LHS

Social Science + LoTE Faculty

10 GEO

TOPIC 1: ENVIRONMENTAL CHANGE AND MANAGEMENT

NAME:

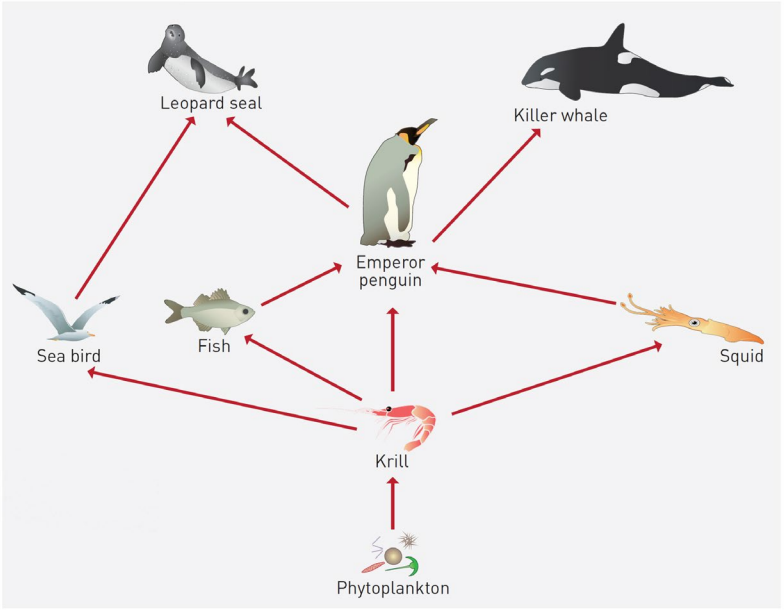
CLASS:

ROLE AND IMPORTANCE OF NATURAL ENVIRONMENTS

An environment is the interrelationship between its living components (biotic) and its nonliving components (abiotic).

The biotic components of an environment include all of the plants (flora) and animals (fauna); it also includes fungi and bacteria, including those found in soil.

The abiotic components of an environment include temperature, rainfall, humidity, wind speed and direction, the non-living part of the soil such as sand, and clay and rock.



Source 5.2 This Antarctic food web is an example of a simple food web.

An ecosystem is the living organisms within a community and the non-living components of the environment in which they live.

The living and non-living components are linked to each other through the flow of energy involved in food chains and food webs.

Each food chain is one possible path that energy and nutrients may take as they move through the ecosystem.

QUESTIONS

1. Choose three environments and answer the questions below:

   A. List the biotic and abiotic factors found in these environments.

Environment	Biotic factor	Abiotic factors

B. Draw the food chains for these environments.

Environment 1:	
Environment 2:	
Environment 3:	

2. Define the difference between food chains and food webs.

3. List the disruptions to a food chain / web.

4. Outline the consequences of these disruptions.

5. Describe the role of a producer, consumer, and decomposers in food webs.

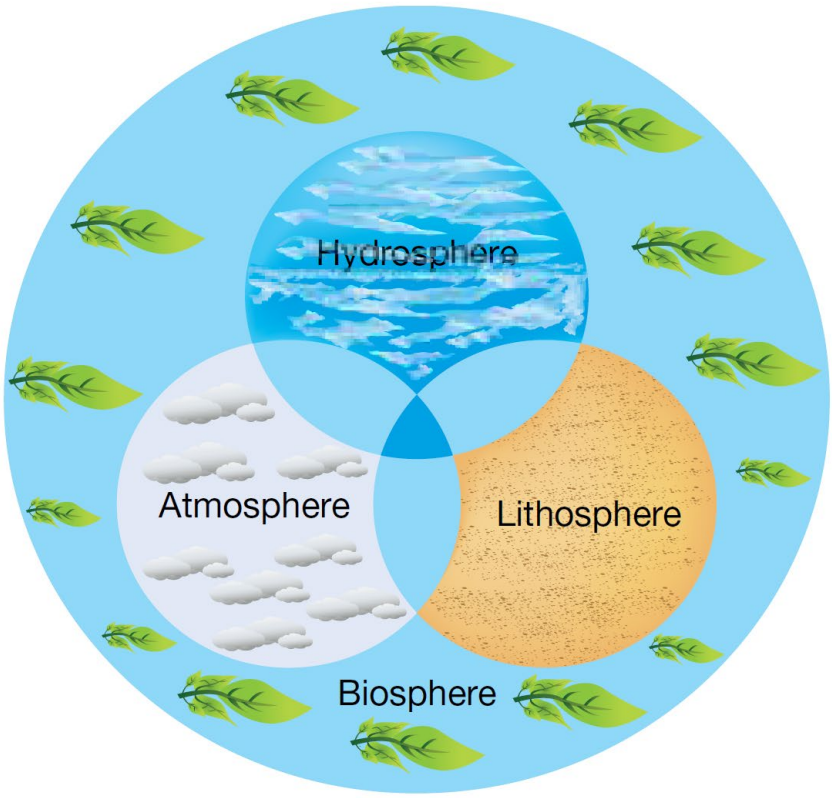
HOW DO ENVIRONMENTS FUNCTION?

The four spheres of the environment are the atmosphere, lithosphere, hydrosphere and biosphere.

- The atmosphere is the layer of gases enveloping the Earth.
- The lithosphere is all the rocks, soils and crust on the Earth's surface.
- The hydrosphere is all the water on Earth including in the oceans, lakes, rivers and glaciers.
- The biosphere is all living things on Earth, such as plants and animals.

Places and environments are formed and transformed by a range of natural geographic processes and influences related to each sphere.

FIGURE 1 The interaction of the four spheres of the environment



Processes in the environment

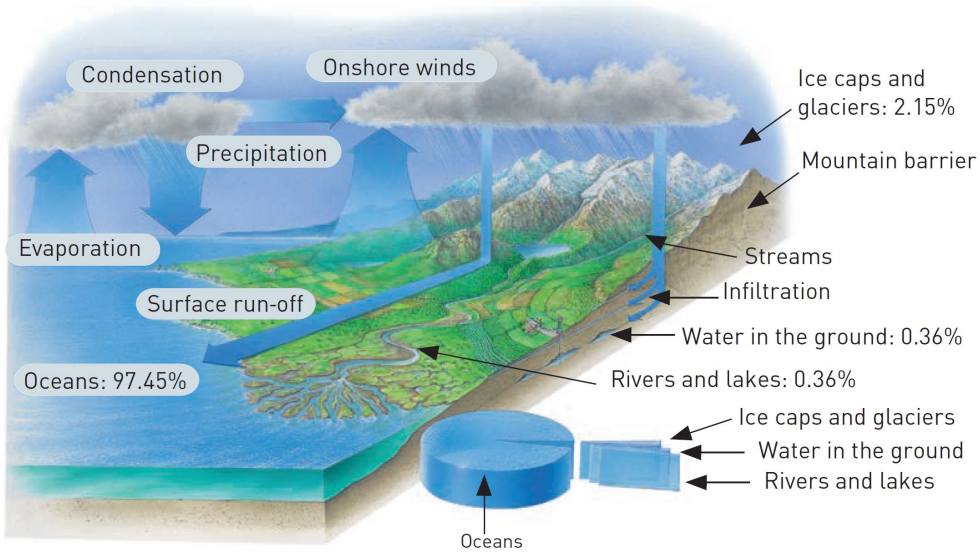
TABLE 1 Geographical processes that form and transform environments

Biospheric processes	Lithospheric processes	Hydrospheric processes	Atmospheric processes
		Carbon cycle	
Oxygen cycle Food chains Photosynthesis Evolution Extinction Migration	Erosion Weathering Nitrogen and phosphorous cycle Tectonic processes	Precipitation Infiltration Runoff Evaporation Transpiration Condensation Transportation Deposition	Carbon cycle Absorption (light) Reflection (light) Scattering (light) Aeolian (winds) Transportation Deposition

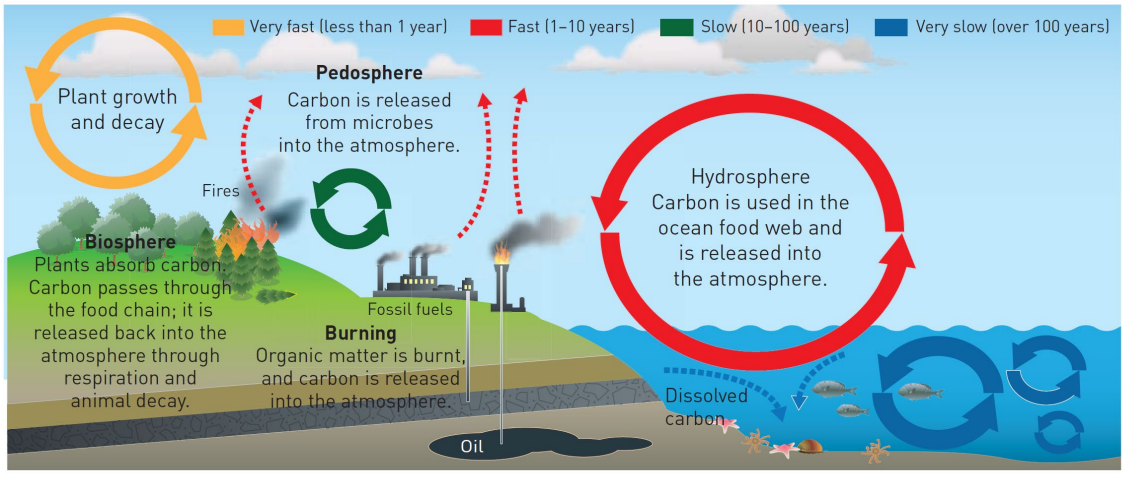
The Earth has a number of physical processes that help sustain life on Earth. These include the hydrological cycle (or water cycle), the carbon cycle and the oxygen cycle.

QUESTIONS

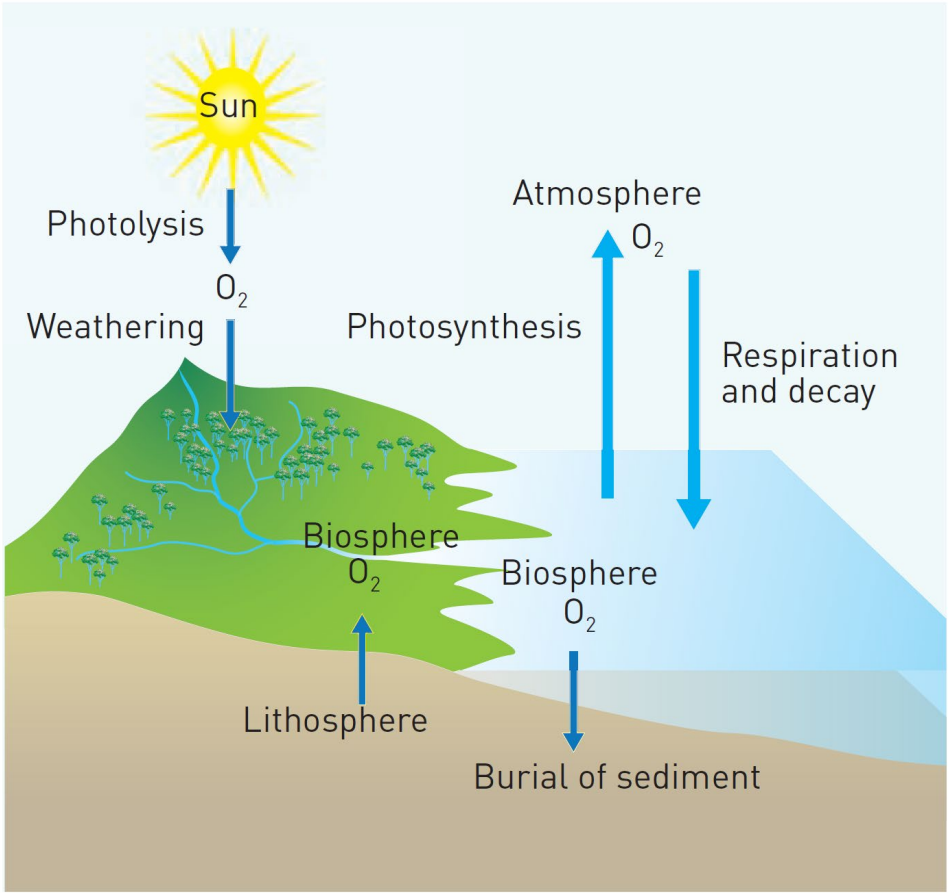
1. Use the attached diagrams to explain how the processes in the environment operate *(i.e. describe the processes that are shown in each diagram and describe how they operate.)*



Source 5.7 The distribution of water on Earth and the hydrological cycle



Source 5.8 The carbon cycle



Source 5.9 The oxygen cycle

LITHOSPHERIC PROCESSES – QUESTIONS

1. Define the following terms and explain how they impact on the environment:

    a) Erosion

    b) Weathering

    c) Deposition

2. What are tectonic processes?

3. Use the following videos to answer the following questions:

https://www.youtube.com/watch?v=kwfNGatxUJI

https://www.youtube.com/watch?v=RA2-Vc4PIOY

https://www.youtube.com/watch?v=zbtAXW-2nz0

https://www.youtube.com/watch?v=3sd6vQA3yws

a) What are plate tectonics?

b) How does plate tectonics work?

c) What types of landforms and landscapes are created by these processes?

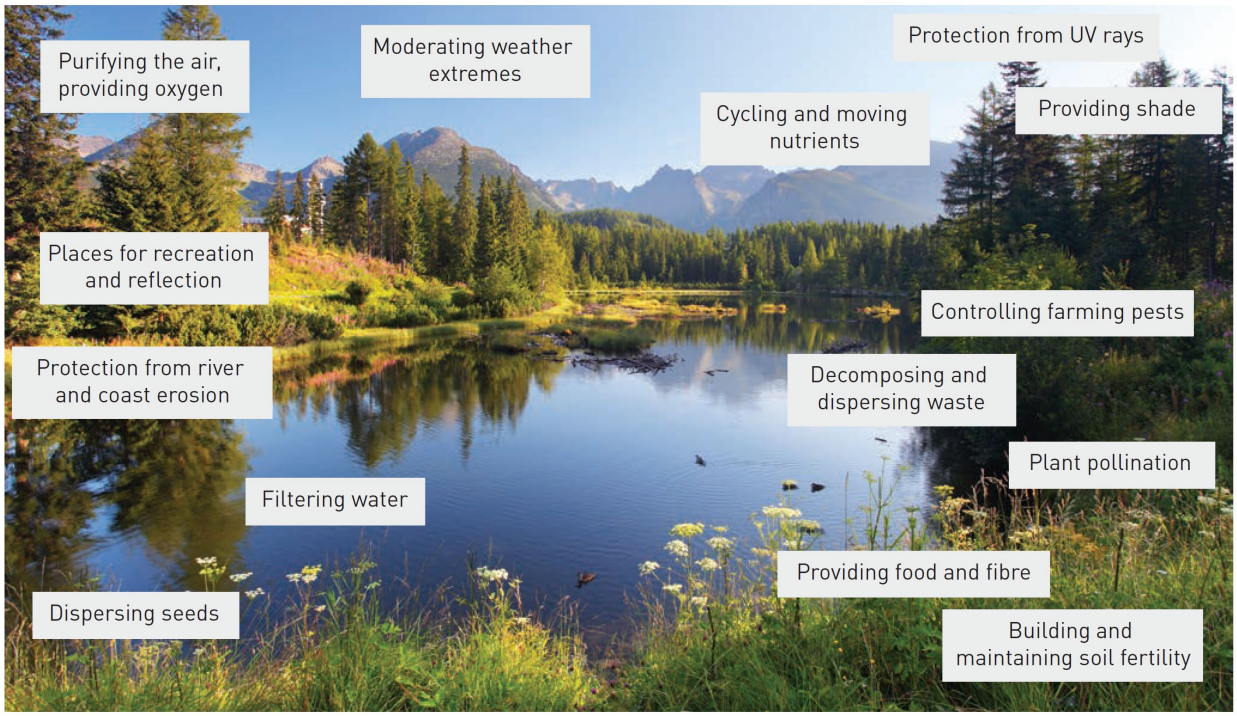
d) What are the types of plate boundaries are there and what do they create when they move?

e) Draw diagrams representing the different plate movements.

FUNCTIONS OF OUR ENVIRONMENT

Ecosystem services can be classified according to the products they provide and the functions they perform. There are four main classifications:

- Sources (also called provisioning services) are those natural products that can be used or converted by humans for our use. For example, mineral deposits such as coal, which we turn into fuel, iron ore, which we use in manufacturing, timber from natural forests, and food sources – from plant crops to deep-sea fish.
- Sinks (also called regulating services) are those processes in the natural environment that absorb our waste. For example, micro-organisms in oceans break down oil spills. In a similar way, bacteria in the soil break down human waste.
- Services (also called supporting services) are things that are done for us by the natural environment that don't produce consumable resources. For example, wetlands filter water and slow floodwaters. Forests absorb carbon dioxide and produce oxygen.
- The environment also has a spiritual function for many people. For some, this is a deep connection to the land formed over many generations. For example, the connection that Indigenous Australians have with their tribal lands. For others, it is the experience of spending time in the natural environment and the sense of wellbeing that this brings. For example, people taking part in activities such as surfing and bushwalking often feel a deep connection with the environment. This can also be referred to as cultural services.



Source 6.2 Some of the ecosystem services provided by the environment

BIODIVERSITY QUESTIONS

1. Define the term biodiversity.

2. What are the biological resources, ecosystem services, and social benefits of biodiversity?

3. Why is biodiversity important in an ecosystem?

4. Outline how loss of biodiversity is occurring.

5. Describe how humans use the environment.

6. Explain how the fishing industry and world fish production can be harmful to the environment.

7. Define what climate change is and what causes it using the diagram below to help you.

Source 6.15 Some of the causes of human-induced climate change

8. Explain the benefits of global warming, and the costs of human induced climate change.

9. Describe how the environment has responded to climate change.

10. Research the Saami people of northern Scandinavia. Outline how climate change has affected them.

11. Describe the causes of air, water and land pollution, and the impacts of these on the environment.

HUMAN-INDUCED ENVIRONMENTAL CHANGE

There are many human activities that change the environment. Some of these are positive but many of our activities have a negative impact. Such activities degrade resources and threaten our capacity to achieve sustainability.

The most common human-induced changes are summarised in the table below.

Human activity	Immediate impacts	Short- to medium-term impacts	Long-term impacts
Emission of carbon dioxide	An increase in carbon dioxide in the atmosphere	Quality of air decreases; amount of carbon dioxide in air increases	Carbon dioxide traps reflected heat from the Earth's surface, warming the planet (global warming)
Deforestation	Loss of vegetation cover; increase in run-off; loss of habitat	Soil erosion and soil salinisation; degradation of streams through sedimentation and high turbidity	Reduced environmental quality for humans, plants and animals; desertification; reduced biodiversity
Manufacturing and heavy industry	Contamination of soil, air and water; noise pollution; loss or degradation of cultural sites	Degraded habitats; accumulation of toxins in plants and animals; increase in acute diseases	Climate change; reduced biodiversity; extinction of species; increase in chronic diseases
Impoundment of water (dams and weirs)	Reduced river flows; degradation of water quality; changes in flood regimes; inability of fish to migrate	Erosion of downstream river; 'river chilling' from cold water releases; habitat degradation; reduced recruitment of aquatic organisms; reduced nutrient levels in flood plain soils	Loss of fish and other aquatic organisms; reduced productivity of agricultural land
Mining	Habitat loss or fragmentation; loss or contamination of groundwater resources	Weed infestation; reduced natural food resources; soil acidification and salinisation	Loss of biodiversity; low agricultural productivity; land subsidence
Overfishing and harmful fishing practices	Loss of breeding population; damage to habitat	Habitat degradation; loss of seagrasses and coral; changes in food chain; changes in biodiversity	Extinction of species; reduced number of fish populations; changes in food web; loss of recreational and commercial fisheries and destruction of marine and freshwater systems
Urbanisation	Increased run-off; decreased infiltration; contamination of soil, air and water; stakeholder conflicts	Loss or degradation of habitat; downstream pollution of rivers; increase in invasive species; fragmented habitats	Extinction of species; loss of biodiversity; reduced food resources
Agriculture	Loss of natural vegetation; increased run-off; increased soil erosion; pollution of waterways	Habitat fragmentation; loss of habitat; sedimentation in nearby streams; water quality degradation in downstream areas	Reduction of biodiversity; chronic soil salinisation

Source 12.2 Some of the most common human-induced environmental changes

QUESTIONS

1. List the activities that would cause environmental damage.

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_____

_____

_____

_____

2. Create a mind-map showing the links between human activities and resulting impacts.

3. Complete the following table:

ISSUE	DEFINITION	CAUSES OF ISSUE	IMPACTS	IMAGE
Land degradation				
Soil degradation / salinity				
Soil erosion				

Ecosystem decline				
Invasive species				
Water degradation				

4. Describe how environments can change at different scales.

WATER DEGRADATION IN THE MURRAY-DARLING BASIN

The Murray–Darling Basin is one of Australia's most important resources. Home to more than two million people, it produces one-third of Australia's food. It also generates 39percent of Australia's income, raised from selling food and fibre overseas. This includes more than half of Australia's cereals, including all of its rice and virtually all of its oranges.

Source 6.46 Salty water seeps from the ground into streams and lakes near Loxton, South Australia.

Many farmers capture rainwater in dams and use it to irrigate their crops and fields but rainfall in the basin is highly variable. If additional water is needed for irrigation it is drawn from the rivers feeding the basin. Farming, along with the basin-wide clearing of natural vegetation, has led to widespread salinity problems in the soil and water resources of the region.

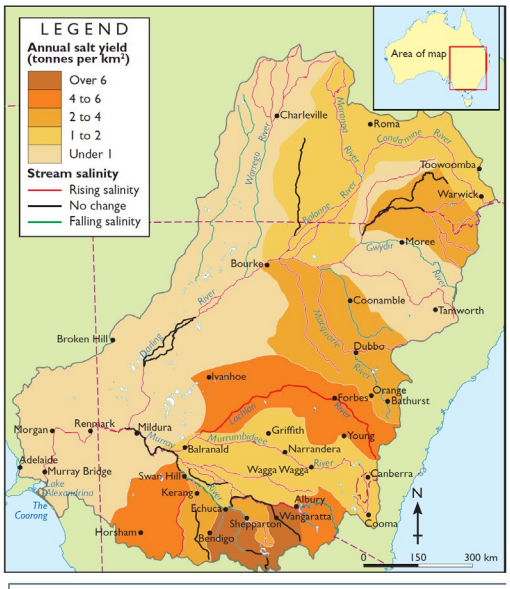
While the amount of salt in the basin is not increasing, it is becoming more concentrated in certain areas. Brought to the surface by the impact of human activities, it is moving into the streams and rivers. As the salt levels increase, natural ecosystems are placed under stress and cannot cope.

Salt-sensitive plants and animals are dying and are being replaced by plants that flourish in the increasing salinity, changing the ecology of the rivers. Human activities are being affected too. The water is becoming less suitable for domestic uses such as drinking and cleaning, and cannot be used to irrigate crops and pastures. The salty water also corrodes the metal pipes the water is transported in.

As salt is moved downstream, areas nearer to the mouth of the river are becoming even saltier. In the irrigation regions of northern Victoria, areas of rising water tables are predicted to triple in the next 50 years, bringing more salt to the surface and into the tributaries of the Murray River.

Without efforts to remove salt from the system, river salinity at the town of Morgan is expected to increase by 25 per cent in the same time period.

MURRAY–DARLING BASIN: MOVEMENT OF SALT TO THE SURFACE



Source 6.47 Source: Oxford University Press

Managing salinity in the Murray– Darling Basin

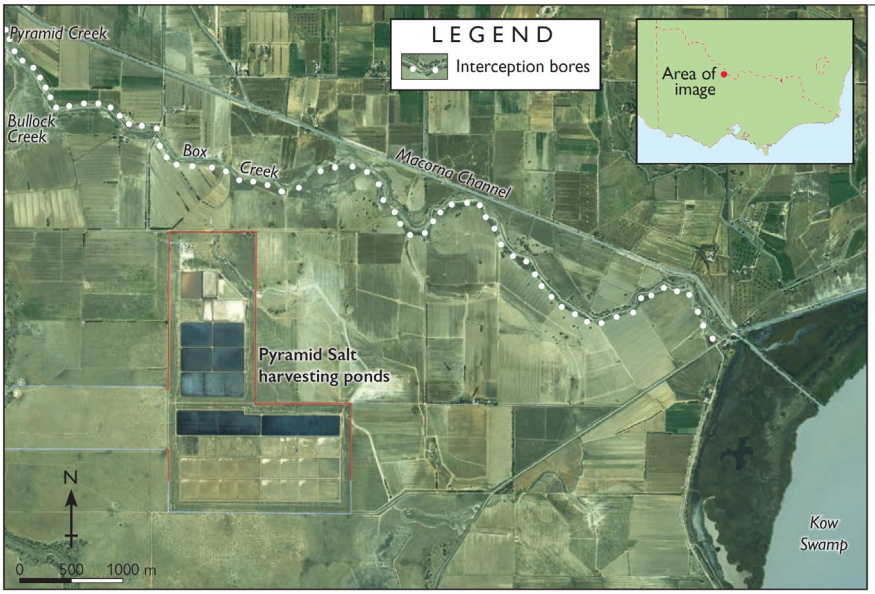
There has been a range of responses to the issue of salinity in the Murray–Darling Basin, some at the local scale and others at the regional scale. The effectiveness of these management responses has differed from place to place, however, and in some instances the response has created new problems. Two main approaches to salinity management in the basin are currently being used. One approach is to improve farming systems so that farmers use less water. Another approach is the use of salt interception schemes.

Salt interception in Pyramid Creek

At 17 places along the Murray River, salty water is pumped from the ground and carried to a basin (known as a salt management basin) before it can flow into a river or stream.

The salt management basin is often lined with sheets of plastic so the salt is trapped. It is estimated that these schemes stop half a million tonnes of salt entering the river system. One such scheme operates at Pyramid Creek near the town of Kerang in northern Victoria (Source 6.48). Salt from this scheme is harvested by a private company, Pyramid Salt, and is sold for use as table salt and swimming-pool salt. The company expects to harvest 36 000 tonnes of salt per year under the scheme.

PYRAMID CREEK: SALT INTERCEPTION SCHEME



Source 6.48 Satellite image of Pyramid Creek near the town of Kerang, northern Victoria, and the Pyramid Salt company with their salt harvesting ponds

QUESTIONS

1 Explain why stream salinity is a major problem in the Murray–Darling Basin despite the total amount of salt in the region staying relatively constant.

2 Describe the impacts of salinity shown in Source 6.46.

3 Examine Source 6.47.

a Which regions of the Murray–Darling Basin produce the most salt?

b Why do you think this might be the case?

c List the rivers in the Murray–Darling Basin that have rising salinity.

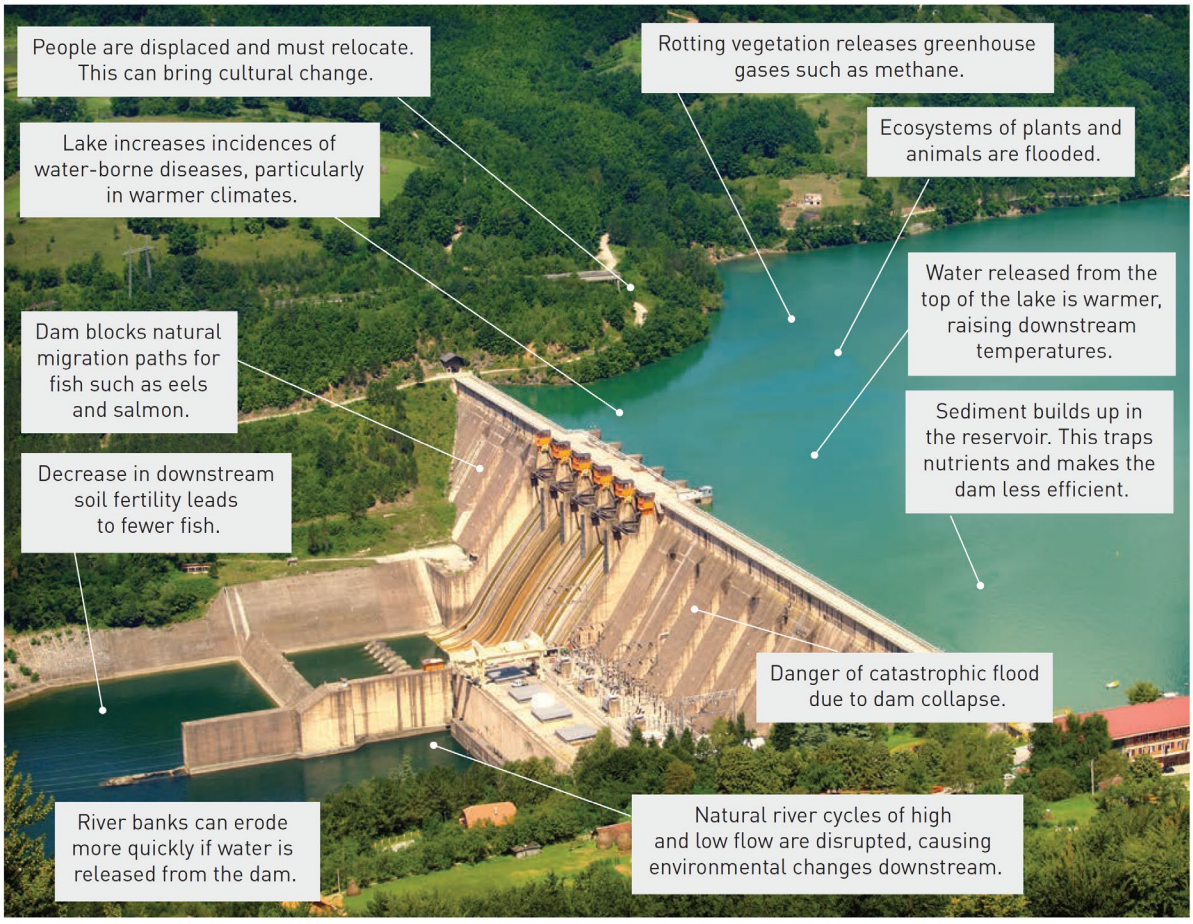
4 The managers of the Pyramid Creek salt interception scheme believe that incorporating salt harvesting helps to make the scheme more sustainable. What do you think this means?

DAMMING THE RIVERS

There are many human activities that bring environmental change to streams and rivers but perhaps the most dramatic of these is building a dam across a river. One of the main reasons' dams are built is to allow a reservoir of water to build up behind the dam, which can then be used for the irrigation of farms, a reliable water supply for towns and cities, flood control and recreation. The energy of the moving water can also be captured behind the dam, and when released through pipes and turbines inside the dam can be used to generate electricity.

This type of electricity (hydroelectricity) provides a cleaner alternative to other methods of power generation such as coal and oil burning. As international pressure mounts to reduce carbon emissions, more and more dams are being built across fast-owing rivers all over the world. Generally speaking, the bigger the dam, the greater the amount of electricity it can generate. Big dams (over 15 metres high) are now considered the most efficient. There are more than 50 000 big dams in the world, half of which are in China, where there are 1600 more under construction. China is by far the world's leading hydroelectricity generator and is home to the Three Gorges Dam, the largest dam in the world.

While big dams bring many benefits, they can also create problems for the environment. Source 6.49 shows some of the human and environmental impacts of damming a fast-flowing river.



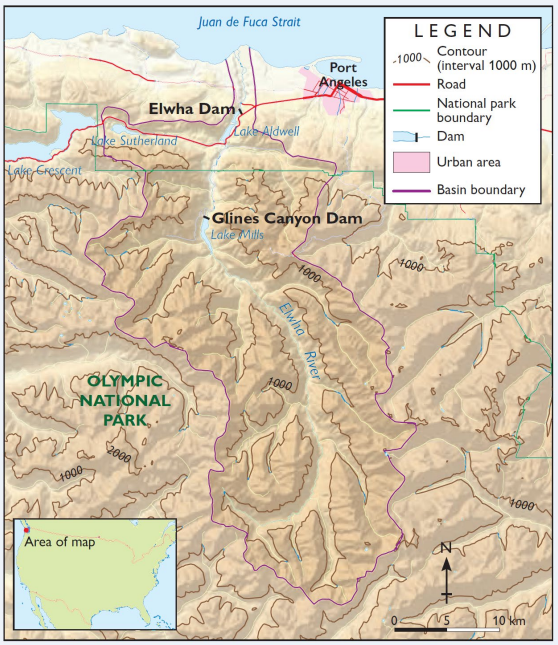
Source 6.49 Some of the human and environmental impacts of damming rivers

The world's largest river restoration project

While much of the world seems engaged in a dam-building frenzy, in the north-western United States two large dams are being torn down piece by piece. For nearly 100 years there have been hydroelectricity dams on the Elwha River in Washington State, but in 2011 excavators mounted on barges began dismantling them.

Most of the Elwha River runs through the Olympic National Park. Studies on the impact of the dams found that natural ecosystems had significantly declined in quality and capacity as a result of the dams. The greatest impact was on the Chinook salmon, whose migration route to spawning rivers had been blocked. This resulted in a 70 per cent decrease in spawning sites (where salmon reproduce). This then affected river fertility and reduced the amount of food available to wildlife such as bears in the national park. By removing the dams, it is hoped that the natural ecosystems will be restored.

ELWHA RIVER: FORMER LOCATIONS OF THE ELWHA RIVER DAM AND THE GLINES CANYON DAM



Source 6.50

Source 6.51 The 64-metre-high Glines Canyon dam partially removed in March 2012

QUESTIONS

1 Why are many fast-flowing rivers dammed?

2 Why has the Glines Canyon dam been removed?

3 Most of the world's big dams are in China. Brainstorm the factors that may be responsible for this.

4 Examine Source 6.50.

a Describe the location of the dams on the Elwha River.

b Estimate the length of this river and the area of its catchment.

c Why is it important to consider the whole catchment rather than just the river when analysing the impact of a dam?

5 Source 6.49 shows some of the negative impacts of dams. List a dam's potential positive impacts on people and the environment.

6 Create an argument for or against the following: 'Despite their negative impacts, dams are beneficial to people and the environment.' (at least 2 paragraphs).

POLLUTANTS IN OUR WATER

Source 6.52 An estimated 100 million tonnes of mining waste was discharged into the Queen River in Tasmania between 1893 and 1995, giving it the reputation as Australia's most polluted river.

More than one billion people around the world today lack access to safe drinking water. This is due to many factors, one of which is the contamination of freshwater sources such as rivers, streams and groundwater with harmful substances. As well as making water unsafe to drink, pollutants reduce the ability of the environment to provide other ecosystem services such as food supply, pest control and recreation.

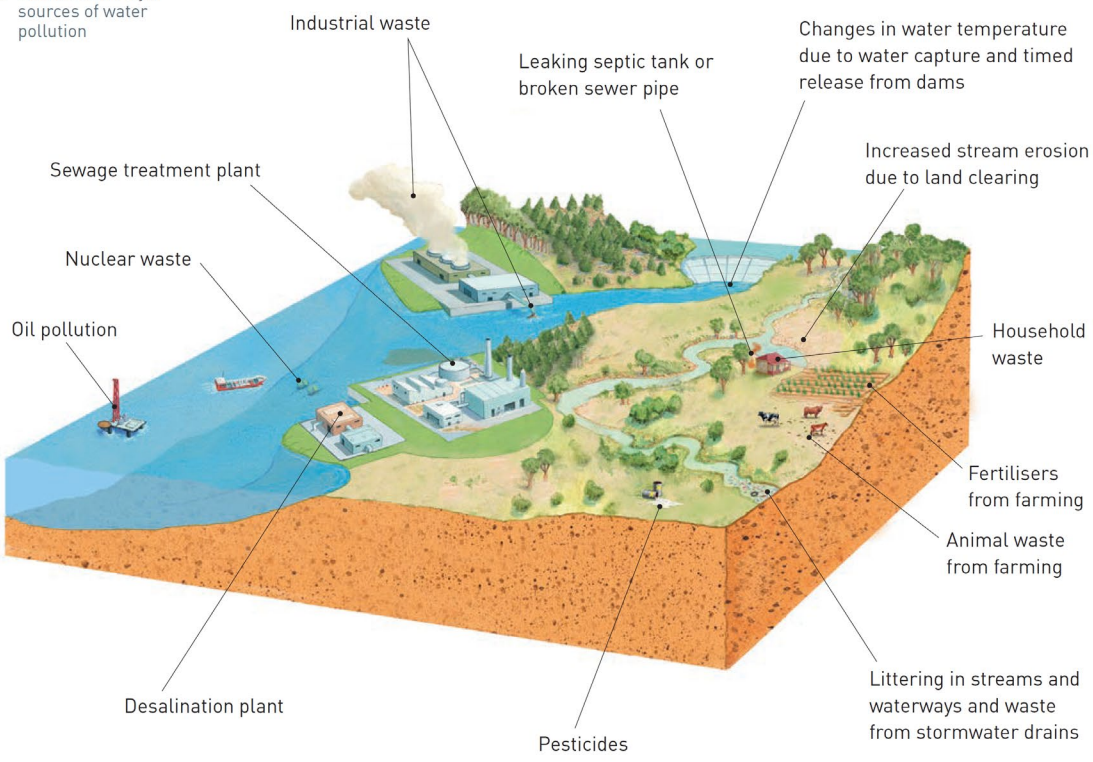
Pollutants that enter our waters can be classified as either physical, chemical or biological.

Physical pollutants

Physical pollutants include particles of soil eroded from the landscape and washed into the waterways and any litter such as plastic bags, cigarette butts, shopping trolleys and tyres. It is estimated, for example, that more than seven billion cigarette butts are littered in Australia each year. Many of these end up washed into drains and carried to streams and coasts where they release chemicals and present a danger to marine life and sea birds.

Soil washing into the waterways is a major source of pollution. These particles of soil can make water cloudy and prevent sunlight entering the water, affecting the plants and animals. When the sediment settles, it can smother small animals and plants living in the water. These sediment particles may also have other substances bound to them such as chemicals and bacteria that can cause pollution.

Source 6.53 Major sources of water pollution



The Ganges River

Source 6.54 Around two million people a day bathe in the Ganges River, one of the world's most polluted rivers.

One of the world's most polluted rivers is the Ganges River of India. An estimated 2900 million litres of sewage is emptied into the river every day, creating a toxic river. In addition, the river is used to dispose of medical waste, dead bodies and waste from tanneries (where leather is made from animal skins) and other factories. A count of harmful bacteria in the river found levels 100 times higher than those considered safe for human use. Millions of people rely on the water of the Ganges for drinking, bathing and cleaning, as well as for its spiritual significance.

Chemical pollutants

Chemical pollutants include heavy metals, oils, pesticides, industrial chemicals and salt. When the concentration of chemicals in waterways reaches levels that are above natural levels it causes pollution. For example, too much of a naturally occurring plant nutrient changes the chemical balance of water, causing excessive plant and algae growth.

Biological pollutants

Biological pollutants include bacteria, parasites and invasive plants and animals. Biological pollutants come from a range of sources including sewage treatment plants, farms, factories and storm water. They can cause harm to other plants and animals in the water, or cause harm to people who drink the water. Bacterial and parasitical pollution such as giardia in the water is usually spread by human and animal waste entering waterways, causing illness.

QUESTIONS

1 What are the three main types of water pollution?

_____

_____

_____

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_____

2 Which of these is the main source of pollutants in the Ganges River?

_____

_____

_____

3 Examine Source 6.53, showing some of the main sources of water pollution. Classify each of these as physical, chemical or biological.

4 Besides water pollution, what other environmental impacts of mining can you identify in Source 6.52, showing the Queen River valley? How might these also contribute to water pollution?

5 There have been several government attempts to reduce pollution in the Ganges River but these have been largely ineffective. Outline some possible reasons for this.

6 The United Nations considers these 10 rivers to be the most 'at risk': Salween-Nu, Danube, La Plata, Rio Grande, Ganges, Indus, Nile, Murray–Darling, Mekong and Yangtze.

a Locate each of these rivers on the world map and describe their distribution.

b Select one of these rivers and research the problems it faces.