exports. ▪ intensive and extensive agriculture are carried out by individuals + corporations where income creation and profit is goal. ▪ rural and remote areas most at risk of change	**Type of government and economy** ▪ centralised, single-party government based around communist ideology. ▪ socialist and open market economy. ▪ transformation of land for development. ▪ land is needed due to large pop. and urban-isation rates: → agricultural production; → coal mining for power generation; → to create new urban areas. ▪ increase exports for wealth in main priority
Institutional arrangements + land ownership ▪ land can be privately bought, owned + sold ▪ land ownership + transactions recorded by state ▪ several acts/plants restrict land use change and protect native areas: → Environment Protection and Biodiversity Conservation Act 1999 → Aboriginal + Torres Strait Islander Protection Act	**Institutional arrangements and land ownership** ▪ private land ownership does not occur ▪ planned economy + communist ideology meant there was no housing market ▪ post-1978, reform and shift in ideology meant housing was a personal commodity ▪ rapid wealth led/leads to ecological problems ▪ problems were unchecked by the Ministry of Environmental protection until Jan 2015 where new laws allow for the prosecution of polluters and protection of natural areas.
Ideology and cultural views ▪ value of natural environment + outdoor lifestyle	**Ideology and cultural views**

▪ vocal opinions/comments of stakeholder groups ▪ environment impact studies are to be conducted + presented ▪ rehabilitations plans by groups such as Green-Peace + Planet Ark can influence cover rate/scale	▪ China has mixed opinions on environment ▪ the environment may be scarified for the betterment of human kind ▪ a change in ideology is currently occurring because of increased air pollutants

INDIGENOUS PEOPLE'S LAND MANAGEMENT

▪ Evidence suggests that the Aboriginal people had a complex system of land management.
▪ Aboriginal people ensured a cycle of supply/regrowth by hunting and gathering for immediate need.
▪ Aboriginal peoples used fire to create a sophisticated system of patchwork burnt and regrowth areas – fire was used to clear vegetation, promote plant growth and to flush animals out of burrows.
▪ "Caring for Country" includes Aboriginal practices, rituals and the seasonal use of resources and fire to achieve optimal environmental conditions.
▪ Traditional methods (e.g. firestick farming) combine with modern methods (e.g. biodiversity surveys).
▪ More example includes: the creation of seasonal harvesting calendars from traditional knowledge, mapping and tracking water resources and the retention of traditional knowledge for future generations.

IMPLICATIONS OF ANTHROPOGENIC BIOMES

▪ Anthropogenic biomes impact ecological balances existing in ecosystems prior to alteration.
▪ The flow of energy through food chains and webs alter as habitats are changed and removed.
▪ The increase, decrease and removal of species has flow on effect onto the rest of the ecosystem.
▪ Herbivores have depleted by encroaching anthropogenic biomes due to habitat destruction which limits their food supply (e.g. panda bears and bamboo grasses).
▪ Depletion of low order producers and consumers results in a decrease in high order consumers.
▪ Sub-Saharan Africa and South-East Asia are most at risk: the lack of economic resilience, rising population and a demanding natural capital (ie. products in forests/fisheries) impacts on biodiversity.

IMPACT OF LAND COVER CHANGE

▪ Land cover change impacts the water cycle, soil quality and erosion, habitat loss and biodiversity.
▪ It can degrade marine and aquatic environments, account for the loss of ecosystem services and explain changes to regional climates and urban heat islands.

LOSS OF ECOSYSTEM SERVICES

▪ Our management of anthropogenic biomes and, therefore, biodiversity and ecosystem services will determine the wellbeing of human kind.
▪ Ecosystem services are the benefits people and communities derive from an ecosystem including flood and disease control, food and water and cultural/spiritual services.
▪ Loss of invasion resistance (ie. foreign species invading native areas) and the lack of pollination of plants reduce the biodiversity of the area.
EX: Bees, which are essential to the pollination process, are required by fruits and vegetables. A reduction may result in a loss or depletion in plants.
▪ A loss of ecosystem services impacts on climate regulation.
EX: Forests provide carbon storage, enhance the albedo effect and play a significant role in evapo-transpiration. A loss of global forest may induce rising temperatures.
▪ A lack of marine diversity may impact on photosynthesis levels, the carbon and nitrogen cycles.
→ This would be particularly catastrophic for biodiversity hot spots such as the Busselton-Augusta area.

A loss of food security	***A loss of energy security***	***Difficulty in providing clean water***
A loss of social relations	**THE IMPLICATIONS OF BIODIVERSITY LOSS**	***A loss of freedom of choice***
Invasion by non-native species	***The lack of pollination of plants***	***An impact on climate regulation.***

CHANGES TO THE WATER CYCLE

▪ Damming increases the amount of evaporation and filtration in the area.
▪ Deforestation reduces evapotranspiration which, therefore, raises the water table.
▪ Any form of land cover change ultimately alters run-off, increasing erosion and sediment deposition.
▪ Irrigation depletes rivers and water tables and can potentially increase the nutrient levels in run-off areas (causing eutrophication).
▪ Any pollutants can change the nature of precipitation.
EXAMPLE: Acid rain, caused by high levels of sulphuric acid, has occurred in China and New York.
▪ An overuse of ground water for drinking, irrigation and industrial use has an impact on the water table.

SOIL EROSION AND DEGRADATION

▪ With greater demand for commodities such as palm oil, coffee, cotton, soybean and wheat comes the need for land cover change for agricultural expansion:
→ grasslands and forests become croplands;
→ increased pollution from fertilisers and pesticides decreases fertile land;
→ soil erosion, compaction, structure loss, salinity and degradation can occur.
▪ As a result of the mining process, waterways have been "clogged" by sediment and soils that are more prone to flooding (as they have lost their water retention qualities).
▪ The loss of arable land, clogged/polluted waterways and increased flooding are effects of soil erosion and degradation.

LOSS OF HABITAT AND BIODIVERSITY

▪ The impact of land cover change on loss of habitat at local and regional level refers mainly to deforestation and the degradation of forests.
▪ This has occurred due to: the expansion of agricultural land; increase in the demand for timber and other forest products; and overgrazing.
EX: Tropical rainforests are at risk of exploitation; they contain over 50% of the world's biodiversity.

BUSSELTON–AUGUSTA ECOSYSTEM

▪ The Busselton-Augusta ecosystem is known as a "biodiversity hotspot" because of the large amount of variety, number and type of living organisms in the area.
▪ This area contains many endemic species, making them particularly unique to Australia.
▪ The ecosystem is made of heathlands and shrubland found along the coastal plain which supports hundreds of different plant species and native invertebrates.

▪ In the south, (Jarrah, Karri and Marri) forests and woodlands provide habitats for a highly diverse range of plants and animals.
▪ Half of WA's native forests have been permanently cleared for agriculture, urban areas and dams.
▪ Loss of this habitat has resulted in a number of threatened and endangered species such as the Carnaby's Black Cockatoo, Chuditch and Brush-tailed Phascogale.
▪ Endemic to WA, aquatic invertebrates are under threat as cave systems are subject to shifts in groundwater movement.

CASE STUDY: PHYTOPHTHORA DIEBACK
▪ Phytophthora Dieback impacts the loss of habitat/biodiversity in the Busselton-Augusta ecosystem.
▪ Dieback is a plant disease caused by microscopic soil borne pathogens which feed on the roots of plants, causing root-rot in susceptible species and eventual death.
▪ Plant death occurs because plants cannot take up the water and nutrients they need for survival.
→ 40% of WA native plant species are susceptible to dieback
▪ The pathogen spreads due to human activities involved with land cover change – such as road construction and earth moving.
→ 20% of WA's Jarrah forest is currently infected with this pathogen.

DEGRADATION AND AQUATIC MARINE ENVIRONMENTS
▪ The quality of the watershed areas and run-off into oceans has an impact on aquatic and marine life.
▪ Pollution is a major issue; chemicals and effluent cause damage to habitats and animals.
▪ Eutrophication occurs when excess nutrients enter water courses and cause an algal bloom.
▪ Algal bloom reduces oxygen in the water, therefore, fish and other marine life dies.
▪ Ocean acidification an occur as a result of the dramatic rise in carbon dioxide levels in the atmosphere.
→ In order to absorb excess CO_2, water becomes acidic (ie. pH levels decrease) – this harms marine life.
▪ Damming stops the normal flow of sediment from flowing down rivers and streams which, in turn, affects physical processes and habitats.
EX: Damming changes water temperature and level of nutrients, which can have far-reaching effects. For example, sediment and nutrients from the Congo River can provide a carbon sink for atmospheric gases in the Atlantic Ocean. They replace fast moving water with slow moving water so that mosquito borne diseases can proliferate and, in case of China's Three Dam Project, they will require people to resettle which creates a whole new land cover change.

CHANGES TO REGIONAL CLIMATES
▪ The urban heat island effect refers to the warming of temperatures due to urban areas.
▪ In urban areas, temperatures during the day are likely to be higher as a result of the materials used to build urban areas, whereas rural areas are likely to have lower mean temperatures as there is less urban structures and more reflective surfaces (ie. the albedo effect).

URBAN HEAT ISLANDS
▪ Urban heat islands are caused by the removal of natural surfaces (which absorb and use a greater level of heat) and the establishment of a built environment (which use materials that are non-reflective and water resistant – radiating more heat).
EXAMPLE: In the downtown areas, the average temperature during the day and night is around 32.8 degrees whilst the rural areas have an average temperature of 29.4 degrees.