UNIT 1 LANDFORMS AND LANDSCAPES

TOPIC 2
Introducing landforms and landscapes

2.1 Overview
Numerous videos and interactivities are embedded just where you need them, at the point of learning, in your learnON title at www.jacplus.com.au. They will help you to learn the content and concepts covered in this topic.

2.1.1 Introduction
Landscapes are the visible features of the land, ranging from the icy landscapes of polar regions and lofty mountain ranges, through to forests, deserts and coastal plains. Shaped by physical processes over millions of years, they have been overlaid by the presence of humans.
2.2 How are landscapes different?

2.2.1 Types of landscapes

There are many different landscapes across the Earth, and similarities can be observed within regions. Variations in landscapes are influenced by factors such as climate; geographical features, including mountains and rivers; latitude; the impact of humans; and where the landscapes are located.

**FIGURE 1** Selected world landscapes.
1 Mountains
Mountains rise above the surrounding landscape. They often have steep sides and high peaks and are the result of processes operating deep inside the Earth. Some reach high into the atmosphere where it is so cold that snow is found on their peaks.

2 Deserts
Deserts are areas of low rainfall; they are an arid or dry environment. They can experience temperature extremes: hot by day and freezing at night. However, not all deserts are hot. Antarctica is the world’s largest desert, and the Gobi Desert, located on a high plateau in Asia, is also a cold desert.

3 Rainforests
Rainforests are the most diverse landscapes on Earth. They are found in a variety of climates, ranging from the hot wet tropics to the cooler temperate areas. The lush vegetation found in these regions depends on a high level of rainfall. Over 50 per cent of all known plant and animal species are found within them. In addition, many of our foods and medicines come from rainforests.

4 Grasslands
Grasslands, or savanna, are sometimes seen as a transitional landscape found between forests and deserts. They contain grasses of varying heights and coarseness, and small or widely spaced trees. They are often inhabited by grazing animals.

5 Polar regions
Polar regions and tundra can be found in polar and alpine regions. Characterised by permafrost, they are too cold for trees to grow. Vegetation such as dwarf shrubs, grasses and lichens have adapted to the extreme cold and short growing season. Glaciers often carve spectacular landscape features.

6 Karst landscapes
Karst landscapes form when mildly acidic water flows over soluble rock such as limestone. Small fractures form, which increase in size over time and lead to underground drainage systems developing. Common landforms include limestone pavements, disappearing rivers, reappearing springs, sinkholes, caves and karst mountains. Around 25 per cent of the world’s population obtains water from karst aquifers.

7 Aquatic landscapes
Aquatic landscapes cover around three-quarters of the Earth and can be classified as freshwater or marine. Marine landscapes are the saltwater regions of the world, and include oceans and coral reefs. Freshwater landscapes are found on land, and include lakes, rivers and wetlands.

8 Islands
Islands are areas of land that are completely surrounded by water. They can be continental or oceanic. Continental islands lie on a continental shelf — an extension of a continent that is submerged beneath the sea.
Oceanic islands rise from the ocean floor and are generally volcanic in origin. A group or chain of islands is known as an archipelago.

9 Built landscapes
Human or built landscapes are those that have been altered or created by humans.

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2.2 Activities
To answer questions online and to receive immediate feedback and sample responses for every question, go to your learnON title at www.jacplus.com.au. Note: Question numbers may vary slightly.

Remember
1. Explain the difference between the terms natural and built environment.
2. What factors make landscapes different?
3. List as many different human or built environments as you can think of.

Explain
4. Why do you think people change landscapes?

Discover
5. The map in figure 1 shows the wide variety of landscapes found on the surface of the Earth. However, it does not show all locations for each landscape type. Investigate one of the featured landscapes and find out other places in which it is found. Show this information on a map. Annotate your map with information from this subtopic and characteristics of your landscape.

Think
6. Copy the following table into your workbook.
   (a) Select one of the landscape types described in this subtopic and complete the table.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>How people use it</th>
<th>Positive impacts</th>
<th>Negative impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

(b) Which list is larger — the positive impacts or negative impacts?
(c) Review the column of negative impacts. Select three of these impacts and suggest a way in which the environment could be used in a more sustainable way.
7. Describe how the scale of the following landscapes might differ around the world: deserts, polar regions, aquatic landscapes and islands.

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learnON RESOURCES — ONLINE ONLY

Try out this interactivity: Landscapes galore: Use this interactivity to learn about the variety of landscapes that are around us.
Searchlight ID: int-3102

Deepen your understanding of this topic with related case studies and questions:
- Grasslands
2.3 What landforms make up Australia?

2.3.1 What processes have shaped Australasia?

The tectonic forces of folding, faulting and volcanic activity have created many of Australia’s major landforms. Other forces that work on the surface of Australia, and give our landforms their present appearance, are weathering, mass movement, erosion and deposition.

Australia is an ancient landmass. The Earth is about 4600 million years old, and parts of the Australian continent are about 4300 million years old.

Over millions of years, Australia has undergone many changes. Mountain ranges and seas have come and gone. As mountain ranges eroded, sediments many kilometres thick were laid down over vast areas. These sedimentary rocks were then subjected to folding, faulting and uplifting. This means that the rocks that make up the Earth’s crust have buckled and folded along areas of weakness, known as faults. Sometimes, fractures or breaks occur, and forces deep within the Earth cause sections to be raised, or uplifted. Over time the forces of weathering and erosion have worn these down again. Erosion acts more quickly on softer rocks, forming valleys and bays. Harder rocks remain as mountains, hills and coastal headlands.

Because it is located in the centre of a tectonic plate, rather than at the edge of one, Australia currently has no active volcanoes on its mainland, and has very little tectonic lift from below. This means its raised landforms, such as mountains have been exposed to weathering forces for longer than mountains on other continents and are therefore more worn down.

About 33 million years ago, when Australia was drifting northwards after splitting from Antarctica, the continent passed over a large hotspot. Over the next 27 million years, about 30 volcanoes erupted while they were over the hotspot. The oldest eruption was 35 million years ago at Cape Hillsborough, in Queensland, and the most recent was at Macedon in Victoria around six million years ago. Over millions of years, these eruptions formed a chain of volcanoes in eastern and south-eastern Australia, that are known today as the Great Dividing Range (see figure 2). At present, the
hotspot that caused the earlier eruptions is probably beneath Bass Strait.

The present topography of much of Australia results from erosion caused by ice. For example, about 290 million years ago a huge icecap covered parts of Australia. After the ice melted, parts of the continent subsided and were covered by sediment, forming sedimentary basins (a low area where sediments accumulate) such as the Great Artesian Basin. On a smaller scale, parts of the Australian Alps and Tasmania have also been eroded by glaciers during the last ice age.

Rivers and streams are another cause of erosion, having carved many of the valleys in Australia’s higher regions.

When streams, glaciers and winds slow down, they deposit or drop the material they have been carrying. This is called deposition. Many broad coastal and low-lying inland valleys have been created by stream deposition. These areas are called floodplains.

2.3.2 What are Australia’s landform regions?

The topography of Australia can be divided into four major regions (see figure 4).

- The coastal lowlands around Australia’s edge are narrow and fragmented. The plains often take the form of river valleys, such as the Hunter River Valley near Newcastle.
- The eastern highlands region (which includes the Great Dividing Range) is mainly a series of tablelands and plateaus. Most of the area is very rugged, because rivers have cut deep valleys. It is the source of most of Australia’s largest rivers, including the Fitzroy, Darling and Murray. The highest part is in the south-east, where a small alpine area is snow-covered for more than half the year.
- The central lowlands are a vast area of very flat, low-lying land that contains three large drainage basins: the Carpentaria Lowlands in the north, the Lake Eyre Basin in the centre (see figure 3) and the Murray–Darling Basin in the south.
- The Great Western Plateau is a huge area of tablelands, most of which are about 500 metres above sea level. It includes areas of gibber (or stony) desert and sandy desert. There are several rugged upland areas, including the Kimberley and the McDonnell Ranges.
FIGURE 3 Kati Thanda–Lake Eyre, the lowest point on the Australian mainland, is part of the Great Artesian Basin. It is 15 metres below sea level. Once a freshwater lake, the region is now the world’s largest salt pan. The evaporated salt crust shows white in the satellite image (a) below left. The lake fills with water only three or four times each century, transforming it into a haven for wildlife. Deep water is shown as black in image (b) below right.

FIGURE 4 Australia’s four major landform regions.

Source: MAPgraphics Pty Ltd Brisbane
2.3.3 The Murray–Darling Basin

CASE STUDY

Water issues in the Murray–Darling Basin region

The Murray–Darling Basin covers about one million square kilometres, and more than 20 major rivers flow into it. It has a wide variety of landscapes, ranging from alpine areas in the south-east to plains in the west. The basin produces 43 per cent of Australia’s food and over 40 per cent of Australia’s total agricultural income.

FIGURE 5 Aerial view of the Murray River, where it enters the Coorong and Lake Alexandrina in South Australia.

FIGURE 6 Australia’s drainage basins.

Key
Timor Sea 23.3%
Water catchment area name
Distribution of Australia’s run-off

Source: MAPgraphics Pty Ltd Brisbane
2.3.4 How does water flow across the land?

Permanent rivers and streams flow in only a small proportion of the Australian continent. Australia is in fact the driest of all the world’s inhabited continents. It has:

- the least amount of run-off
- the lowest percentage of rainfall as run-off
- the least amount of water in rivers
- the smallest area of permanent wetlands
- the most variable rainfall and stream flow.

Australia has many lakes, but they hold little water compared with those found on other continents. The largest lakes are Kati Thanda–Lake Eyre (see figures 6 and 7) and Lake Torrens in South Australia. During the dry seasons, these become beds of salt and mud. Yet an inland sea did once exist in this area. It covered about 100,000 square kilometres around present-day Kati Thanda–Lake Eyre and Lake Frome. South Australia is Australia’s driest state, and has very few permanent rivers and streams.
2.3 Activities

To answer questions online and to receive immediate feedback and sample responses for every question, go to your learnON title at www.jacplus.com.au. Note: Question numbers may vary slightly.

Remember

1. In your own words, explain what is meant by the terms folding, faulting and uplift.
2. Describe some of the physical changes Australia’s landmass has undergone.

Explain

3. Describe the major characteristics of Australia’s four main landform regions.
4. Explain why Australia is so low in altitude and flat compared with other continents.

Discover

5. Use your atlas to list the highest mountains in each Australian state and territory. Describe the location of each.
6. Use Google Earth to view any part of the Murray–Darling Basin. Describe the landscape that you see.
7. Divide your class into four groups. Assign each group one of Australia’s landform regions to investigate. Collectively compile a list of landforms that are found in each region. Then have each member of the group investigate a different landform and prepare a series of PowerPoint slides that show the following:
   (a) the landform
   (b) where it is located
   (c) how it was formed
   (d) whether people might want to visit this landform, including the reasons why it is or is not a popular landform.

   Put the individual presentations together for viewing by the rest of the class.

Predict

8. Use your atlas to find the Cape Hillsborough and Macedon volcanoes, or refer to figure 2.
   (a) Calculate the distance between them.
   (b) Use the information in this subtopic to work out the rate at which the Australian landmass is moving.
   (c) How far has Australia moved over the Bass Strait hotspot? Now calculate where under Bass Strait this hotspot might now lie.
   (d) Use the information in this subtopic to explain why this hotspot has changed its location over time.
9. It is said that the amount of water that flows down the Amazon River in a day is more than flows down the Murray in a year.
   (a) What does that tell you about how dry Australia’s climate is?
   (b) How might this affect the way the environment around the Murray River is affected?

Think

10. Australia is an ancient landmass and has undergone many changes over millions of years. In groups, brainstorm and compile lists under the following headings.
   • Physical changes that have taken place on the Australian landmass
   • Tectonic processes that have contributed to these changes
   • Changes caused by processes such as weathering and erosion

   Within your group, write a series of paragraphs that explain the interconnection between these factors.
2.4 SkillBuilder: Recognising land features

WHAT ARE LAND FEATURES?
Land features are landforms with distinct shapes, such as hills, valleys and mountains. You can recognise these as you look around your natural environment. On topographic maps you can recognise land features from the patterns formed by the contour lines.

Go online to access:
- a clear step-by-step explanation to help you master the skill
- a model of what you are aiming for
- a checklist of key aspects of the skill
- a series of questions to help you apply the skill and to check your understanding.

FIGURE 1 Landforms matched to a topographic map.

2.5 What landforms are found in the Pacific?
Access this subtopic at www.jacplus.com.au

2.6 What processes shape landscapes?
2.6.1 Are all processes natural?
There are processes at work that continuously sculpt and change the landscape. In the future, the Earth’s surface will look very different from the way it looks today.
There are a variety of natural processes that shape and reshape not only the surface of the Earth, but also what lies beneath it. Natural processes include uplift, such as that caused by tectonic activity, erosion, deposition and weathering. People change the landscape when they clear land for agriculture or build cities and road networks. Sometimes they alter the course of a river or trap its flow behind the walls of a dam.

2.6.2 What role do tectonic forces play?

The Earth’s surface, or crust, is split into a number of plates, which fit together like a giant jigsaw puzzle. These plates sit on a layer of semi-molten material in the Earth’s mantle — the layer of the Earth between the crust and the core. Heat from the Earth’s core creates convection currents within the mantle, causing the plates to move. Most of the Earth’s great mountain regions were formed as a result of this movement.

When two plates collide, one plate often slides under the other, in a process known as subduction, and it becomes part of the mantle. Other rocks are forced upwards and bent or folded. Large mountain ranges that were formed in this way include the Himalayas in Asia and the Rocky Mountains in North America. You will find more information on how mountains are formed in subtopic 5.5.

2.6.3 How is the landscape worn away?

Erosion is the wearing away of the Earth’s surface by natural elements such as wind, water, ice and human activity. The landscape is further eroded when agents such as wind, water and ice transport these materials to new locations. Eventually, transported material is deposited in a new location. Over time, this material can build up and new landforms result. The Grand Canyon in Colorado in the United States (figure 1) is an example of these elements at work. These processes work more quickly on softer rocks.
Human activity also contributes to erosion. Deforestation, agriculture, urban sprawl, logging and road construction all alter the natural balance and increase erosion by as much as 40 per cent in some areas. Vegetation not only provides valuable habitat for native animals but is also vital for binding the soil together. Once vegetation is removed, it is more easily broken down and removed by wind and water. When topsoil (see figure 3 in subtopic 2.8) is removed, plants are unable to obtain the nutrients they need for growth. Sometimes wide, deep channels, known as gullies, form (figure 2).

**FIGURE 2** Note the scale of this gully compared to the people.

**FIGURE 3** After tectonic forces cause a section of the Earth to be raised (uplifted), other processes take over and resculpt the landscape.

1. Weathering is the breakdown of rocks due to the action of rainwater, temperature change and biological action. The material is not transported (removed). It can be physical, chemical or biological.

2. Erosion is the process whereby soil and rocks are worn away and moved to a new location by agents such as wind, water or ice.

3. Transportation is the process that moves eroded material to a new location — examples include soil carried by the wind, sediment or pebbles in a stream.

4. Deposition — materials moved by wind and water eventually come to a halt. Over time new landforms are built. Sand dunes and beaches are common landforms associated with deposition.
2.7 What is hidden underground?

2.7.1 What is karst?

Apart from rivers and streams that flow across the surface of the Earth, vast networks of rivers also exist under the ground. The result is a network of caves and channels that carve a very different landscape, known as karst.

Karst is a landscape formed by water dissolving bedrock (solid rock beneath soil) over hundreds of thousands of years (see figure 2). On the surface of the Earth, sinkholes (holes in the Earth’s surface), vertical shafts (tunnels), and fissures (cracks) will be evident. Rivers and streams may seem to simply disappear, but underground there are intricate drainage networks, complete with caves, rivers, stalactites and stalagmites (see figure 1).
Karst topography makes up about 10 per cent of the Earth’s surface; however, a quarter of the world’s population depends on karst environments to meet its water needs.

2.7.2 How are karst landscapes formed?

Water becomes slightly acidic when it comes into contact with carbon dioxide in the atmosphere (as it does when raindrops form) or when it filters through organic matter in the soil and percolates into the ground. Acidic water is able to dissolve soluble bedrock, such as limestone and dolomite. This creates cracks or fissures, allowing more water to penetrate the rocks. When the water reaches a layer of non-dissolving rocks, it begins to erode sideways, forming an underground river or stream. As the process continues, the water creates hollows, eventually creating a cave. Some karst landscapes contain aquifers that are capable of providing large amounts of water.

2.7.3 Where in the world do you find karst landscapes?

Karst landscapes are found all over the world, as shown in figure 3, in locations where mildly acidic water is able to dissolve soluble bedrock such as limestone and dolomite.

In tropical regions, where rainfall is very high, karst mountains sometimes develop. This is because the high rainfall levels wear away the soluble rock much faster than rock is worn away in karst areas with lower rainfall. Examples of tropical karst mountains include the peaks of Ha Long Bay in Vietnam and the Guilin Mountains in China.

The Earth’s largest arid limestone karst cave system is located on Australia’s Nullarbor Plain, covering 270,000 square kilometres. It extends 2000 kilometres from the Eyre Peninsula in South Australia to Norseman in the Goldfields–Esperance region of Western Australia, and from the Bunda Cliffs on the Great Australian Bight in the south to the Victoria Desert in the north. The extensive cave system provides a unique habitat for a variety of native flora and fauna. Within the caves are fossils that can reveal much about our distant past, along with important Indigenous heritage sites.
2.7 Activities

To answer questions online and to receive immediate feedback and sample responses for every question, go to your learnON title at www.jacplus.com.au. Note: Question numbers may vary slightly.

Remember
1. In your own words, explain how a karst landscape is formed.

Explain
2. Describe the global distribution of karst landscapes.
3. Do you think we should preserve karst landscapes? Give reasons for your answer.

Discover
4. Examples of karst landscapes in Australia include the Buchan, Naracoorte, Jenolan, Labertouche, Princess Margaret Rose, Juddarra and Abercrombie caves. Working with a partner, investigate one of these environments and prepare an annotated visual display. Show its location on a map, and include the scale, features, land use and any concerns or threats to the environment. Include information on what is being done to ensure the sustainable management of the place. Share your findings with the rest of the class.

Think
5. The largest limestone arid karst system is found on the Nullarbor Plain, Australia.
   (a) The Nullarbor Plain is an example of a desert landscape; suggest how an environment formed by water can occur in this location.
   (b) This cave environment is a popular destination for caving groups. Use the internet to investigate this environment and why people are attracted to it. Compare this environment to the one you studied in question 4 above. Pay particular attention to the scale and change that has occurred in each place. Is one more fragile than the other? Explain. Suggest strategies for the sustainable management of karst in the Nullarbor.
   (c) Describe how you think this landscape would be different if it were located in Australia’s tropical north.

2.8 What’s beneath our feet?

2.8.1 What is soil?

We rarely give much thought to the soil beneath our feet. But soil is the basis of all life on the Earth. It provides the nutrients needed for growing plants, which provide food for animals. Without soil, people could not grow crops or raise livestock. Without soil, nothing could survive.

Soil is a thin layer of material on the surface of the Earth. In it, plants can grow. In some parts of the world it is metres deep, but in Australia it is a thin layer of 15 to 20 centimetres. The composition of soil is shown in figure 1 and the factors that influence soil formation are shown in figure 2 in section 2.8.2.

Australia generally has poor soils when compared with those found on other continents such as North America and Europe. Australian soils are generally low in nutrients and, in some areas, especially arid zones, they have a high salt content. Patches of good soil, though, are scattered throughout the continent. For example, there is:

- volcanic soil on the Darling Downs in Queensland and at Orange in New South Wales
- alluvial soil in river valleys such as around the Margaret River in Western Australia and the Clarence River in New South Wales.

In many parts of Australia, it takes more than 1000 years for natural processes to produce three centimetres of soil.

2.8.2 How is soil formed?

Factors that influence soil formation are shown in figure 2.

2.8.3 What is a soil profile?

Soil forms in layers called horizons (see figure 3). A soil profile is a side view or cross-section of these different layers or horizons.
Horizon O (organic matter): Thin layer of decomposing matter, humus and material that has not started to decompose, such as leaf litter.

Horizon A (topsoil): The upper layer of soil, nearest the surface. It is rich in nutrients to support plant growth and usually dark in colour. Most plant roots and soil organisms are found in this horizon. In areas of high rainfall, such as tropical rainforests, minerals are leached out of this layer. A constant supply of decomposing organic matter is needed to maintain soil fertility.

Horizon B (subsoil): Plant litter is not present in horizon B so little humus is present. Nutrients leached from horizon A accumulate in this layer, which is lighter in colour.

Horizon C (parent material): Weathered rock that has not broken down enough to be soil. Nutrients leached from horizon A are also found in this layer.

D: Underlying layer of solid rock.

Soil development may be influenced by the parent material and the minerals it contains. A coarse, sandy soil will develop from sandstone. Bedrock that is mainly granite produces a sandy loam, while shale turns into heavy clay soil.

Surface rocks and bedrock are broken down through weathering and erosion. The type of soil that forms depends on the parent material and the minerals it contains. A coarse, sandy soil will develop from sandstone. Bedrock that is mainly granite produces a sandy loam, while shale turns into heavy clay soil.

Decaying plant and animal matter on the soil’s surface is broken down by microorganisms into material that is incorporated into the soil, making it nutrient rich.

Surface features such as hills, valleys and layers influence soil development. Soil is generally deeper on the top and at the base of a hill than on its slopes. Floodplains next to river valleys are often nutrient rich due to sediment being deposited as floodwaters recede.

Surface rocks and bedrock are broken down through weathering and erosion. The type of soil that forms depends on the parent material and the minerals it contains. A coarse, sandy soil will develop from sandstone. Bedrock that is mainly granite produces a sandy loam, while shale turns into heavy clay soil.

Climate affects the rate of weathering of soil. In high rainfall areas, soil develops more rapidly, but excess moisture also washes out or leaches nutrients. In rainforests, for example, the rich supply of humus from decaying plant matter produces lush vegetation. However, high rainfall means that without this constant supply of humus, soil fertility is quickly lost. In arid regions, where evaporation is high, soils often contain too much salt to support plant growth. Weather also plays a role; a climate with a freezing and thawing cycle will speed up the breakdown of rocks. In warm climates, the activity of soil organisms is high, and chemical processes also happen more quickly.

These processes take place over long periods of time. Soils undergo many changes with the passage of time.

Soil development may be influenced by the parent material and the minerals it contains. A coarse, sandy soil will develop from sandstone. Bedrock that is mainly granite produces a sandy loam, while shale turns into heavy clay soil.
2.8 Activities

To answer questions online and to receive immediate feedback and sample responses for every question, go to your learnON title at www.jacplus.com.au. Note: Question numbers may vary slightly.

Remember
1. What is soil?
2. Why is soil important?

Explain
3. In your own words, explain how soil is formed and why it is not uniform across the surface of the Earth.

Discover
4. Use the internet to investigate soils found in desert and rainforest environments. Construct a soil profile for each place and highlight the differences between them. Find out if the percentages shown in figure 1 are different in each place, and add this information to your soil profiles.
5. Use the Animated soil formation weblink in the Resources tab. Describe the main steps in the formation of soil.

Predict
6. (a) Dig a hole outside where the soil has not been disturbed too much. Dig until you find small pieces of weathering rock. Measure the depth of your hole. How does this compare with the depth of soils in Australia and overseas?
   (b) Find two pieces of rock that show signs of weathering. Check the hardness of these rocks; the harder the rocks, the more difficult it will be to obtain a sample. Rub them together over a piece of paper. Were you able to collect a spoonful of grains in a reasonable amount of time? If so, how long did it take to rub off a spoonful of particles?
   (c) The rate of soil formation is estimated at less than 0.05 millimetres a year in eastern Australia. How long would it take to develop one centimetre of soil? How long would it take to form enough soil to replace what was in the hole you dug earlier?
   (d) Write a paragraph explaining what this exercise tells you about soil formation and the need to use soil in a sustainable manner.

2.9 SkillBuilder: Using positional language

WHAT IS POSITIONAL LANGUAGE?
Positional language is the use of compass points to locate places and provide directions between places. North, north-east, east, south-east, south, south-west, west, and north-west are shown on an 8-point compass. We can use positional language to describe the location of one feature in relation to another.

Go online to access:
• a clear step-by-step explanation to help you master the skill
• a model of what you are aiming for
• a checklist of key aspects of the skill
• a series of questions to help you apply the skill and to check your understanding.
2.10 How do different cultures view landscapes?

2.10.1 The Australian context

Landscapes are the product of processes that have operated for millions of years. While all humans have come to realise the importance of the landscape and the role it plays in our lives, indigenous groups were the first to recognise that it is important to work with nature rather than always seek to change and exploit it.

Aboriginal peoples and Torres Strait Islander peoples are recognised as the first Australians. Evidence of their presence in Australia is found across the continent.

FIGURE 1 Rock art depicting a cloud or rain spirit, found in Western Australia’s Kimberley region.

FIGURE 2 Map of Kakadu National Park.

RESOURCES — ONLINE ONLY

Watch this eLesson: Watch this video to learn how to use positional language.
Searchlight ID: eles-1649

Try out this interactivity: Use this interactivity to learn how to use positional language.
Searchlight ID: int-3145
in their rock art (as shown in figure 1), in archaeological records, and through their cultural heritage passed down through generations. As hunter–gatherers they relied on the plants, animals and the environment for their survival, and so have an understanding of the complex nature of Australia’s varying landscape.

Europeans, on the other hand, arrived in 1788 and occupied the area. They had a very different view of the landscape, based on ideas they brought with them from Britain. They sought to change the landscape and adapt it to meet their needs. They established permanent settlements and depended on agriculture to provide for their needs.

The perspective of Indigenous Australian peoples is one of being part of the landscape, while the European perspective is based on the idea of land ownership. Use the One Night the Moon weblink in the Resources tab to find out more about the different ways in which the landscape is viewed.

2.10.2 Kakadu — Australia’s first World Heritage Area

Kakadu National Park, as seen in figure 2, covers an area of approximately 20 000 square kilometres of the Northern Territory — an area roughly a third the size of Tasmania. It stretches 200 kilometres from north to south, and spans 100 kilometres from east to west. Within the boundaries of the park are vast uranium deposits. Kakadu is unique in that it is recognised for both its natural beauty and its cultural value.
2.10.3 Kakadu and its resources

Kakadu is rich with the historical records and ancestry of the first Australians. In addition, it supports a treasure trove of native plant and animal species and provides a temporary home to a large number of migratory birds. More than 170,000 tourists visit Kakadu annually, attracted by its vast wetlands and scenery, including steep gorges, Aboriginal rock art, waterfalls such as Jim Jim Falls (see Figure 4), and lookouts.

Kakadu also has vast deposits of uranium ore, which some regard as a valuable export for Australia. Opponents of uranium mining are concerned about the possibility that Australia’s uranium could be processed and used to make nuclear weapons. Others fear the effects of mining on the environment and the potential for a devastating pollution event.

The Ranger uranium mine has been operating for 30 years and lies within the boundaries of Kakadu National Park. Three kilometres downstream from the mine, the Mirrar people (a local Aboriginal community) swim and fish. Since the mine opened, there have been more than 200 leaks and spills, and the mine has generated some 30 million tonnes of liquid radioactive waste (see Figure 5).

2.10 Activities

To answer questions online and to receive immediate feedback and sample responses for every question, go to your learnON title at www.jacplus.com.au. Note: Question numbers may vary slightly.

Remember

1. Where is Kakadu National Park and why is it important?
2. Copy the table below into your workbook and use it to compile a list of differences in the way the Australian landscape was viewed by Aboriginal and Torres Strait Islander peoples and non-Aboriginal and Torres Strait Islander Australians. The first one has been done for you.

<table>
<thead>
<tr>
<th>Aboriginal and Torres Strait Islander peoples views</th>
<th>Non-Aboriginal and Torres Strait Islander views</th>
</tr>
</thead>
<tbody>
<tr>
<td>The land is communally owned.</td>
<td>Individuals own the land.</td>
</tr>
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FIGURE 4 Jim Jim Falls at Kakadu is a popular tourist destination.

FIGURE 5 Timeline of major breaches at the Ranger uranium mine since 2002.
2.11 How are landscapes preserved and managed?

2.11.1 The World Heritage Convention

Worldwide, people recognise the value of landscapes and the need to protect their natural beauty and cultural heritage, and to manage their resources sustainably. Landscapes are easily damaged or destroyed but are difficult to recreate and repair. The key is to ensure that they are carefully managed so that the landscapes we value today are still present in the future.

From the middle of the twentieth century, there was growing concern about the need to protect areas of both cultural and natural significance (see figure 1).
2.11.2 The Artesian Range

The Artesian Range is a unique part of the Australian landscape. It has been described as a lost world, a modern-day Noah’s Ark, our last opportunity to protect and preserve a part of the Australian mainland that has had little contact with modern civilisation. Within its hidden valleys and canyons lies a diverse range of flora and fauna. The rich tropical rainforests and woodlands provide vital habitats for some of Australia’s most endangered wildlife.

The Artesian Range covers 1800 square kilometres (see figure 2). It is largely inaccessible; the only way in is by helicopter or boat. It is a maze of hidden valleys and canyons, rocky ranges and plateaus, towering escarpments, wide valleys and deep gorges (see figure 3). Its sandstone ranges were formed as a result of moving tectonic plate activity. These rock formations date back some 1.8 million years.

Although it is difficult for humans to reach the area, exotic species such as donkeys, horses, pigs and cats have gradually invaded the Kimberley. And while fire is a natural part of the landscape, changing fire patterns and the increasing number of late-season wildfires are also a threat to the Artesian Range. Australian Wildlife Conservancy (AWC), an independent non-profit organisation funded by donations, has now secured the land, and manages it for conservation. AWC undertakes fire management, feral animal control, and biological surveys and monitoring, protecting the full length of the Artesian Range.
FIGURE 3 The Artesian Range is a rugged and largely inaccessible landscape, renowned for its natural beauty and unique wildlife.

Source: AWC/Wayne Lawler

2.11 Activities
To answer questions online and to receive immediate feedback and sample responses for every question, go to your learnON title at www.jacplus.com.au. Note: Question numbers may vary slightly.

Remember
1. Why is it important to protect sites that have cultural or natural significance?
2. Describe the location of the Artesian Range and why is it unique.

Explain
3. Suggest why the Artesian Range has been largely inaccessible to people.
4. Explain how exotic species such as cats, foxes and camels have been able to become established in the Artesian Range when it is difficult for people to enter the region.

Discover
5. Use the World Heritage list weblink in the Resources tab and select a site in one of the countries listed on the map. Prepare a visual presentation of one of the sites listed, outlining its importance and how it is protected.

Predict
6. In small groups, investigate an invasive species and describe the ways in which it has changed the environment. Is this change occurring on a small or large scale? Explain. Suggest a strategy that the Australian Wildlife Conservancy could employ to eradicate invasive species from this environment.
Think

7. (a) Explain what you understand by the terms cultural significance and natural significance.
(b) Is it possible for places to have both cultural and natural significance? Draw up a table like the one below. With the aid of a partner, add as many places as you can to the list. Try to have a balance of Australian and international examples. Compare your list with that of another pair of students.

<table>
<thead>
<tr>
<th>Cultural significance</th>
<th>Natural significance</th>
<th>Cultural and natural significance</th>
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(c) Which column has the most entries? Suggest a reason for the pattern you observe.
(d) Select one place from column 3. Find a picture of this place and copy and paste it into a Word document. Add annotations to explain the major features of your chosen place and why it is of cultural and natural significance.

8. Evaluate the ways in which the community demonstrates the value it places on cultural diversity and why this is important to the community.

learn on

RESOURCES — ONLINE ONLY

Explore more with this weblink: World Heritage list

myWorld Atlas

Deepen your understanding of this topic with related case studies and questions:

- World Heritage sites

2.12 Review

2.12.1 Review
The Review section contains a range of different questions and activities to help you revise and recall what you have learned, especially prior to a topic test.

2.12.2 Reflect
The Reflect section provides you with an opportunity to apply and extend your learning.
Access this subtopic at www.jacplus.com.au