

Geography Level 8

Chapter 3 — Landforms and landscapes

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Contents

Section	Page
Australia's landscapes: kinds, signature landforms, and where they are	2
Why people treasure landscapes and landforms: belief, beauty and culture	15
Shaping the land: geomorphological processes and a local landform study	29
How people change landforms, how the change is managed, and a local landform study	45
Volcanoes, earthquakes, tsunamis and landslides: causes, impacts and the human response	63
Chains of cause and effect: making sense of a changing environment	80

Australia's landscapes: kinds, signature landforms, and where they are

Where this section comes from: content description VC2HG8K12 (Victorian Curriculum F–10 Version 2.0, Geography, Levels 7 and 8, VCAA). Tasks in this section draw on elaborations VC2HG8K12 .E01, .E02, .E03, .E04 and .E05. This is the first section of Chapter 3, *Landforms and landscapes*: here we **describe** Australia's landscapes — the types, the landforms that mark each type, and where each type is found. Later sections ask what landscapes mean to people (3B), how they were made (3C), how people change them (3D), the hazards found in them (3E) and how to explain them using geographical concepts (3F). Level 8 is the destination year of this band: by the end of this section you should be able to identify the types, describe their distributions and compare Australia with another country **without scaffolding**.

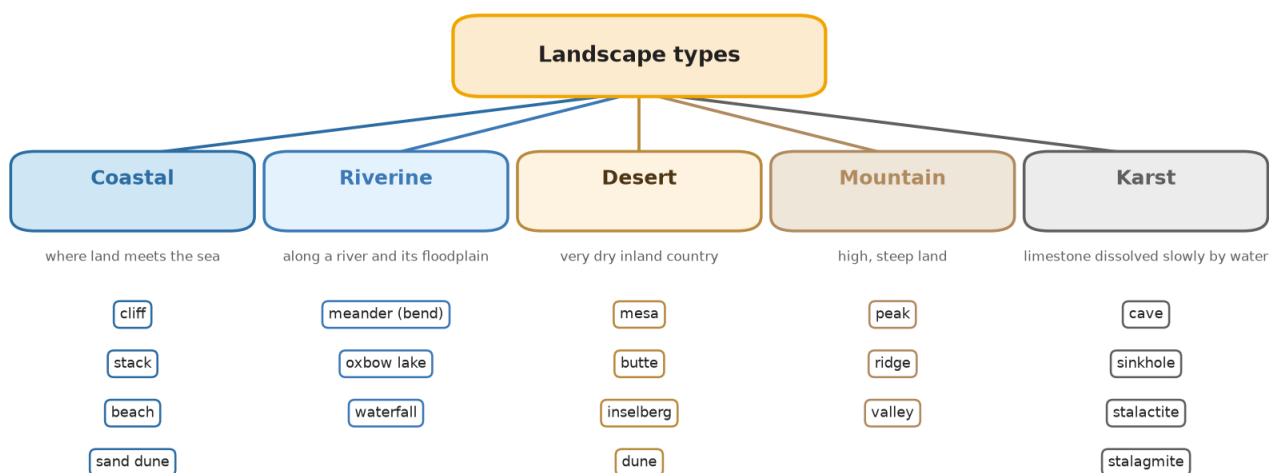
Key ideas

Landscape, landform, and the step between them. A **landscape** is the whole scene across a wide area of land — all of its natural features taken together. A **landform** is one single natural feature of the Earth's surface, such as a cliff, a sand dune or a mountain peak. The skill this section builds is moving between the two: a landscape **type** is recognised by the *distinctive* landforms found inside it. A desert *landscape* (the whole dry scene) contains desert *landforms* (dunes, mesas, isolated rock hills); a coastal *landscape* contains coastal *landforms* (cliffs, beaches, stacks).

Five example types. The curriculum names five example types: **coastal**, **riverine**, **mountain**, **desert** and **karst** (limestone country shaped by water slowly dissolving the rock — *dissolving* here means chemically breaking the rock down and carrying it away in solution). These five are examples, not a full list: Australia has others, such as the tropical **savanna** (hot grassland with scattered trees) of the north. Figure 1 links each type to some of its landforms.

Australia's landscape types and some landforms found in each

A landscape is a whole scene; a landform is one natural feature within it.



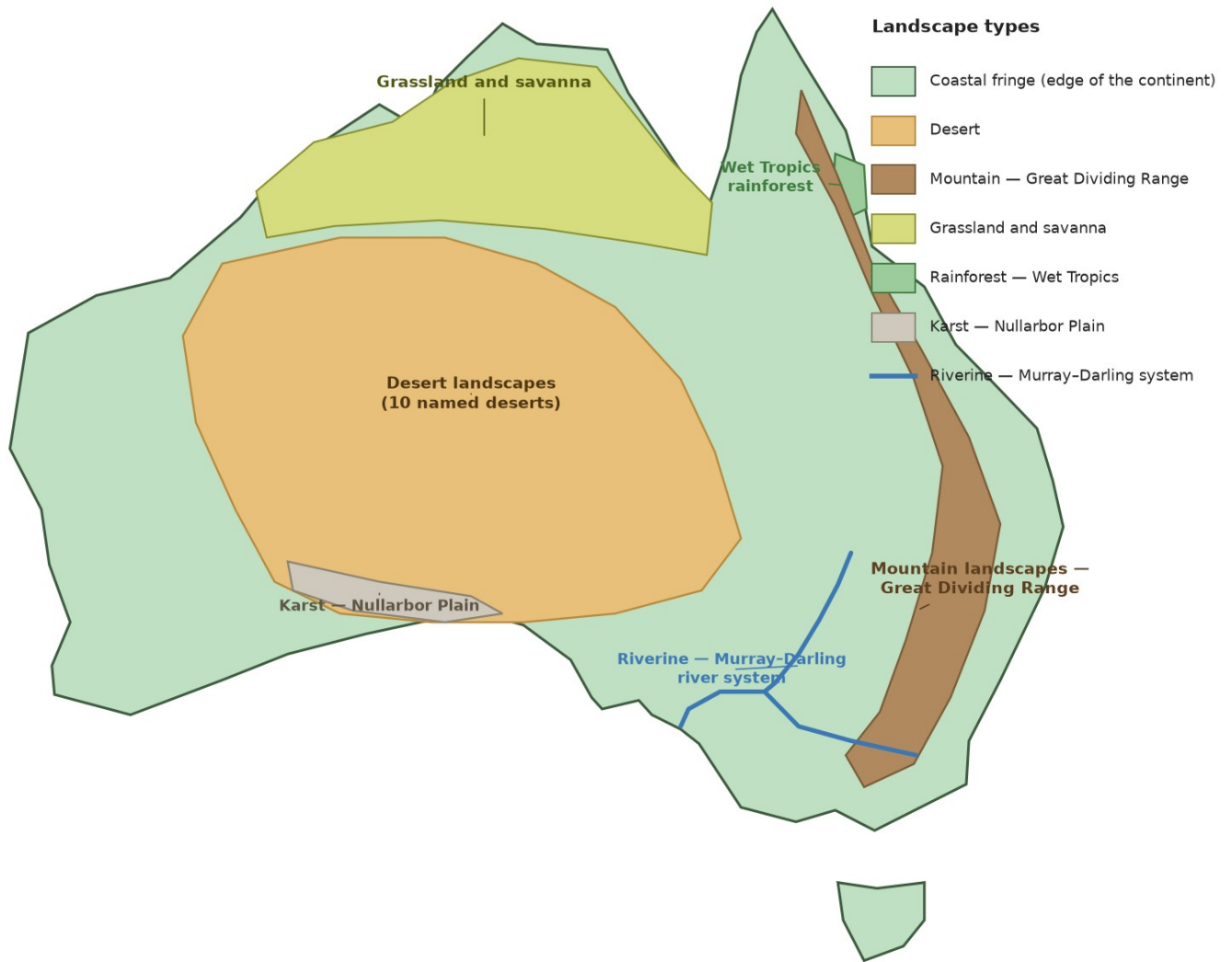
These five types are the curriculum's examples — Australia has others (for example, tropical savanna in the north).

Concept map linking Australia's five example landscape types (coastal, riverine, desert, mountain, karst) to example landforms found in each, such as cliffs, meanders (river bends), mesas (flat-topped rock hills), peaks and caves

Distribution: where, what pattern, what evidence. **Distribution** means *where something is found, and in what pattern*. At Level 8, a good distribution statement does three jobs: it says **where** the feature is, using map words (north, south, inland, coastal, central, western); it says the **pattern** (grouped or spread out? a band, a block, or a line along something?); and it gives **evidence** — one or two named places or numbers from the map or table. The three-step method is summarised in Figure 10, and Worked example 1 shows it in action. Figure 2 shows where Australia's landscape types are found.

Where Australia's landscape types are found

Simplified, schematic map — regions show real locations, not exact boundaries

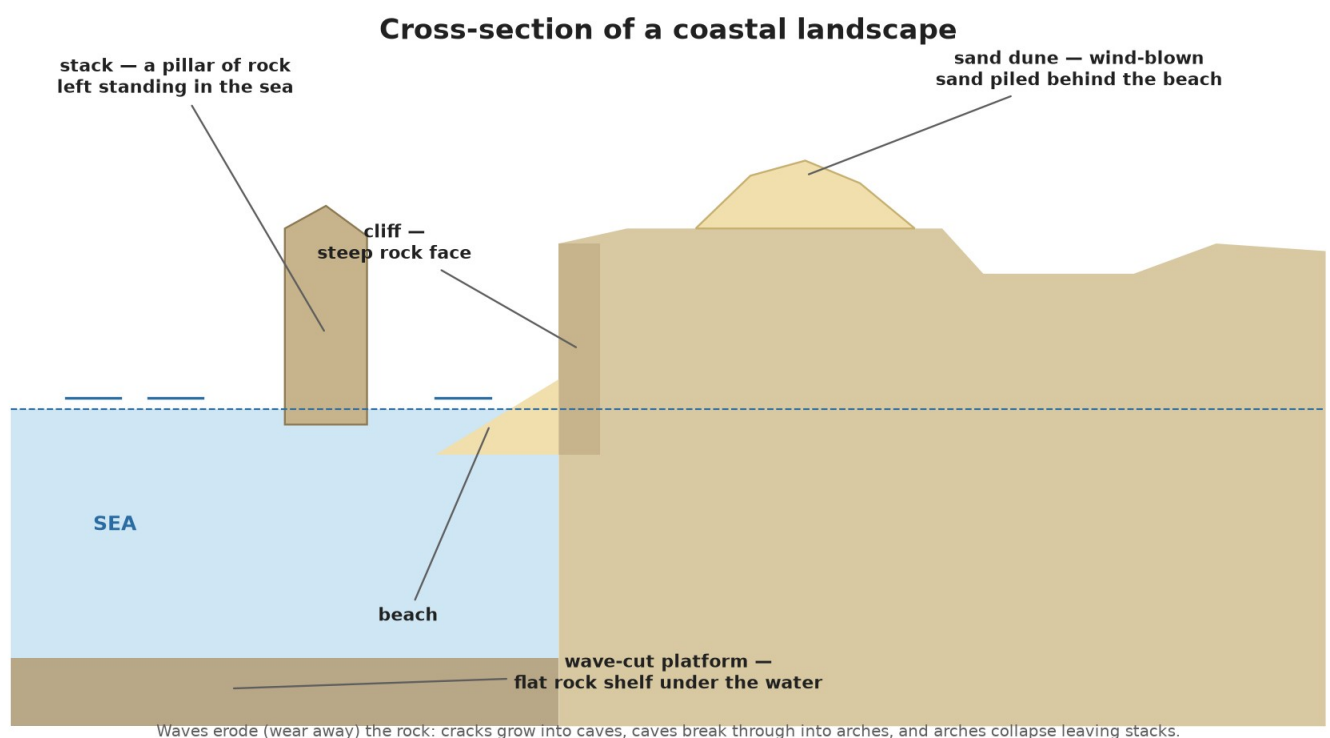


Simplified map of Australia showing where each landscape type is found: a coastal fringe around the whole continent, desert across the centre and west, mountain landscapes along the Great Dividing Range in the east, grassland and savanna across the north, rainforest in the Wet Tropics of north Queensland, riverine landscapes along the Murray–Darling river system, and karst at the Nullarbor Plain

Table 1 — Australia’s five example landscape types.

Landscape type	What it is	Where it is found in Australia	Example landforms
Coastal	where the land meets the sea	as a fringe around the whole continent	cliffs, stacks (isolated rock pillars left standing in the sea), beaches, sand dunes
Riverine	along a river, its valley and its floodplain (flat land beside the river, covered when it floods)	e.g. the Murray–Darling river system in the south-east	meanders (bends in the river), oxbow lakes (bends the river has cut off), waterfalls
Desert	very dry country with little rain	across the inland centre and west	mesas and buttes (flat-topped rock hills; a butte is the narrower one), dunes, inselbergs (single rock hills standing alone on a plain)
Mountain	high, steep land	along the Great Dividing Range in the east, from Cape York to Victoria	peaks, ridges, valleys
Karst	land shaped by water slowly dissolving limestone (a rock laid down from ancient sea life that dissolves easily)	the Nullarbor Plain across WA and SA — Australia’s largest karst area; Jenolan Caves (NSW); Naracoorte Caves (SA)	caves, sinkholes (dips where rock has dissolved and fallen in), stalactites (mineral spikes hanging from cave ceilings)

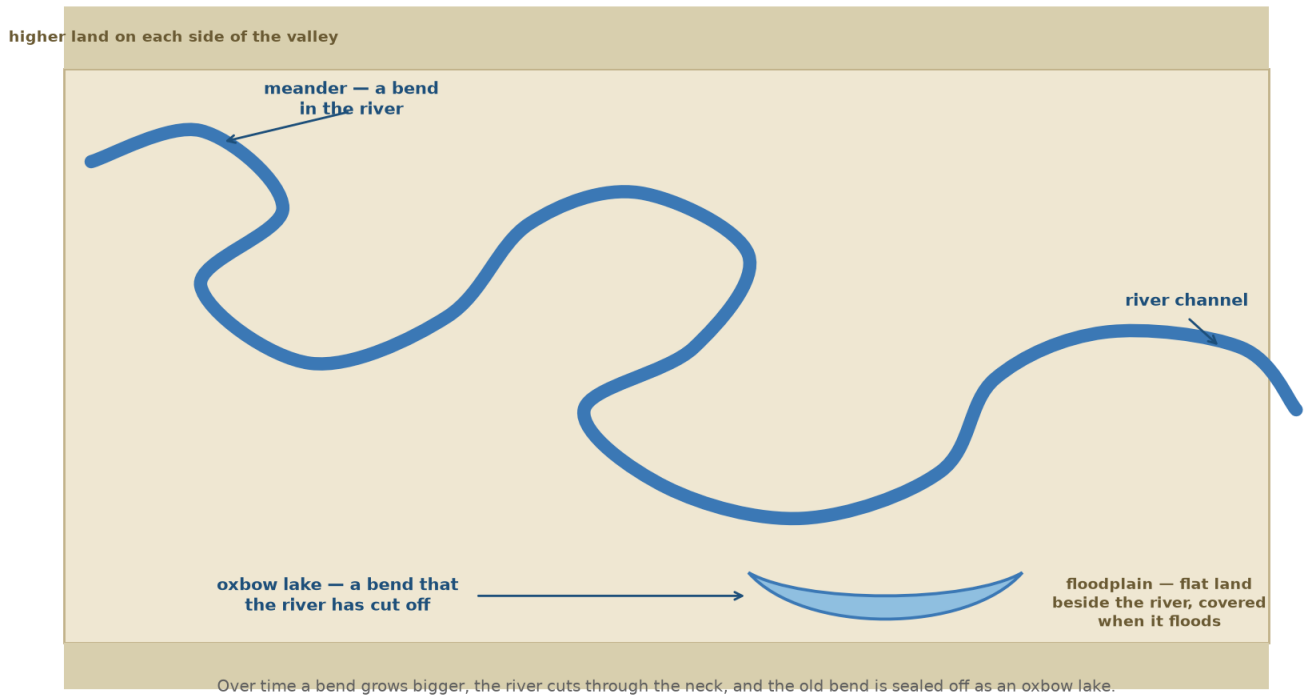
Landforms inside each landscape. Figures 3–6 are simple cross-sections and a map view of four of the types, with their landforms labelled.



Labelled cross-section of a coastal landscape: a stack (a pillar of rock left standing in the sea), a cliff, a beach, a sand dune, and a wave-cut platform (a flat rock shelf under the water)

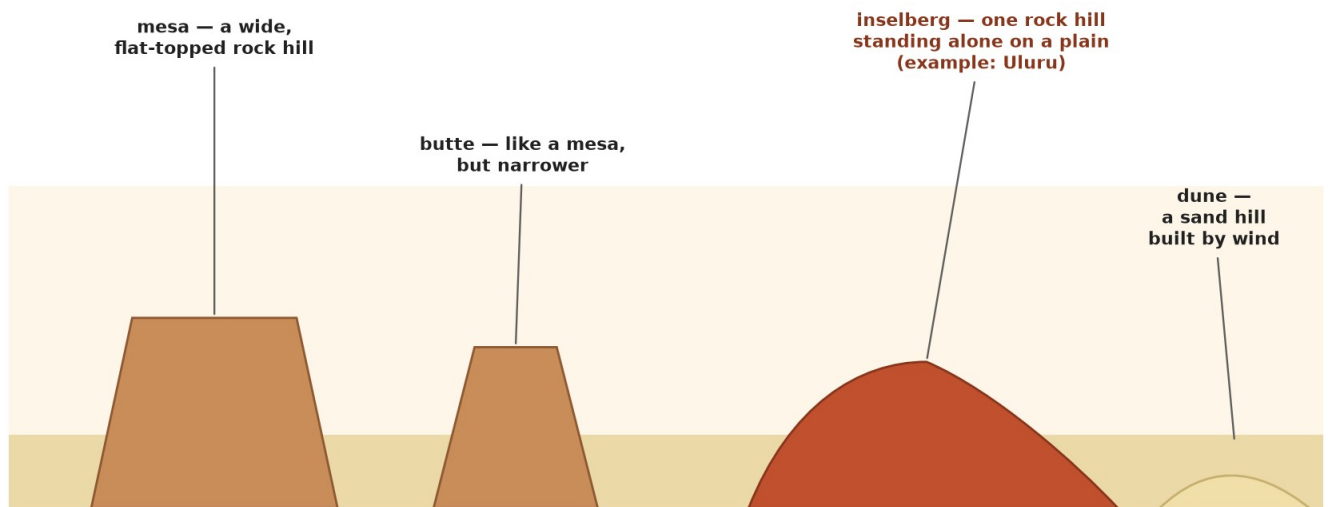
Map view of a riverine landscape

Looking straight down on a river that wanders across wide, flat land



Labelled map view of a riverine landscape: a meander (a bend in the river), the river channel, an oxbow lake (a bend the river has cut off) and the floodplain (flat land beside the river, covered when it floods)

Cross-section of desert landforms

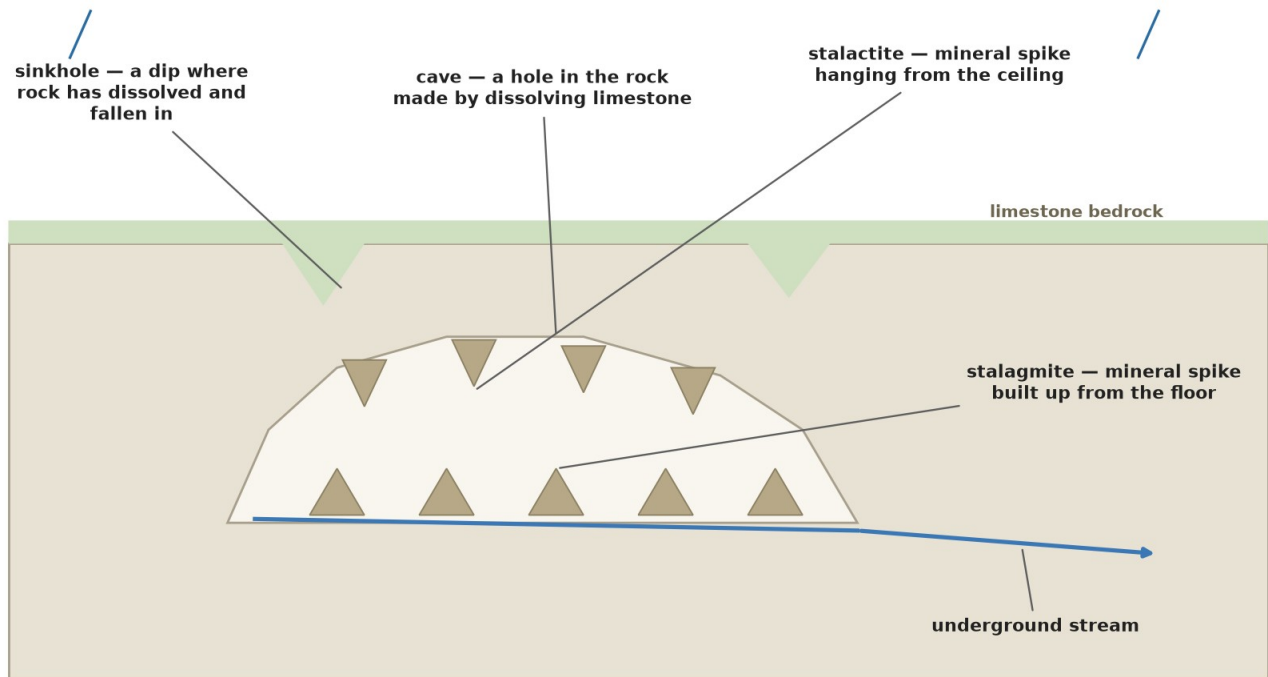


Wind and sudden rare rain slowly wear the rock down: mesas shrink into buttes, and all that is left is an isolated rock hill.

Landform words: mesa and butte came into English from Spanish; inselberg is German for 'mountain island'.

Labelled cross-section of desert landforms on a flat plain: a mesa (a wide, flat-topped rock hill), a butte (like a mesa but narrower), an inselberg (one rock hill standing alone, such as Uluru) and a dune (a sand hill built by wind)

Cross-section of a karst landscape



Rain picks up weak acids as it sinks through soil and slowly dissolves the limestone, opening caves over thousands of years. Example: the Nullarbor Plain (WA/SA).

Labelled cross-section of a karst landscape in limestone bedrock (the solid limestone under the surface): sinkholes at the surface, a cave below with stalactites hanging from the ceiling and stalagmites built up from the floor, and an underground stream; the Nullarbor Plain is the example region

In Figure 6, notice the pair built by dripping water in karst caves: **stalactites** hang *down* from the ceiling, and **stalagmites** build *up* from the floor. (How each landform in Figures 3–6 was *made* — waves, river water, wind, dissolving water — is the work of section 3C; here we identify the landforms and map where they occur.)

The desert type, in more detail. Desert is Australia's biggest landscape type by area. Australia has ten named deserts, and together they cover about 18% of the mainland (Geoscience Australia, retrieved 25 August 2026). The largest is the Great Victoria Desert (about 348,750 km²) and the smallest is the Pedirka Desert (about 1,250 km²). Figure 7 maps their distribution, with Uluru marked in Central Australia: one of the world's largest **inselbergs**, rising 348 m above the plain and 863 m above sea level (Geoscience Australia). Figure 8 ranks the ten deserts by area.

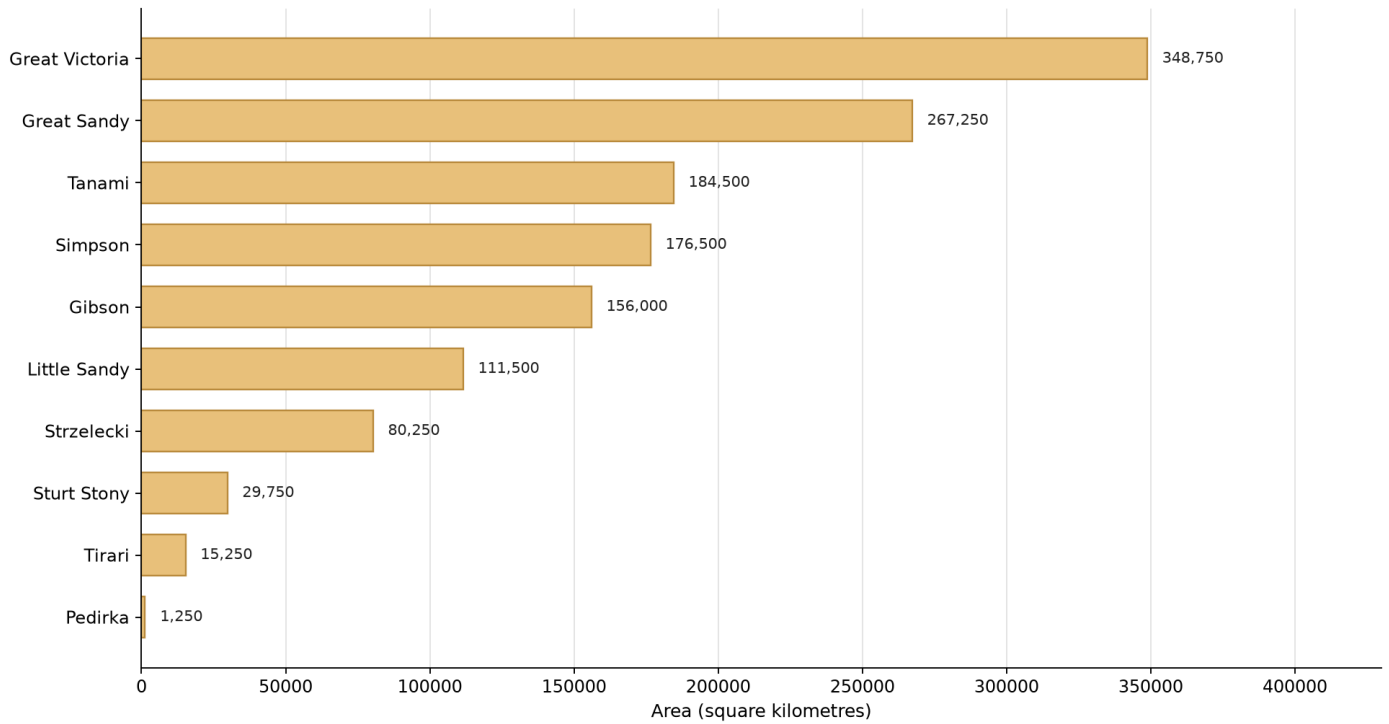
Australia's ten named deserts

Simplified, schematic map — desert shapes show real locations, not exact boundaries



Simplified map of Australia showing the distribution of the ten named deserts (Great Victoria, Great Sandy, Tanami, Simpson, Gibson, Little Sandy, Strzelecki, Sturt Stony, Tirari and Pedirka), with Uluru marked in Central Australia at 131.0 degrees east, 25.3 degrees south

The ten named deserts of Australia, largest to smallest



Together the deserts cover 1,371,000 km² — about 18% of the Australian mainland (Geoscience Australia, retrieved 25 August 2026).

Bar chart ranking the ten named deserts of Australia from largest to smallest: Great Victoria 348,750 square kilometres, Great Sandy 267,250, Tanami 184,500, Simpson 176,500, Gibson 156,000, Little Sandy 111,500, Strzelecki 80,250, Sturt Stony 29,750, Tirari 15,250 and Pedirka 1,250

Table 2 — The ten named deserts of Australia.

Desert	Area (km ²)	Desert	Area (km ²)
Great Victoria	348,750	Little Sandy	111,500
Great Sandy	267,250	Strzelecki	80,250
Tanami	184,500	Sturt Stony	29,750
Simpson	176,500	Tirari	15,250
Gibson	156,000	Pedirka	1,250

Areas: Geoscience Australia, retrieved 25 August 2026.

Iconic landforms. Some landforms are famous around the world. The Victorian Curriculum uses the word *iconic* but does not define it, so this section states its working meaning up front: here, **iconic** means *widely known and treated as a symbol of a place*. Notice what kind of word that is: “iconic” reports how **people respond** to a landform, so which landforms count as iconic is a judgement people make, not a fact written into the rock. A landform usually earns the label because of its size, its shape, its beauty, or how often it is used in photos and films to stand for a country. Figure 9 lists iconic landforms in Australia and in other countries.

Iconic landforms of Australia and other countries

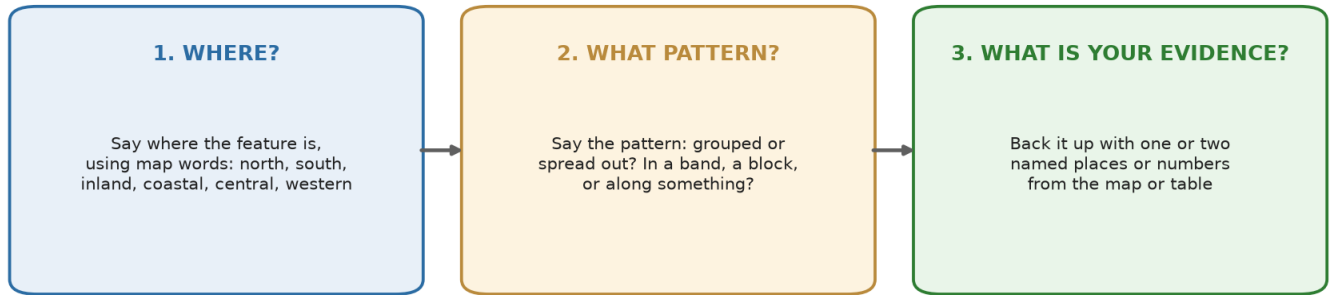
Landform	Kind	Where it is	What makes it iconic
Uluru	Inselberg (isolated rock hill)	Central Australia, Northern Territory	One of the largest inselbergs on Earth — rises 348 m above a flat plain (863 m above sea level), a red landmark seen from far away
Great Barrier Reef	Coral reef	Coral Sea, off the Queensland coast	The largest reef system on Earth — over 2,300 km long, made by billions of tiny sea animals
Twelve Apostles	Limestone stacks	Great Ocean Road, Victoria	Rock pillars up to 50 m high standing in the Southern Ocean
Mount Kosciuszko	Mountain peak	Snowy Mountains, New South Wales	The highest peak on the Australian mainland — 2,228 m
Mount Everest	Mountain peak	Nepal and China	The highest mountain on Earth — 8,849 m
Grand Canyon	River gorge	Arizona, United States of America	A gorge about 446 km long, cut by the Colorado River over millions of years
Mount Fuji	Volcano	Honshu, Japan	Japan's highest peak (3,776 m), famous for its smooth, symmetrical shape

Sources: Geoscience Australia (Uluru, Mount Kosciuszko) · Great Barrier Reef Marine Park Authority · Parks Victoria · Nepal–China joint survey, 2020 · US National Park Service · Japan's national mapping agency. Retrieved 25 August 2026.

Table of iconic landforms of Australia and other countries: Uluru, the Great Barrier Reef, the Twelve Apostles and Mount Kosciuszko in Australia, and Mount Everest, the Grand Canyon and Mount Fuji overseas, each with its kind, its location and what makes it iconic

A few of the facts behind that table, with sources (all retrieved 25 August 2026): the Great Barrier Reef is the largest coral reef system on Earth, over 2,300 km long, in the Coral Sea off Queensland (Great Barrier Reef Marine Park Authority); Mount Kosciuszko (2,228 m) in the Snowy Mountains of NSW is the highest peak on the Australian mainland (Geoscience Australia); the Twelve Apostles are limestone stacks up to 50 m high beside the Great Ocean Road in Victoria (Parks Victoria). Around the world, Mount Everest is the highest mountain on Earth at 8,849 m (Nepal–China joint survey, 2020), the Grand Canyon in Arizona, USA, is a river **gorge** (a deep, narrow valley cut by a river) about 446 km long (US National Park Service), and Mount Fuji (3,776 m) is Japan's highest peak (Japan's national mapping agency).

How to describe a distribution in three steps



Example — Australia's deserts (see Figure 7 and Table 2)

Step 1: Australia's deserts lie in the inland centre and west of the continent.

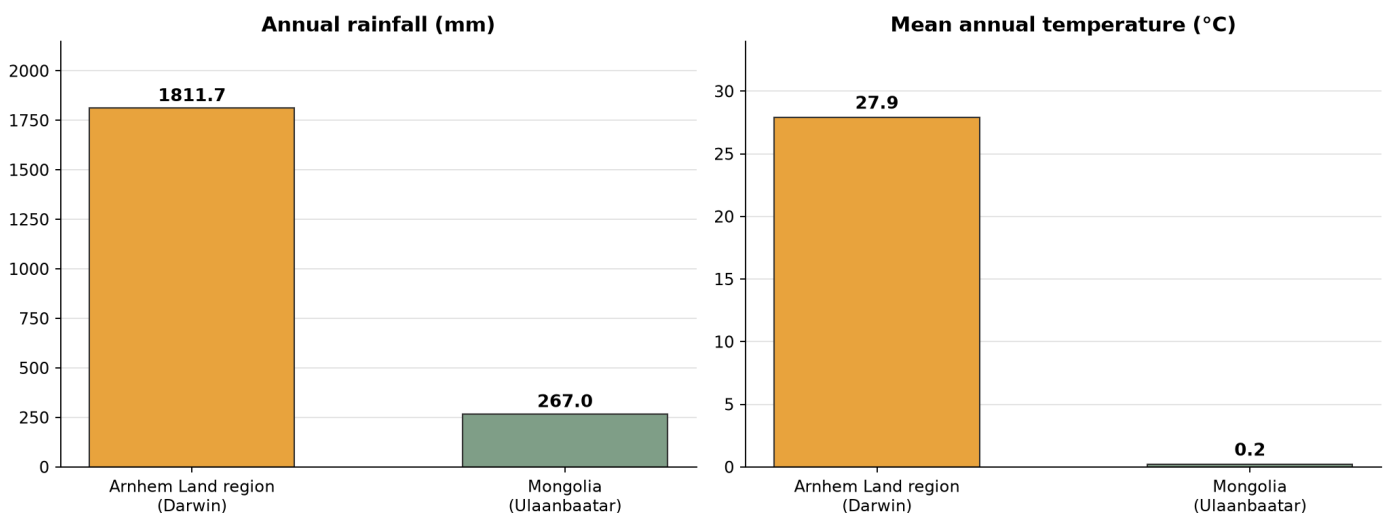
Step 2: They form one grouped band across the interior, from north-west to south-east.

Step 3: The largest is the Great Victoria Desert (348,750 km²); together they cover about 18% of the mainland, and none of them touch the coastal fringe.

Three-step method for describing a distribution - step 1 WHERE (say where the feature is using map words), step 2 WHAT PATTERN (grouped or spread out, a band, a block or along something), step 3 WHAT IS YOUR EVIDENCE (back it up with named places or numbers) - with a worked strip applying the steps to Australia's deserts

Comparing Australia's distributions with another country. Landscape types are not unique to Australia — but their **distribution** is different from country to country. Compare grasslands: northern Australia (the Arnhem Land region) is covered by tropical grasslands and savanna, while Mongolia's grasslands are part of the cold Mongolian–Manchurian **steppe** (a vast, dry grassland), about 887,300 km² across Mongolia, China and Russia (WWF grassland-region data, retrieved 25 August 2026). Same landscape type, very different climates (Figure 11).

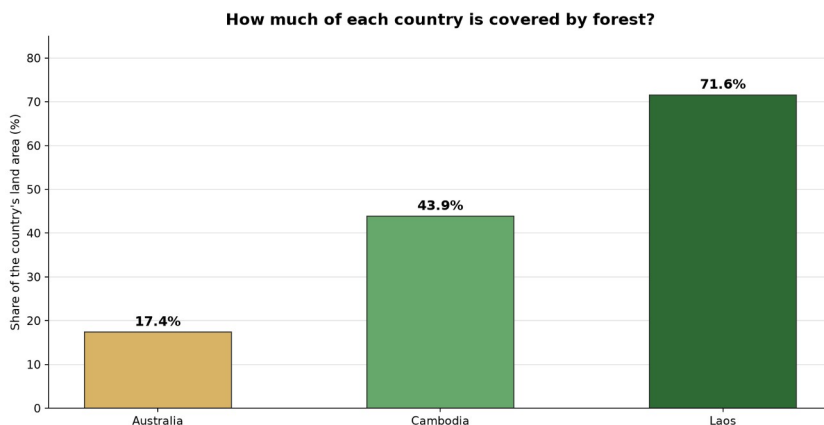
Two grassland landscapes, two very different climates



Darwin Airport: Bureau of Meteorology climate statistics. Ulaanbaatar: WMO climate normals — the coldest capital city on Earth. Retrieved 25 August 2026.

Bar charts comparing the Arnhem Land grassland region (Darwin) with Mongolia (Ulaanbaatar): annual rainfall 1,811.7 millimetres versus 267 millimetres, and mean annual temperature 27.9 degrees Celsius versus 0.2 degrees Celsius

The same is true of forest landscapes. Tropical rainforest grows in far north Queensland (the Wet Tropics World Heritage Area, about 893,453 ha — Australian Government, retrieved 25 August 2026), and forest covers very different shares of other countries (Figure 12).



Forest counts every kind of tree cover: most of Australia's share is open eucalypt woodland, while Laos and Cambodia hold large areas of tropical and monsoon forest — the same word hides different landscapes. World Bank, Forest area (% of land area), 2022. Retrieved 25 August 2026.

Bar chart of the share of each country's land covered by forest: Australia 17.4 per cent, Cambodia 43.9 per cent and Laos 71.6 per cent

Worked examples

Worked example 1 — describing the distribution of Australia's deserts (map-led)

Use Figures 7 and 8, Table 2 and the three-step method in Figure 10 to describe the distribution of Australia's deserts.

How to answer a “describe the distribution” question at Level 8: (1) **where** — say where the feature is, using map words; (2) **pattern** — say how it is arranged (grouped or spread out, a band, a block, a line along something); (3) **evidence** — back it up with one or two named places or numbers. At Level 8, add a fourth move where you can: a short **comparison** with another distribution on the same map.

Model answer. Australia's deserts lie in the **inland centre and west** of the continent — none of the ten touch the coastal fringe (*where*). They form **one grouped band** across the interior, running from the Great Sandy Desert in the north-west through to the Strzelecki Desert in the south-east (*pattern*). The largest, the Great Victoria Desert (348,750 km²), sits across the WA–SA border in the south of the band; the smallest, the Pedirka Desert (1,250 km²), sits in the centre; together they cover about 18% of the mainland, and Uluru stands about mid-way across this desert country (*evidence*). By contrast, mountain landscapes hug the **eastern** side of the continent in one long band, so the two types almost never overlap (*comparison*).

Worked example 2 — comparing a landscape type in Australia and another country (data-led)

Compare the grassland landscapes of the Arnhem Land region (Australia) and Mongolia, using Figure 11.

Model answer. Both places are grassland landscapes, but they sit in very different climates. The Arnhem Land region's grasslands are tropical: Darwin's airport weather station records 1,811.7 mm of rain a year and a mean annual temperature of 27.9 °C (Bureau of Meteorology). Mongolia's steppe is cold and dry: Ulaanbaatar gets only 267 mm of rain a year, and its mean annual temperature is 0.2 °C — it is the coldest capital city on Earth (World Meteorological Organization). So the **same landscape type is distributed in opposite kinds of climate**: hot, with a heavy wet season, in northern Australia; cold and dry in Mongolia. That is the Level 8 point — a distribution comparison needs climate evidence, not just position on a map.

Practice questions

Scaffolded

Q1. In your own words, state the difference between a *landscape* and a *landform*, then give one example of each using Figure 1.

Q2. Copy the table and match each landform to its landscape type: cliff, meander, mesa, cave, peak, oxbow lake, sinkhole, dune. (Types: coastal, riverine, desert, mountain, karst.)

Q3. Using Table 2 and Figure 8: (a) which is the largest desert in Australia, and what is its area? (b) which is the smallest? (c) about what share of the mainland do the ten deserts cover together? (d) about how many times larger is the Great Victoria Desert than the Simpson Desert? Show the calculation.

Q4. Using Figure 7, complete the sentence starters: “Australia’s deserts are found in the ...”, “The pattern they form is ...”, “One piece of evidence for this pattern is ...”, “Uluru is located in ...”.

Q5. Look at Figure 3 (the coastal cross-section). Name the landform that: (a) stands alone in the sea; (b) is the steep rock face; (c) is the flat rock shelf under the water; (d) is built by wind behind the beach.

Q6. Karst country is made of one kind of rock. (a) Name it. (b) From Figure 6, name the landform that hangs from the cave ceiling and the one that grows up from the cave floor. (c) Name Australia’s largest karst area.

Un scaffolded

Q7. Using Figure 2, compare the distribution of mountain landscapes and desert landscapes in Australia. Write three to four sentences using map words and pattern words.

Q8. The Murray is Australia’s longest river at 2,508 km (Geoscience Australia). Explain why the Murray and its floodplain are a *riverine* landscape, name two landforms you would expect to find there, and give one way this landscape differs from a *coastal* landscape.

Q9. Using Figure 11 and Worked example 2, explain how two grassland landscapes on opposite sides of the world can have such different climates. Use both the rainfall and the temperature numbers, and add one sentence on what this shows about the idea “same landscape type means same environment”.

Q10. Describe the pattern shown in Figure 12 (forest cover in Australia, Cambodia and Laos). Which country has forest on most of its land, and why does the figure’s footnote mean these bars are not comparing identical landscapes?

Extend — evidence-based response

E1. Choose **one** iconic landform from Figure 9. Write a short paragraph (80–100 words) — or produce a labelled caption card instead — that: names the landform and its landscape type; gives its location using a state, territory or country; includes at least **two numbers** from this section as evidence (underline them); and explains, in your own words and using this section’s working meaning of *iconic*, why people treat it as a symbol of its country.

Answers

Q1. A landscape is the whole scene across a wide area of land; a landform is one single natural feature within it. Examples vary (e.g. coastal landscape / cliff). **Q2.** Cliff → coastal; meander → riverine; mesa → desert; cave → karst; peak → mountain; oxbow lake → riverine; sinkhole → karst; dune → desert (coastal dunes also accepted). **Q3.** (a) Great Victoria Desert, 348,750 km². (b) Pedirka Desert. (c) About 18% of the mainland. (d) About two times ($348,750 \div 176,500 \approx 2$). **Q4.** ...inland centre and west of the continent; ...one grouped band across the interior; ...e.g. the Great Victoria Desert in the south-west of the band and the Strzelecki Desert in the south-east, with no deserts on the coast; ...Central Australia, inside the inland desert country. **Q5.** (a) The stack. (b) The cliff. (c) The wave-cut platform. (d) The sand dune. **Q6.** (a) Limestone. (b) Stalactite (ceiling); stalagmite (floor). (c) The Nullarbor Plain. **Q7–Q10.** Answers vary (see solutions). **E1.** Answers vary.

Fully-worked solutions

Q1. A **landscape** is everything you see across a wide area of land — the whole scene and its mix of features. A **landform** is one single natural feature of the surface, like a cliff or a dune. Landforms are the parts; a landscape is the whole. Example from Figure 1: the karst *landscape* contains the cave *landform*.

Q2. Cliff → coastal; meander → riverine; mesa → desert; cave → karst; peak → mountain; oxbow lake → riverine; sinkhole → karst; dune → desert (a sand dune also fits coastal; dunes are named under desert in Figure 1, so coastal is accepted with a reason).

Q3. (a) The Great Victoria Desert, about 348,750 km². (b) The Pedirka Desert, about 1,250 km². (c) About 18% of the mainland. (d) $348,750 \div 176,500 \approx 1.98$, so about **two times** larger.

Q4. Australia's deserts are found in the **inland centre and west** of the continent. The pattern they form is **one grouped band** across the interior, north-west to south-east. One piece of evidence is that the **Great Victoria Desert (348,750 km²)** sits in the south-west of the band while the **Strzelecki Desert** sits in the south-east, and no named desert touches the coast. Uluru is located in **Central Australia**, inside the inland desert country.

Q5. (a) Stack. (b) Cliff. (c) Wave-cut platform. (d) Sand dune.

Q6. (a) Limestone. (b) The stalactite hangs down; the stalagmite builds up. (c) The Nullarbor Plain.

Q7. Mountain landscapes run in a **long, narrow band down the east**, along the Great Dividing Range from Cape York to Victoria. Desert landscapes form a **broad block across the inland centre and west**. Both stay off the coastal fringe, but the mountains line up along one side of the continent while the deserts fill the interior — two clear bands at right angles to each other.

Q8. A riverine landscape is the land along a river and its valley and floodplain, and the Murray — with its bends, floodplain and wetlands — is exactly that. Landforms expected there include meanders, oxbow lakes and floodplains (and waterfalls in its upper reaches). A coastal landscape differs because it sits where the land meets the sea, so its landforms — cliffs, beaches, stacks — are cut by waves, not by river water.

Q9. The Arnhem Land region's grasslands get 1,811.7 mm of rain a year and average 27.9 °C, so they are hot tropical grasslands driven by a heavy wet season. Mongolia's steppe gets only 267 mm and averages 0.2 °C, so it is a cold, dry grassland. Same landscape type, opposite climates. This shows that "same landscape type means same environment" is false: a type is named by its plants and landforms, while its climate can be anything — which is why distribution studies must compare climate data as well as map position.

Q10. The share of land covered by forest rises from Australia (17.4%) to Cambodia (43.9%) to Laos (71.6%), so forest landscapes dominate Laos and are a minority of Australia's land. The footnote warns that "forest" counts every kind of tree cover: most of Australia's share is open eucalypt woodland, while Laos and Cambodia include large areas of tropical and monsoon forest. So the bars compare the *word* "forest", not identical landscapes.

E1. Example response (about 80 words): "*Uluru is a desert-landscape landform — an inselberg in Central Australia, in the Northern Territory. My evidence: it rises 348 m above the plain and stands 863 m above sea level, and it sits at 131.0° E, 25.3° S in the inland desert band. Using this section's working meaning, Uluru is iconic because people around the world know it and treat its smooth red shape, standing alone on a flat plain, as a symbol of Australia in photos, films and logos.*"

Teaching sequence (teacher)

1. **Hook (5 min):** show two photos (a coast, a desert). Ask "same country?" — surface the idea that one continent holds many landscapes, and that a *type* is recognised by its distinctive landforms.
2. **Direct teaching (10 min):** landscape vs landform; the five types; Table 1; Figure 1. Define *distribution* as the three jobs (where, pattern, evidence), and define *iconic* explicitly — the iconic box is a worked example of defining an undefined curriculum word, and of noticing that it is a response-reporting word.
3. **Map work (10 min):** Figures 2, 7 and 10; model Worked example 1 once, then have students run the three-step method themselves on mountain landscapes (the comparison move of Q7).
4. **Data work (10 min):** Worked example 2 and Figures 11–12 — the E05 comparison with Mongolia, Laos and Cambodia (Asia engagement), stressing that distribution comparisons need climate and cover data, not just map position.
5. **Practice (10 min):** Q1–Q6 in class; set Q7–Q10 and E1 for homework or a second lesson — the unscaffolded set is the Level 8 evidence of the skill.
6. **Check for understanding:** exit card — "one landscape type, one landform inside it, one where–pattern–evidence sentence describing its distribution."

This section teaches physical geography only: place names such as Uluru and Arnhem Land are used as examples of landforms and landscape distribution, with no cultural content attached.

Sources (retrieved 25 August 2026 unless stated)

- Geoscience Australia — desert list and areas, the 18% figure, Uluru heights and position, Murray River length, Great Dividing Range, Mount Kosciuszko, Nullarbor Plain karst extent.
- Bureau of Meteorology — Darwin Airport climate statistics (rainfall 1,811.7 mm; mean of daily maxima 32.4 °C and minima 23.3 °C, mean 27.9 °C).
- World Meteorological Organization — Ulaanbaatar climate normals (267 mm; 0.2 °C mean annual).
- WWF — extent of the Mongolian–Manchurian grassland region.
- Australian Government — Wet Tropics of Queensland World Heritage Area extent.
- World Bank (FAO) — forest area as a share of land area, 2022.
- Great Barrier Reef Marine Park Authority; Parks Victoria; US National Park Service; Nepal–China joint survey (2020); Japan's national mapping agency — iconic landform facts.

All maps in this section are simplified outlines drawn from primitives for this workbook; region shapes show real locations schematically.

Why people treasure landscapes and landforms: belief, beauty and culture

Where this section comes from: content description VC2HG8K13 (Victorian Curriculum F–10 Version 2.0, Geography, Levels 7 and 8, VCAA). One clause of this content description — its inclusion of the values these landscapes and landforms hold for Aboriginal and Torres Strait Islander Peoples — is not taught in this series (Content Policy Rule 1; see the notice at the front of the book), so elaborations VC2HG8K13.E01, .E02, .E05 and .E06 are set aside. Tasks in this section draw on the retained elaborations VC2HG8K13.E03, .E04 and .E07. This is the second section of Chapter 3, *Landforms and landscapes*: section 3A **described** Australia’s landscapes; this section asks what landscapes and landforms **mean to people**; later sections ask how they were made (3C), how people change them (3D), the hazards found in them (3E) and how to explain them using geographical concepts (3F).

Key ideas

1. “Value” is a contested word — so this section defines it before using it. A **contested** word is a word with competing meanings, where the meaning you pick can change the conclusion. The curriculum uses the word *value* but does not define it, so this section fixes one meaning up front, and says so openly: **value means the importance people give to a place**. Because that meaning always depends on *whose* importance we mean, every claim in this section gives its frame — **which people, and why**. Figure 1 sorts words into five kinds, so you can see what kind of word you are using before you argue with it. Words like *beautiful* are **response-reporting**: they tell us how people respond to a place. Those responses — poems, paintings, pilgrimages, visitor numbers — are the **evidence** geographers study.

What kind of word is 'value'? — defining terms before we argue

Not every word works the same way. Five kinds of term, and how each behaves:

Measurable

one agreed meaning — people argue only about the measuring

e.g. height, rainfall

Frame-dependent

exact once you say whose point of view you mean

e.g. near, far (near to what?)

Stipulated

fixed by an authority, which may define it its own way

e.g. a national park (fixed by law)

Contested

competing meanings exist — the meaning you pick changes the conclusion

e.g. fair, freedom

Response-reporting

reports how someone feels about something — sincere, but not a fact about the thing itself

e.g. beautiful, boring

Where 'value' sits in this section

The curriculum uses the word *value* but does not define it. This section treats *value* as the importance people give to a place. Whose importance? That is the frame: this section always says which people value a place, and why.

Words like *beautiful* are response-reporting — they tell us how people respond to a landscape, and those responses can be studied as evidence. Two people can value the same landscape in different ways and both be sincere. The geography is in explaining why.

Chart sorting words into five kinds of term — measurable, frame-dependent, stipulated, contested and response-reporting — with a box explaining how this section defines the word value

2. **Three kinds of value.** Geographers sort the reasons people value landscapes and landforms into three kinds (Figure 2):

- **Spiritual value** — the place matters to people's beliefs about what is sacred (holy). People may make a **pilgrimage** (a journey made for religious reasons) to it, or hold ceremonies there.
- **Aesthetic value** — the place is valued for how it looks, sounds and feels: its beauty. Painters, writers and composers try to capture it.
- **Cultural value** — the place becomes part of a group's identity, stories and way of life, and people represent it in art, music, film and festivals.

One place can hold all three values at once. Mount Fuji, in Japan, is sacred (spiritual), beautiful (aesthetic) and famous in art (cultural) — all at the same time.

Three kinds of value landscapes and landforms hold for people

People can value the same place for different reasons. Geographers sort these reasons into three kinds.

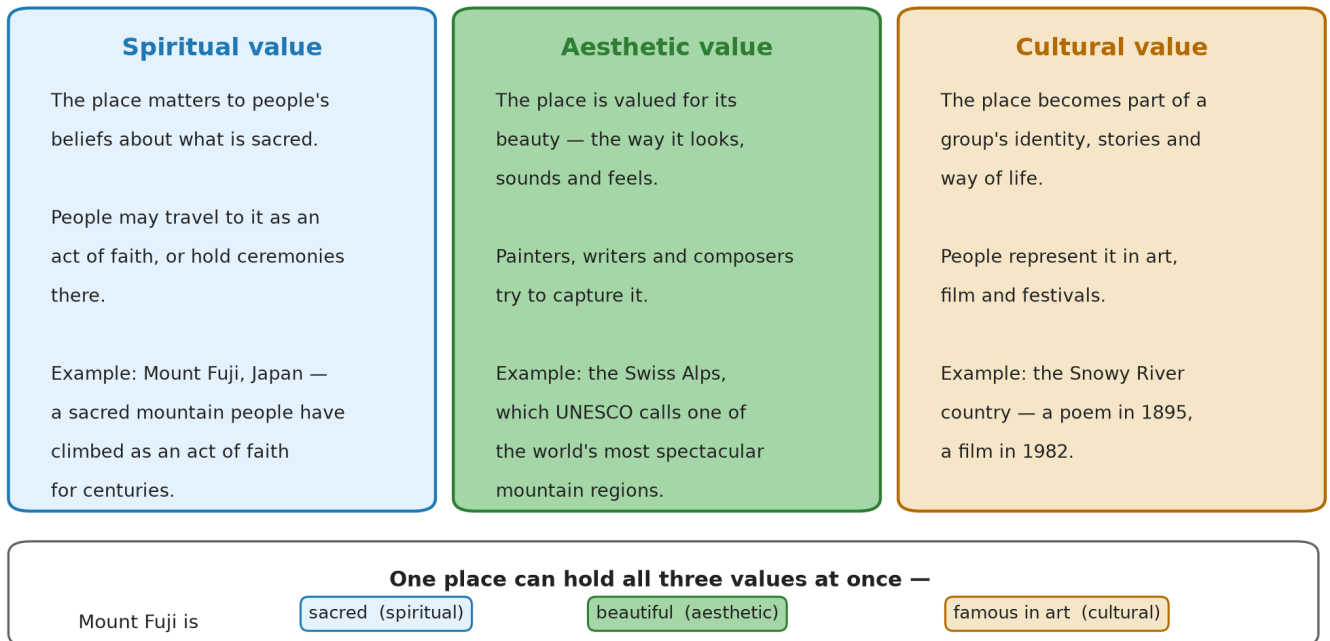


Diagram of the three kinds of value landscapes hold for people — spiritual, aesthetic and cultural — each with a definition and an example place, showing Mount Fuji holding all three at once

3. World Heritage is one way the world formally records value. UNESCO (the United Nations Educational, Scientific and Cultural Organization) keeps the **World Heritage List** — a list of places judged to have outstanding value for all humanity. A place is added only if it meets **criteria** — standards set out by UNESCO. Listings come in three kinds: **cultural** (value made by human history and belief), **natural** (value in the physical world) and **mixed** (both). Figure 3 sets out five World Heritage places this section uses, and what UNESCO's own words say people value in each.

What World Heritage recognition records about the values people see in five landscapes

Listing type and criteria are how UNESCO says, formally, what people value about a place.

Place	Listing kind	Year	Criteria	What the recognition is about
Mount Fuji, Japan	cultural	2013	(iii)(vi)	a sacred place and pilgrimage site; a source of art
Mount Huangshan (the Yellow Mountains), China	mixed	1990	(ii)(vii)(x)	exceptional beauty; shaped China's art and writing
Swiss Alps Jungfrau-Aletsch, Switzerland	natural	2001	(vii)(viii)(ix)	outstanding scenery; how mountains and glaciers form
Great Barrier Reef, Australia	natural	1981	(vii)(viii)(ix)(x)	beauty under the sea; Earth's history; habitats
English Lake District, England	cultural	2017	(ii)(v)(vi)	ideas about beauty; farming, art and writing

The criteria, shortened from UNESCO's official wording:

- (ii) an important interchange of human values

(v) traditional land use

(vii) outstanding natural beauty

(ix) ecological processes still at work
- (iii) a living or vanished cultural tradition

(vi) links to living traditions, beliefs or works of art

(viii) major stages of Earth's history, including landforms

(x) key natural habitats for plants and animals

Note: Uluru is not shown here. The reasons for its recognition lie in Aboriginal and Torres Strait Islander culture, which this series does not cover (see the front-of-book note).

Source: UNESCO World Heritage List, retrieved 25 August 2026.

Table of five World Heritage places — Mount Fuji, Mount Huangshan, the Swiss Alps Jungfrau-Aletsch, the Great Barrier Reef and the English Lake District — showing each listing kind, year, criteria and what the recognition is about, with a key to the criteria

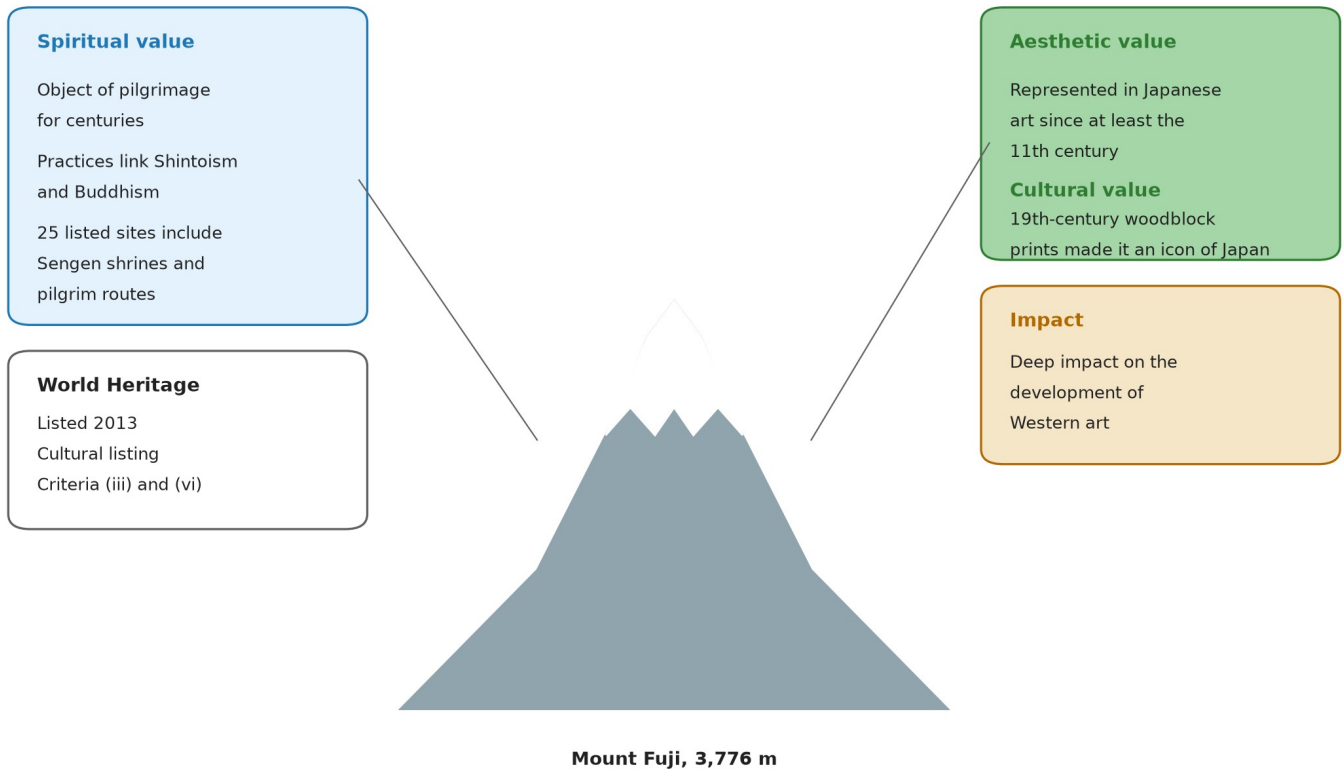
UNESCO’s own wording shows value in action. For the Swiss Alps Jungfrau-Aletsch region, criterion (vii) says the area ‘played an important role in European art, literature, mountaineering and alpine tourism’ and is ‘globally recognised as one of the most spectacular mountain regions’ (UNESCO, retrieved 25 August 2026). For the English Lake District, UNESCO says the place stands for ‘the idea that landscape has a value, and that everyone has a right to appreciate and enjoy it’ (UNESCO, retrieved 25 August 2026). A World Heritage listing is, in effect, the world writing down what it values.

4. Value in an Asian context. The curriculum asks us to look at the ways people in Japan and China value their famous landscapes (VC2HG8K13.E03).

Mount Fuji (Fujisan), Japan — a solitary volcano, 3,776 m tall, about 100 km south-west of Tokyo (Figure 4). UNESCO listed it in 2013 as a cultural property under criteria (iii) and (vi). Its spiritual value is recorded directly: it has ‘inspired artists and poets and been the object of pilgrimage for centuries’, and its religious practices link Shintoism and Buddhism. The listing covers 25 separate sites together, including Sengen shrines and pilgrim routes. Its aesthetic and cultural value are recorded too: Fuji has been represented in Japanese art since at least the 11th century, and 19th-century woodblock prints made it ‘an internationally recognised icon of Japan’ with ‘a deep impact on the development of Western art’ (UNESCO, retrieved 25 August 2026).

Mount Fuji: one place, three kinds of value

Fujisan — a solitary volcano, 3,776 m tall, about 100 km south-west of Tokyo (UNESCO).



Source: UNESCO World Heritage List, retrieved 25 August 2026.

Mount Fuji drawn as a volcano with labelled panels: spiritual value (pilgrimage, links between Shintoism and Buddhism, 25 listed sites), aesthetic value (art since the 11th century), cultural value (19th-century woodblock prints) and its 2013 cultural World Heritage listing

Mount Huangshan (the Yellow Mountains), China — granite peaks in Anhui Province, many over 1,000 m high, rising through what UNESCO calls a perpetual sea of clouds (Figure 5). UNESCO listed it in 1990 as a mixed property under criteria (ii), (vii) and (x); the listed area is 16,060 hectares, with a **buffer zone** (a protected area around it) of 49,000 hectares. A Tang Dynasty legend dated 747 gave the mountain its name, and UNESCO calls it ‘the loveliest mountain of China’ — a magnet for hermits (people who live alone, often for religious reasons), poets and landscape artists. In the Ming Dynasty, about the 16th century, Huangshan inspired the influential **Shanshui** (‘Mountain and Water’) school of landscape painting, which UNESCO says shaped the way the world pictures China’s mountain landscapes (UNESCO, retrieved 25 August 2026).

Mount Huangshan (the Yellow Mountains): beauty that shaped a school of painting

Anhui Province, China — called the loveliest mountain of China by UNESCO.

Spiritual and cultural

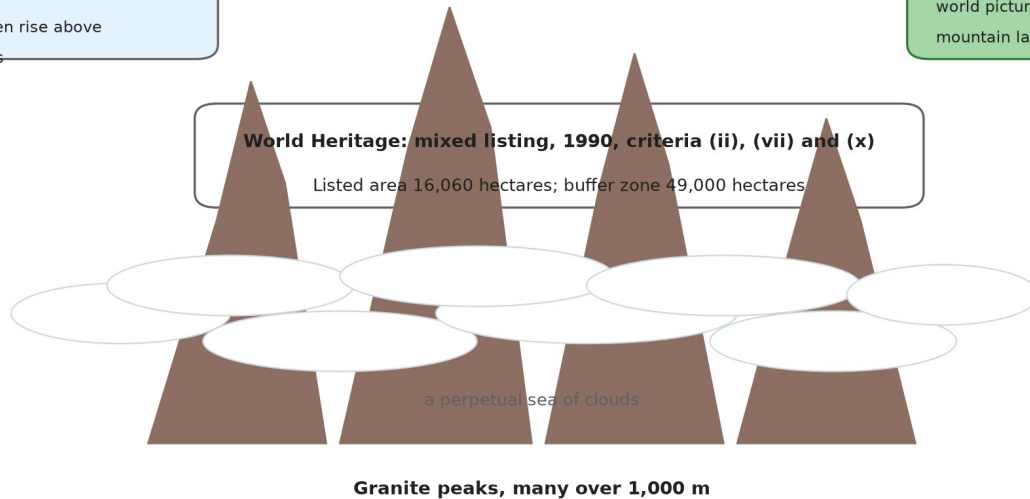
A Tang Dynasty legend dated 747 gave the mountain its name

A magnet for hermits, poets and landscape artists

Peaks often rise above the clouds

Aesthetic

In the Ming Dynasty (about the 16th century) it inspired the Shanshui (Mountain and Water) school of landscape painting — the way the world pictures China's mountain landscapes



Source: UNESCO World Heritage List, retrieved 25 August 2026.

Mount Huangshan drawn as granite peaks rising through a sea of clouds, with panels on its Tang Dynasty legend, the Shanshui school of landscape painting it inspired, and its 1990 mixed World Heritage listing

5. Aesthetic value through the arts. Works of art, music, writing and film represent landscapes and landforms (VC2HG8K13.E04). Each representation is a response-report: it records how people respond to a real place, and those responses can be studied as evidence of value (Figure 6).

How landscapes and landforms are represented in art, music, literature and film

Every work below is a response to a real place — and each response is evidence of value.

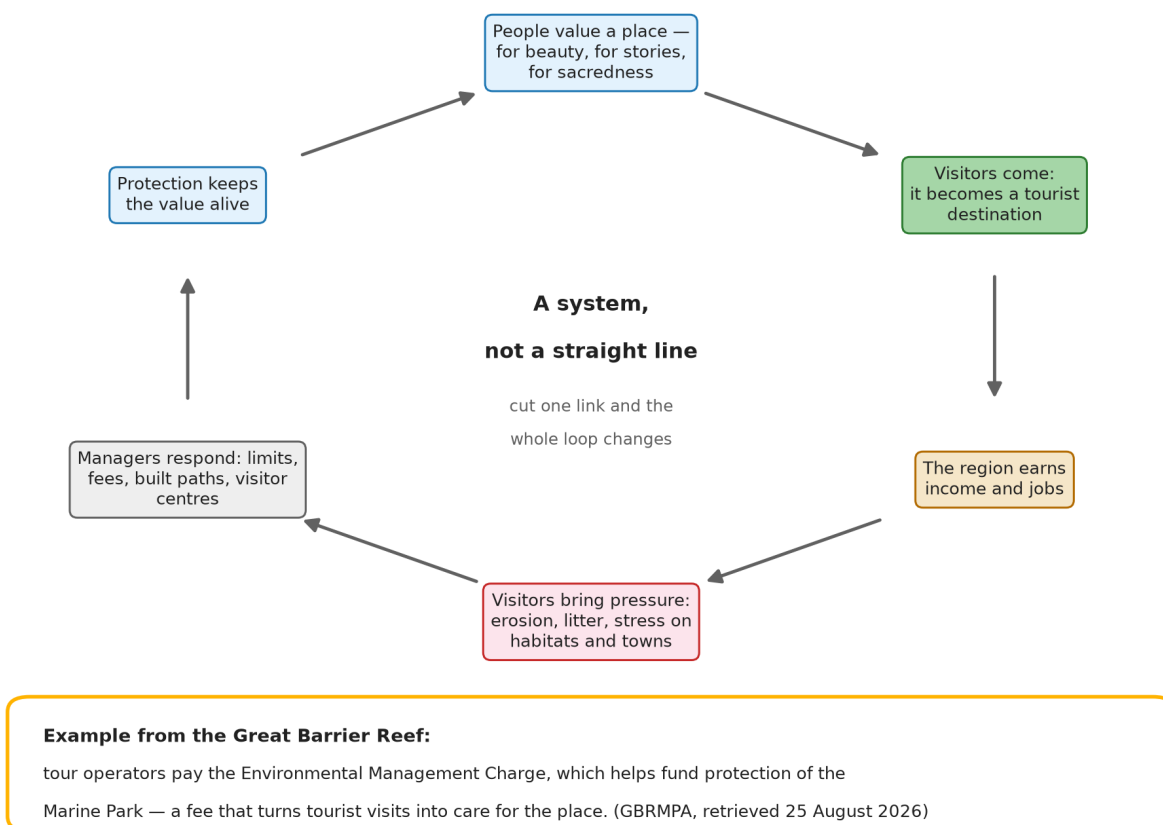
Art form	The work, and the place behind it	What it shows about value
Art	19th-century Japanese woodblock prints of Mount Fuji. The Shanshui (Mountain and Water) school of landscape painting, inspired by Mount Huangshan.	Aesthetic + cultural: art can make a place famous far beyond its own country. (UNESCO)
Music	Beethoven, Symphony No. 6 'Pastoral' (Op. 68), first performed in Vienna on 22 December 1808. The composer called it 'more an expression of feeling than painting'.	Aesthetic: music reports how landscape and countryside make people feel. (Wikipedia, retrieved 25 August 2026)
Literature	'The Man from Snowy River' (1895), a poem by A. B. 'Banjo' Paterson. (Project Gutenberg Australia)	Cultural: the Snowy River country became part of Australia's stories.
Film	'The Man from Snowy River' (1982), based on Paterson's poem, filmed in the Victorian High Country.	Cultural: a real landscape reaches new audiences.

Every work is a response-report: it records how people respond to a place. Those responses can be studied as evidence of aesthetic and cultural value (see Figure 1).

Table showing how landscapes are represented in four art forms: woodblock prints of Mount Fuji and Shanshui painting from Mount Huangshan in art, Beethoven's Pastoral Symphony in music, The Man from Snowy River poem in literature, and the 1982 film of the same name

6. Tourism: value you can count. Landscapes and landforms also have value because people travel to see them — tourism (VC2HG8K13.E07). Tourism works as a **system** (Figure 7): value draws visitors, visitors bring income and pressure, and management decides what survives.

Tourism as a system — value brings visitors, visitors bring income and pressure



Circular diagram of tourism as a six-step system: people value a place, visitors come, the region earns income and jobs, visitors bring pressure, managers respond, and protection keeps the value alive, with a Great Barrier Reef fee example

Because tourism is a system, managing it needs data. The Great Barrier Reef Marine Park Authority counts tourist visits using published rules — what counts, what does not, and which numbers best show the trend (Figure 8). The Great Barrier Reef itself was listed as a natural World Heritage property in 1981 under criteria (vii), (viii), (ix) and (x); it covers 34,870,000 hectares and stretches from about 10°S to 24°S along the Queensland coast, and UNESCO calls it ‘the world’s most extensive coral reef ecosystem’ (UNESCO, retrieved 25 August 2026).

How reef tourism is counted — Great Barrier Reef Marine Park Authority

Before you can manage tourists, you must count them. Counting needs rules.

Counts as a tourist visit

Full day visits — day trips of more than 3 hours
Part day visits — less than 3 hours
Coral viewing
Scenic flights

Does not count

Transfer passengers
Some listed exempt visits

How the numbers are used

Full day visits are the best gauge of the general trend of tourism in the park.
The Authority updates the data twice a year.
Its own note: the numbers shown have not been fully checked — a source worth trusting says what its data can and cannot do.

The management tie-in

Tourism operators pay the Environmental Management Charge, so each counted visit also contributes to the care of the reef.
Counting is not just book-keeping: it is how a valued place is protected.

Source: GBRMPA, Tourism visitation data (last updated 24 November 2025), retrieved 25 August 2026.

Diagram of how the Great Barrier Reef Marine Park Authority counts tourist visits: what counts, what does not, how the numbers are used, and how the Environmental Management Charge links counting to protecting the reef

The Swiss Alps are another tourism landscape named in the curriculum: the Jungfrau-Aletsch region was listed in 2001 under criteria (vii), (viii) and (ix), from 809 m to 4,274 m in altitude, with the Aletsch Glacier the largest in the Alps (UNESCO, retrieved 25 August 2026). In Australia, the curriculum's named tourism examples are the Great Barrier Reef and **Uluru**. This section teaches Uluru as a **landform and tourism example** (Figure 9): its size, rock type, formation and climate are the physical facts that make it famous, and fame brings visitors. The part of Uluru's World Heritage recognition that relates to Aboriginal and Torres Strait Islander culture is outside the scope of this series (see the notice at the front of the book), so it is not covered here.

Uluru: the numbers behind a famous landform

Taught here as a landform and tourism example (see the scope note below).

The scale of it

Rises 348 m above the surrounding plain
Higher than the Eiffel Tower, the Chrysler
Building or the Eureka Tower (Parks Australia)
Base walk: 9.4 km around
About 1,425,000,000 tonnes of rock above
ground (NT Geological Survey, 2018 estimate)
About 300 mm of rain a year; summer days
up to 47 degrees; winter nights to minus 7
21 mammals, 73 reptiles, 178 birds,
4 desert frog species recorded

How it formed (Parks Australia)

About 550 million years ago

Rock eroding from the Petermann
Ranges built huge fans.

About 500 million years ago

A sea covered the area; the sand fan
became sandstone (Uluru), rock fans
became conglomerate — a rock of
glued pebbles (Kata Tjuta).

About 400 million years ago

The sea was gone; plates shifted;
Uluru tilted 90 degrees.

The last 300 million years

Softer rock eroded away; Uluru and
Kata Tjuta were left standing.

Uluru, from the plain

fresh rock is grey — the red is rusting iron

arkose, a kind of sandstone

Shown as physical geography only: the part of Uluru's World Heritage recognition that relates to

Aboriginal and Torres Strait Islander culture is outside the scope of this series (front-of-book note).

Uluru drawn as a red dome with statistics: 348 metres above the plain, 9.4 kilometres around the base, about 1,425,000,000 tonnes of rock above ground, and a four-step formation timeline from about 550 million years ago

7. People disagree about value — steelman before you argue. When people argue about what should happen to a valued place, the rule in this workbook is to **steelman**: state the strongest honest version of the other side's position before you argue against it (Figure 10). Marks in this section reward reasoning, not the conclusion you reach.

Steelmanning both sides: should popular places limit visitor numbers?

A steelman is the strongest honest version of a position. State it fully before you argue against it.

Yes — limit visitor numbers (the strongest case)

Visitors wear valued places down — erosion, litter and stress on habitats.

Limits let the value survive for future visitors, not just this year's.

Fees can fund protection: on the Great

Barrier Reef, operators pay the

Environmental Management Charge.

(GBRMPA, retrieved 25 August 2026)

No — keep places open (the strongest case)

People value what they have experienced —

closing a place can cut the very bond that protects it.

Limits can lock out people who cannot book early or pay.

Tourism income pays for park staff, paths and protection.

Rules for this debate in our class

1. Define value before arguing — whose importance, and why?
2. Argue from evidence — real places, real numbers, real rules.
3. Answer the strongest version of the other side, not a weak copy of it.

Marks reward reasoning, not the conclusion you reach.

Two-panel steelman of the debate about limiting visitor numbers at popular places: the strongest case for limits and the strongest case against, with class rules for the debate

Worked examples

Worked example 1 — linking UNESCO's wording to kinds of value (source-led)

Use Figures 3, 4 and 5 to show how UNESCO's own wording records spiritual, aesthetic and cultural value at Mount Fuji and Mount Huangshan.

How to answer a “link the source to the idea” question: (1) quote the exact words from the source; (2) name the kind of value those words record; (3) explain the link in one sentence.

Model answer. At **Mount Fuji**, UNESCO's words ‘the object of pilgrimage for centuries’ and its note that religious practices link Shintoism and Buddhism record **spiritual value** — people climb Fuji as an act of faith. The words ‘represented in Japanese art since at least the 11th century’ record **aesthetic value** — artists kept drawing the mountain because of how it looks. The words about 19th-century woodblock prints making Fuji ‘an internationally recognised icon of Japan’ record **cultural value** — the mountain shaped art beyond Japan, including Western art. At **Mount Huangshan**, the Tang Dynasty legend dated 747 and the mountain's pull on hermits, poets and landscape artists record **spiritual and cultural value**, and the peaks rising through the sea of clouds — ‘the loveliest mountain of China’ — record **aesthetic value**. The Shanshui school of landscape painting, inspired there in the Ming Dynasty, records **cultural value**: one landscape shaped how the world pictures China's mountains.

Worked example 2 — how counting tourists helps manage a valued place (data-led)

Using Figure 8, explain how counting tourism is part of managing a valued place.

How to answer a “how does this data help management” question: (1) say what is counted and what is left out; (2) say which number best shows the trend, and why; (3) link the counting to one management action.

Model answer. The Great Barrier Reef Marine Park Authority counts four kinds of tourist visit: full day visits (day trips of more than 3 hours), part day visits (less than 3 hours), coral viewing and scenic flights. It leaves out transfer

passengers and some listed exempt visits. For the trend over time, the Authority says **full day visits are the best gauge**, and it updates the data twice a year. The Authority also says openly that its numbers have not been fully checked — a sign of a source worth trusting, because it tells you what its data can and cannot do. Counting links directly to management: tourism operators pay the **Environmental Management Charge**, so each counted visit also contributes money to the care of the reef. So counting is not just book-keeping — it is how a valued place is protected.

Practice questions

Scaffolded

- Q1.** (a) What does the word *value* mean in this section? (b) Why does the section define the word before using it? (Hint: what kind of word is *value*?)
- Q2.** List the three kinds of value from Figure 2. For each kind, give the example place Figure 2 uses.
- Q3.** Using Figure 3: (a) name the two places with cultural listings and the year each was listed; (b) which place has a mixed listing? (c) which three criteria does the Great Barrier Reef share with the Swiss Alps Jungfrau-Aletsch?
- Q4.** Using Figure 4, give one piece of evidence for each kind of value at Mount Fuji: (a) spiritual; (b) aesthetic; (c) cultural.
- Q5.** Using Figure 5: (a) which dynasty's legend gave Mount Huangshan its name, and what year is the legend dated? (b) what school of painting did the mountain inspire, and roughly when? (c) complete the sentence: 'UNESCO says this school shaped ...'.
- Q6.** Using Figure 8: (a) list two kinds of visit that count as tourist visits in the Great Barrier Reef Marine Park; (b) name one kind of person who does not count; (c) what does the Authority say is the best gauge of the general trend, and how often is the data updated? (d) what do tourism operators pay, and what does it fund?

Un scaffolded

- Q7.** Explain how a landform's physical features can give it tourism value. Use Uluru and at least three numbers from Figure 9 in your answer.
- Q8.** Figure 7 shows tourism as a system. Explain what would likely happen to the other links if managers removed the 'limits and fees' link. Use one real example from this section.
- Q9.** Compare the values people see in Mount Fuji and Mount Huangshan: give one similarity and one difference, each backed with evidence from Figures 4 and 5.
- Q10.** The Great Barrier Reef Marine Park Authority notes that its visitor numbers have not been fully checked. Explain why it matters to know that before you use the numbers as evidence. (Hint: what makes a source worth trusting?)
-

Extend — evidence-based response

E1. Question: *Should popular places limit visitor numbers?* Write a response of 120–160 words that: defines *value* the way you are using it; steelman the side you disagree with (state its strongest case fully); takes a position of your own and supports it with at least two named places from this section and at least one number or rule from this section. Marks reward reasoning, not the conclusion you reach.

Answers

Q1. (a) The importance people give to a place. (b) Because *value* is a contested word — people mean different things by it, and the meaning chosen can change the conclusion. **Q2.** Spiritual — Mount Fuji; aesthetic — the Swiss Alps; cultural — the Snowy River country. **Q3.** (a) Mount Fuji (2013) and the English Lake District (2017). (b) Mount Huangshan. (c) (vii), (viii) and (ix). **Q4.** (a) Pilgrimage for centuries; practices linking Shintoism and Buddhism. (b) Represented in Japanese art since at least the 11th century. (c) Woodblock prints made it an internationally recognised icon of Japan. **Q5.** (a) Tang Dynasty, dated 747. (b) The Shanshui ('Mountain and Water') school of landscape painting, in the Ming Dynasty, about the 16th century. (c) '...the way the world pictures China's mountain landscapes.' **Q6.** (a) Any two of: full day visits, part day visits, coral viewing, scenic flights. (b) Transfer passengers. (c) Full day visits; twice a year. (d) The Environmental Management Charge; the care (protection) of the Marine Park. **Q7–Q10.** Answers vary (see solutions). **E1.** Answers vary.

Fully-worked solutions

Q1. (a) In this section, *value* means **the importance people give to a place**. (b) *Value* is a **contested** word: different people mean different things by it, and the meaning you pick can change your conclusion. Defining it up front means everyone is arguing about the same idea — and because the meaning depends on whose importance we mean, each claim should also say which people, and why.

Q2. Spiritual value — example: Mount Fuji. Aesthetic value — example: the Swiss Alps. Cultural value — example: the Snowy River country.

Q3. (a) Mount Fuji (2013) and the English Lake District (2017). (b) Mount Huangshan (the Yellow Mountains). (c) Criteria (vii), (viii) and (ix). The reef adds criterion (x).

Q4. (a) Spiritual: Fuji has been 'the object of pilgrimage for centuries', and its religious practices link Shintoism and Buddhism. (b) Aesthetic: it has been represented in Japanese art since at least the 11th century. (c) Cultural: 19th-century woodblock prints made it 'an internationally recognised icon of Japan', with a deep impact on the development of Western art.

Q5. (a) A Tang Dynasty legend, dated 747. (b) The Shanshui ('Mountain and Water') school of landscape painting, inspired in the Ming Dynasty — about the 16th century. (c) 'UNESCO says this school shaped the way the world pictures China's mountain landscapes.'

Q6. (a) Full day visits (day trips of more than 3 hours), part day visits (less than 3 hours), coral viewing, scenic flights — any two. (b) Transfer passengers (some listed exempt visits also do not count). (c) Full day visits are the best gauge of the general trend of tourism in the Marine Park; the data is updated twice a year. (d) Operators pay the Environmental Management Charge, which helps fund protection of the Marine Park.

Q7. A landform's physical features give it tourism value when they attract visitors. Uluru rises 348 m above the surrounding plain — higher, Parks Australia notes, than the Eiffel Tower, the Chrysler Building or the Eureka Tower — and its base walk is 9.4 km around. About 1,425,000,000 tonnes of rock sit above ground. Its colour is part of the draw too: the rock is arkose (a kind of sandstone), originally grey, and its red comes from rusting iron. These measurable facts make the landform famous, and fame sits at the start of the tourism system in Figure 7 — value draws visitors.

Q8. If managers removed the 'limits and fees' link, the pressure link would grow — more erosion, litter and stress on habitats — while the money for protection shrank. On the Great Barrier Reef, for example, removing the Environmental Management Charge would cut funding that helps protect the reef while visits kept coming. Over time, the very value that attracted visitors would wear down, and eventually visitor numbers would fall too: the loop would eat itself. That is why management is a link in the system, not an extra.

Q9. Similarity: both mountains are valued for spiritual and cultural reasons as well as beauty. Fuji is a pilgrimage site whose practices link Shintoism and Buddhism; Huangshan is a magnet for hermits, poets and landscape artists, and a Tang Dynasty legend dated 747 gave it its name. Difference: the art each mountain shaped is different. Fuji's fame spread through 19th-century woodblock prints that influenced Western art, while Huangshan inspired the Shanshui

school of landscape painting in the Ming Dynasty. The listings differ too: Fuji is a cultural listing (2013), while Huangshan is a mixed listing (1990).

Q10. Knowing the numbers are not fully checked tells you how hard to lean on them. A source worth trusting says what its data can and cannot do: the Authority's note means its figures are a useful guide to the trend — especially full day visits — but not a final, checked count. If you used the numbers as proof without that caution, you could claim more than the evidence supports.

E1 (model). *Value means the importance people give to a place. The strongest case against limits is this: people value what they have experienced, and closing a place can cut the very bond that protects it; limits can also lock out people who cannot book early or pay, and tourism income pays for park staff and protection. Even so, I support limits where pressure is proven. Mount Fuji's 25 listed sites, including pilgrim routes, carry centuries of spiritual value; crowds with no limits would wear down what makes the place valued. On the Great Barrier Reef, operators already pay the Environmental Management Charge, a rule that turns each visit into funding for protection. Limits and fees together let this year's visitors see the place without spending next generation's share of it.*

Teaching sequence (teacher)

1. **Hook (5 min):** show a photo of Mount Fuji. Ask: "Why do people climb this mountain?" Collect reasons on the board and sort them — faith, beauty, fame. Announce: today we study *value*.
2. **Direct teaching (10 min):** Figure 1 — the five kinds of term and why *value* needs a definition before we argue (worked example of defining an undefined curriculum word). Then Figure 2 — the three kinds of value; stress that one place can hold all three.
3. **The heritage record (10 min):** Figure 3. Define UNESCO, World Heritage listing, criteria. Worked example 1 — model the three-step source-to-value method, then have students try it on the Lake District row (UNESCO: 'the idea that landscape has a value').
4. **Asia focus — E03 (10 min):** Figures 4 and 5. Students complete Q4 and Q5 in pairs. Emphasise the Asia priority: the section's case studies sit deliberately in Japan and China.
5. **Art and tourism — E04, E07 (10 min):** Figure 6 (representation in art, music, literature, film), then Figures 7–8 and Worked example 2. Students attempt Q6.
6. **Uluru as a landform (5 min):** Figure 9 — teach the physical facts only (size, rock, formation, climate). Say plainly to the class that the part of Uluru's significance covered elsewhere in the public record is outside the scope of this series (front-of-book notice), so we study it here as a landform and tourism example.
7. **Debate (10 min):** Figure 10 steelman; set E1. Remind students: marks reward reasoning, not conclusion.
8. **Check for understanding:** exit card — "one kind of value, one place that holds it, one piece of evidence."

This section teaches the retained elaborations only (VC2HG8K13.E03, .E04, .E07). Uluru appears as a landform and tourism example with physical-geography facts only; no Aboriginal and Torres Strait Islander content is taught anywhere in this section, in line with Content Policy Rule 1 and the §2A record in the TOC.

Sources (retrieved 25 August 2026 unless stated)

- UNESCO World Heritage List — 'Fujisan, sacred place and source of artistic inspiration' (2013, criteria iii and vi); 'Mount Huangshan' (1990, criteria ii, vii and x); 'Swiss Alps Jungfrau-Aletsch' (2001, criteria vii, viii and ix); 'Great Barrier Reef' (1981, criteria vii, viii, ix and x); 'The English Lake District' (2017, criteria ii, v and vi). Quoted wording normalised to Australian spelling.
- Great Barrier Reef Marine Park Authority — 'Tourism visitation data' (page last updated 24 November 2025): visit categories, exclusions, full day visits as the best gauge of trend, twice-yearly updates, the Authority's note that its data has not been validated (paraphrased here as 'not fully checked'), and the Environmental Management Charge.
- Parks Australia — Uluru fact sheet: 348 m above the plain; comparisons with the Eiffel Tower, Chrysler Building and Eureka Tower; 9.4 km base walk; NT Geological Survey 2018 estimate of about 1,425,000,000 tonnes of above-ground rock; climate and species counts. Uluru geology page: formation sequence (about 550, 500 and 400 million years ago); arkose; red colour from rusting iron.

- Project Gutenberg Australia — A. B. ‘Banjo’ Paterson (1864–1941); ‘The Man from Snowy River’ published in his 1895 collection.
- Wikipedia (tertiary) — ‘Symphony No. 6 (Beethoven)’: the ‘Pastoral’ nickname, first performed at the Theater an der Wien, Vienna, on 22 December 1808, and the composer’s inscription ‘more an expression of feeling than painting’; ‘The Man from Snowy River (1982 film)’: released 25 March 1982, based on the Paterson poem, filmed in the Victorian High Country near Mansfield.

All figures in this section are drawn from primitives for this workbook; no publisher’s map or diagram has been traced or copied.

Shaping the land: geomorphological processes and a local landform study

Section 3C · Victorian Curriculum 2.0, Levels 7 and 8 Geography · Content description VC2HG8K14 · Draws on elaborations VC2HG8K14.E01, .E02, .E03, .E04, .E05 and .E06.

Look at almost any part of Australia and you can see shapes in the land: a line of rocky hills, a steep-sided valley, a row of sand dunes, or cliffs with tall pillars of rock standing out in the sea. Each of these shapes is a **landform** — a natural feature of the Earth's surface, such as a mountain, a hill, a dune, a beach or a gorge. This section answers the question behind every landform: *what made this shape?* The study of the shape of the land, and of the processes that shape it, is called **geomorphology** (say it: jee-oh-mor-FOL-uh-jee). The processes themselves are the **geomorphological processes** of the title — and they are not ancient history. Some are slow enough to need millions of years; others you could watch happening on a beach this afternoon.

Teaching sequence (for the teacher)

1. **The framing (CD; VC2HG8K14.E02).** Open with the question *what made this shape?* using a landform every student has seen — a local hill, a creek bank, a beach. Define landform, geomorphology and geomorphological processes at first use. The CD text is delivered in full by the theory blocks below; “Draws on” ids are linkage, not teaching order (the recorded series plan, D10).
2. **The two engines.** Figure 3C.1 classifies the processes into inside-the-Earth (building up) and at-the-surface (wearing down and rebuilding). This map is reused in Worked Example 4 and Practice Q1.
3. **Building up (VC2HG8K14.E02, .E03).** Folding and faulting (Figure 3C.2) and volcanism (Figure 3C.3), each with the curriculum's named exemplars: the MacDonnell Ranges (folded country in the Northern Territory); the Great Sumatran Fault (also called the Semangko Fault) in Indonesia; and Krakatoa, the Indonesian volcano. Victorian examples (the Organ Pipes, the You Yangs, the Newer Volcanics Province) keep the content local; the Asia priority stays live through the Indonesian cases.
4. **Wearing down (VC2HG8K14.E02).** Weathering — physical and chemical — happens in place (Figure 3C.4); erosion, transportation and deposition move the material (Figure 3C.5). Keep the distinction sharp: weathering breaks rock; erosion carries it.
5. **Two case studies of one set of processes (VC2HG8K14.E04).** The Twelve Apostles (erosion by waves, tides and ocean currents; Figure 3C.6) and K'gari (deposition by waves, currents and wind; Figure 3C.7). Both are the curriculum's own named examples; both stay physical-geography teaching points.
6. **Diversity at the national scale (VC2HG8K14.E01).** Figure 3C.8 surveys the landscape types and the named landform examples (Himalayan Mountains, the Steppe, the Daintree, the Gobi) as *products* of the processes. Keep this block brief — the distribution of Australia's landscapes is owned by Section 3A (VC2HG8K12), not re-taught here.
7. **Reading shape (VC2HG8K14.E05).** Contour lines, the three reading rules, and contour map to cross-section (Figure 3C.9, a practice map drawn for this section). Name Vicmap Topographic Maps as Victoria's official source of real contour maps for any locality.
8. **The local study (VC2HG8K14.E05, .E06).** Figure 3C.10 gives the five-step study cycle, generic to any Victorian locality (the recorded series plan requires tasks that any school can run locally; D6). 3C studies how the local landform was produced; Section 3D studies how people are changing and managing the same landform; the reporting is taught in Section 6C — one connected fieldwork thread.

Worked Examples 1 and 2 are the two worked demonstrations (contour-to-cross-section; the Twelve Apostles process story built on cited data); the practice set is figure-led throughout.

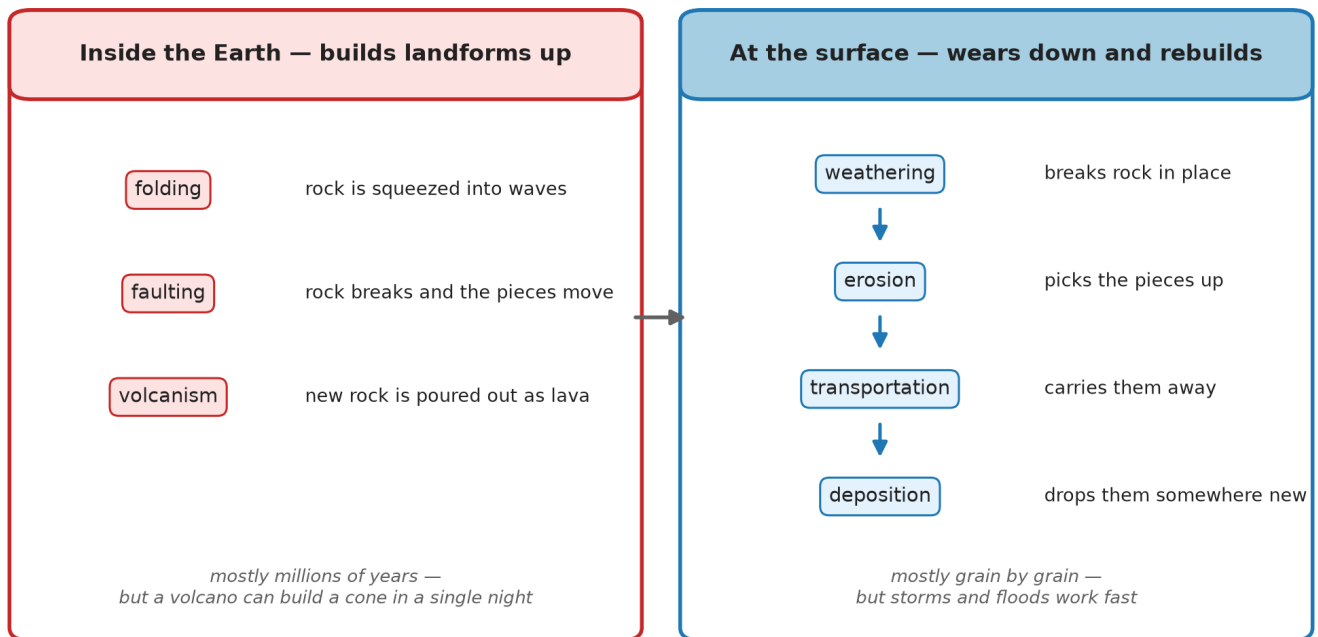
Theory

The two engines of landform change

Geographers sort geomorphological processes into two big groups. **Inside-the-Earth processes** build the large features up: they push rock into folds, break it along faults, and pour out new rock from volcanoes. **At-the-surface**

processes wear those features down and rebuild the pieces in new places: **weathering** breaks rock apart where it lies; **erosion** picks the broken material up; **transportation** carries it away; and **deposition** drops it somewhere new.

The two engines of landform change



The two engines are connected: rock lifted up is at once worn down.

Figure 3C.1 — The two engines of landform change. Inside-the-Earth processes build landforms up: folding (rock squeezed into waves), faulting (rock broken and moved) and volcanism (new rock poured out as lava). At-the-surface processes wear them down and rebuild the pieces: weathering breaks rock in place, erosion picks it up, transportation carries it, and deposition drops it somewhere new to build new landforms. Original figure for this workbook; the process groups follow VC2HG8K14.E02.

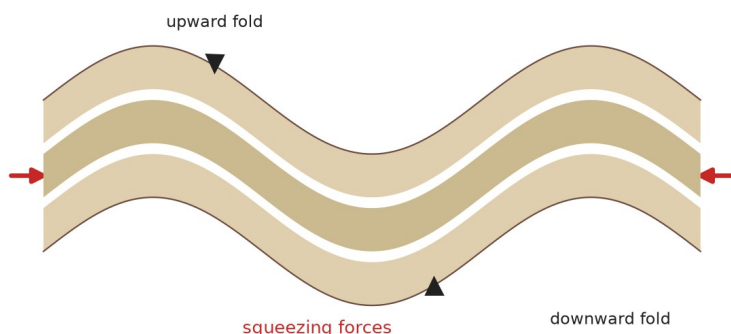
The two engines work on different clocks. Inside-the-Earth processes usually need millions of years to show results — but a volcano can build a new island in a single night. Surface processes are mostly slow too, grain by grain — but a storm can cut a cliff, and a flood can move a river bank, in hours. And the two engines are connected: inside-the-Earth processes lift the rock up, and the moment it stands up, wind, water and ice begin to wear it down.

Building up 1: folding and faulting (VC2HG8K14.E02, .E03)

The Earth's outer shell is not one solid skin. It is broken into huge, slow-moving slabs called **plates** (a **plate** is one of about twenty giant pieces of the Earth's rocky outer shell). Plates move only a few centimetres a year — about as fast as your fingernails grow — but they carry enormous forces with them. Where plates squeeze together, rock is pushed into waves, just as the bonnet of a car crumples when it hits a wall. A wave of bent rock is called a **fold**, and the bending is **folding**.

When rock bends and breaks: folding and faulting

Folding — rock layers bent by squeezing



Folding

Example: the MacDonnell Ranges, Northern Territory — rock squeezed into folds and lifted about 300–400 million years ago, then carved by erosion

Faulting — rock breaks, and the pieces move along the break

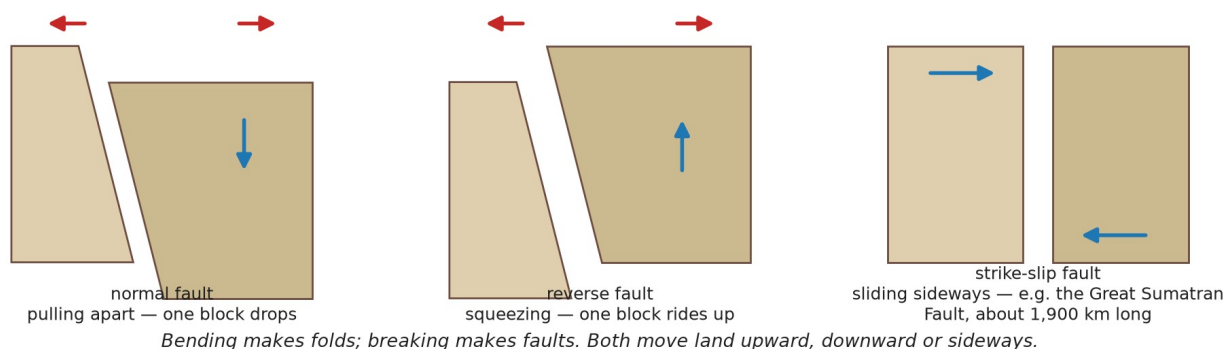


Figure 3C.2 — When rock bends and breaks: folding and faulting. Top: squeezing forces bend rock layers into upward folds and downward folds — folding made ranges like the MacDonnell Ranges. Bottom: when rock breaks instead of bending, the blocks move along a fault. A normal fault pulls apart and drops one block down; a reverse fault squeezes and pushes one block up over the other; a strike-slip fault slides sideways, like the Great Sumatran Fault. Original figure for this workbook; the processes follow VC2HG8K14.E02, the examples VC2HG8K14.E03. Data: Wikipedia, “MacDonnell Ranges” and “Great Sumatran Fault”, retrieved 25 August 2026.

Australia’s **MacDonnell Ranges**, west and east of Alice Springs in the Northern Territory, are folded country. Around 300 to 400 million years ago, slow forces inside the Earth squeezed and buckled the rock there and lifted it into ranges, and since then erosion has carved the folds into the steep red ridges and gorges you can see today.

Where the forces break rock instead of bending it, the pieces move along the break. A break in rock along which pieces have moved is a **fault**, and the moving is **faulting**. Figure 3C.2 shows the three main kinds. **Indonesia’s Great Sumatran Fault** (also called the Semangko Fault) is one of the world’s great faults: a crack about 1,900 kilometres long running almost the full length of the island of Sumatra, where the two sides slide sideways past each other. That sideways slide is why Sumatra has frequent earthquakes — a reminder that faulting is not finished.

Building up 2: volcanism (VC2HG8K14.E02, .E03)

Deep under some places, rock melts into a thick, hot liquid called **magma**. Magma is lighter than the solid rock around it, so it rises, and when it reaches the surface it erupts as **lava** (lava is simply magma that has reached the surface), ash and gas. **Volcanism** is the family of processes built around those eruptions, and a **volcano** is the landform an eruption builds — usually a cone of hardened lava, ash and cinders around the opening, called a **vent**, where the magma came out.

Volcanism builds new land

Example: Krakatoa, Indonesia — its August 1883 eruption was one of the largest in recorded history; a new cone, Anak Krakatau, has been growing from the same site since 1927.

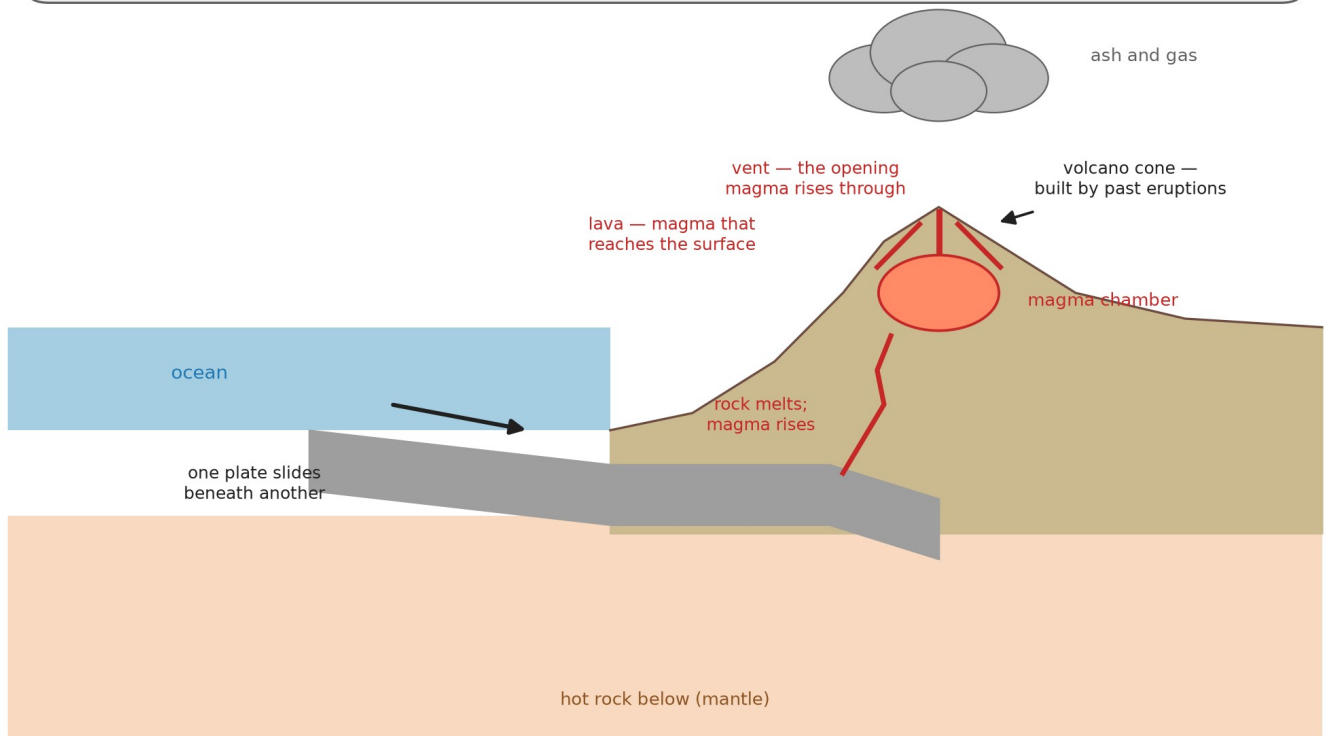


Figure 3C.3 — Volcanism builds new land. Where one plate slides beneath another, rock deep below melts into magma; the magma is lighter than the rock around it and rises, collecting in a magma chamber before erupting through a vent as lava, ash and gas. Each eruption adds new rock, building a volcanic cone. Krakatoa in Indonesia erupted this way — and a new cone, Anak Krakatau, has been growing from the same site since 1927. Original figure for this workbook; the process follows VC2HG8K14.E02, the example VC2HG8K14.E03. Data: Wikipedia, “Krakatoa”, retrieved 25 August 2026.

Krakatoa, a volcanic island in Indonesia, shows volcanism at its most dramatic. In August 1883 it blew apart in one of the largest eruptions in recorded history; the explosions and the huge sea waves they caused killed more than 36,000 people. From the wreckage, a new volcano — **Anak Krakatau**, “child of Krakatoa” — has been growing since 1927. Volcanism destroys places and produces new ones, sometimes in the same lifetime.

Victoria has its own volcanic story. Near Melbourne, **Organ Pipes National Park** holds a gorge of basalt — a dark volcanic rock — cracked into tall six-sided columns like the pipes of an organ, as the lava cooled and shrank 2.5 to 2.8 million years ago. The basalt belongs to a chain of more than 400 small volcanoes across western Victoria and South Australia whose youngest eruptions happened only about 5,000 years ago. And the **You Yangs**, south-west of Melbourne, are made of granite — rock that cooled from magma *underground* about 365 million years ago, and was only uncovered later, when erosion wore away the rock above it. One landform can be started by one process and finished by another.

Wearing down 1: weathering — rock broken in place (VC2HG8K14.E02)

Weathering is the breaking down of rock *where it lies*, before anything carries it away. It comes in two kinds.

Physical weathering breaks rock into smaller pieces without changing what the rock is made of. Water seeps into cracks, freezes on cold nights and expands, wedging the crack wider (frost wedging); tree roots grow into cracks and slowly lever them apart; and rock buried deep underground, once uncovered by erosion, can shed curved layers as the pressure comes off — a bit like an onion shedding its skin. **Chemical weathering** changes the rock itself: weak acids in rainwater slowly dissolve some rocks, such as limestone, and the iron in some rocks reacts with air and water and crumbles to rust.

Weathering — rock broken down where it lies

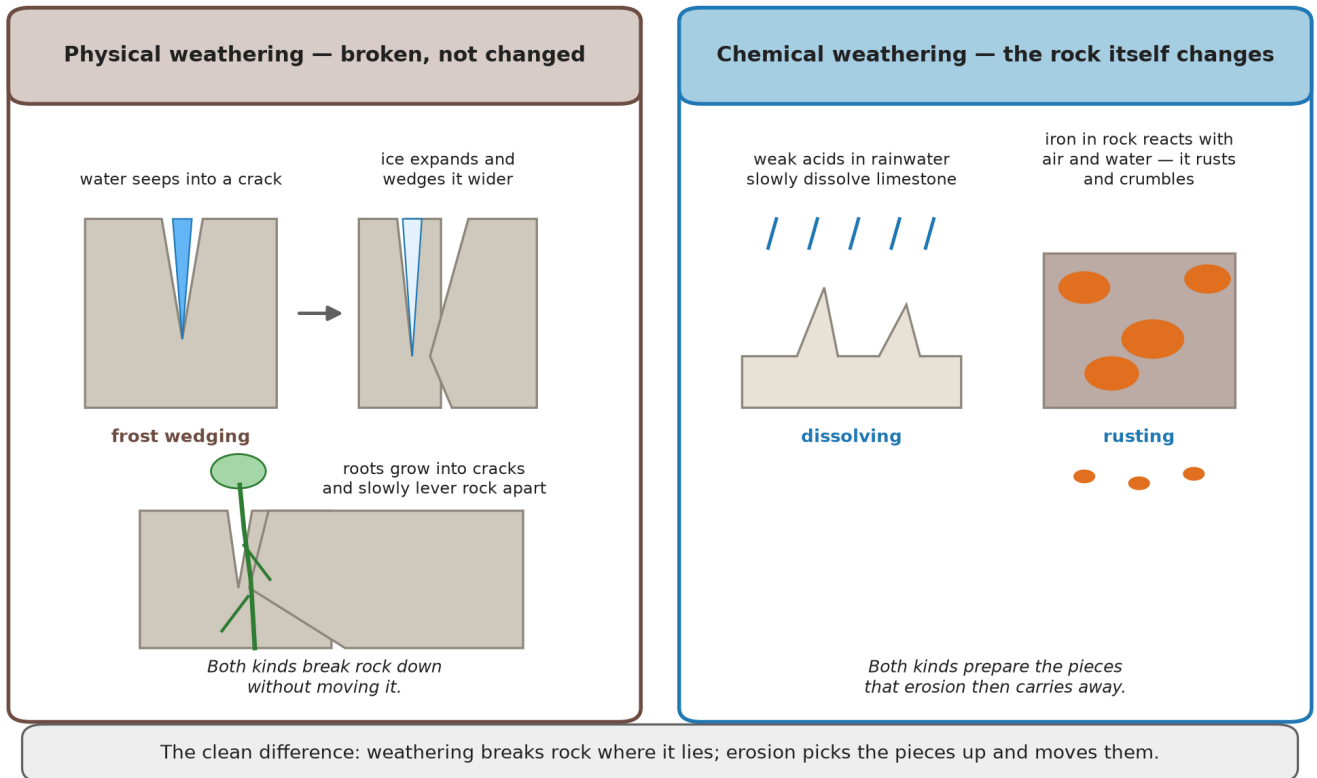


Figure 3C.4 — Weathering breaks rock down in place. Physical weathering: water freezes and expands in cracks (frost wedging) and roots grow into cracks, both prying rock apart without changing it. Chemical weathering: weak acids in rainwater dissolve rock such as limestone, and iron in rock reacts with air and water and crumbles to rust — the rock itself is changed. Weathering prepares the material that erosion then carries away. Original figure for this workbook; the process types follow VC2HG8K14.E02.

Weathering and erosion are easy to mix up, so here is the clean difference: **weathering** breaks rock down without moving it; **erosion** picks the pieces up and carries them away. Weathering is the preparation; erosion is the removal.

Wearing down 2: the journey of the pieces — erosion, transportation, deposition (VC2HG8K14.E02)

Once rock is broken, something carries it. The main carriers are **water** — rain, rivers, waves and ocean currents — and **wind**. The journey has three stages, and each stage has a landform job to do:

The journey of broken rock: erosion, transportation, deposition

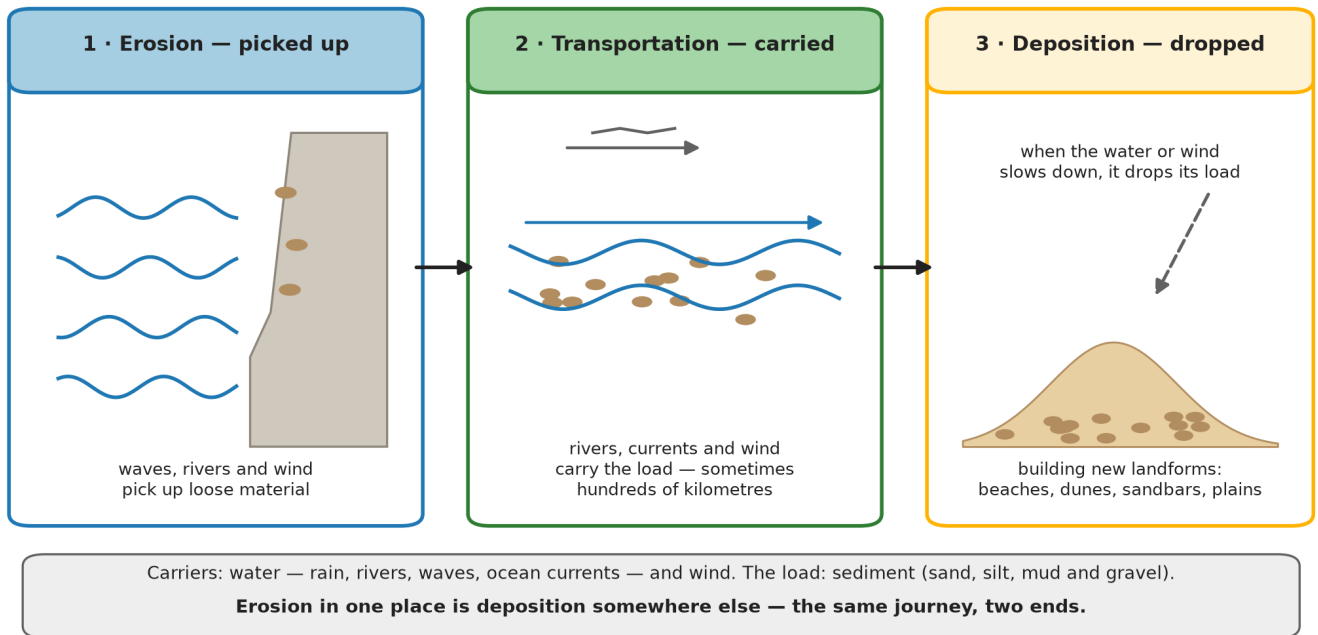


Figure 3C.5 — The three-stage journey of broken rock. *Erosion: water and wind pick up the material that weathering prepared. Transportation: rivers, waves, currents and wind carry it, sometimes for hundreds of kilometres. Deposition: when the water or wind slows down, it drops its load — building new landforms such as beaches, sand dunes, sandbars and wide plains of sediment. Material eroded from one place is deposited to make landform in another. Original figure for this workbook; the stages follow VC2HG8K14.E02.*

- **Erosion** picks the material up — waves hammer a cliff, a river plucks at its bed, wind lifts sand.
- **Transportation** carries it — along a coast, down a river, across a desert.
- **Deposition** drops it when the carrier slows down — because moving material takes energy, and slower water and wind can carry less.

The material being carried is called **sediment** — the sand, silt, mud and gravel that eroded rock is broken into. Deposition is a builder: beaches, sand dunes, sandbars and broad flat plains are all landforms made from deposited sediment. Keep the link in mind, because it runs through the rest of this section: *erosion in one place is deposition somewhere else*.

Case study 1: the Twelve Apostles — erosion at work (VC2HG8K14.E04)

The **Twelve Apostles**, on Victoria's coast near Port Campbell along the Great Ocean Road, are tall pillars of limestone standing in the sea beside tall cliffs. They were made by **erosion** — by waves, tides and ocean currents attacking the rock.

How the sea carves a coast: headland, cave, arch, stack

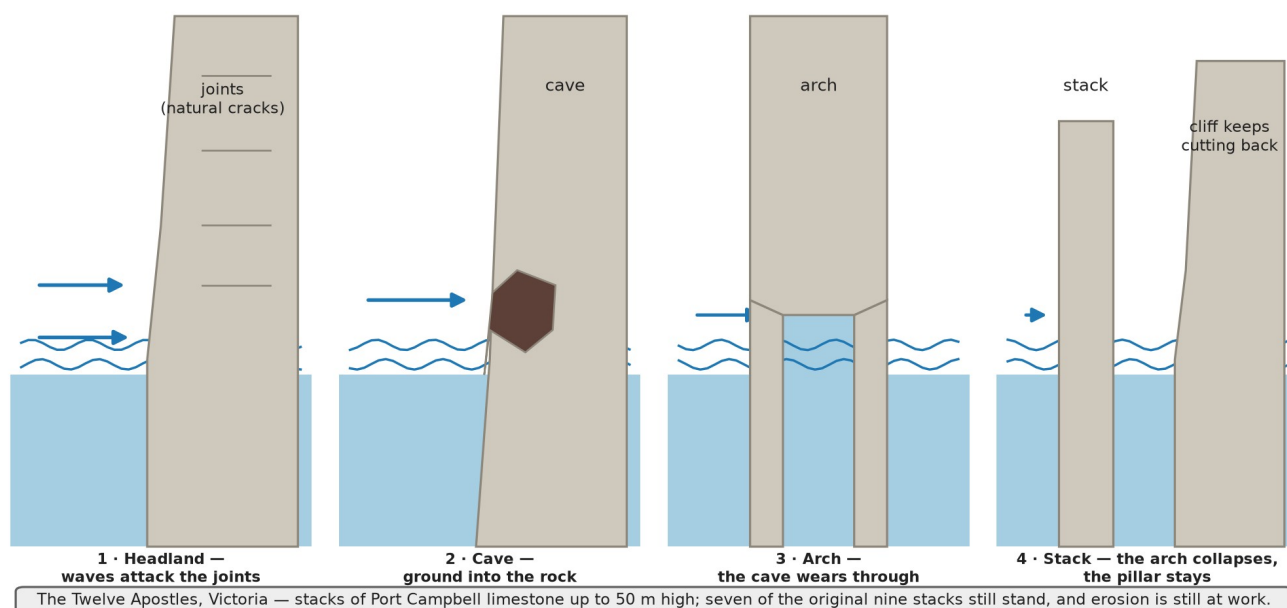


Figure 3C.6 — How the sea carves a coast: the erosion sequence behind the Twelve Apostles, Victoria. Waves attack weak spots (joints) in a headland and grind a cave into it; the cave is worn through to make an arch; the arch roof collapses, leaving an isolated pillar of rock — a stack — standing in the sea. The Twelve Apostles are stacks like these, up to 50 metres high. Original figure for this workbook; the sequence follows VC2HG8K14.E04, whose named example is the Twelve Apostles on Victoria's coast, cut by wave erosion, tides and currents. Data: Wikipedia, "Twelve Apostles", retrieved 25 August 2026.

The story starts with the rock itself. The cliffs and stacks are **Port Campbell limestone**, a rock that formed on an old sea floor as layers of shell and sand, roughly 15 to 5 million years ago. When the sea floor rose to become the coast, waves began attacking it. Limestone is soft enough for waves to grind away, especially where the rock has natural cracks, called **joints**. Waves forced sand and pebbles into the joints and ground them wider, opening **caves** in the cliffs. Where a cave was worn right through a headland, an **arch** was left; when an arch's roof became too thin and collapsed, only an isolated pillar — a **stack** — remained standing in the sea. The tallest stacks reach about 50 metres. The work is not finished: of the original nine stacks, seven remain standing today, and the cliffs are still being cut back.

Case study 2: K'gari — deposition at work (VC2HG8K14.E04)

At the other end of the coast, in Queensland, sits **K'gari** (formerly Fraser Island) — the world's largest sand island, about 123 kilometres long. If the Twelve Apostles show erosion taking rock away, K'gari shows **deposition** building land up.

K'gari, Queensland — an island built by deposition

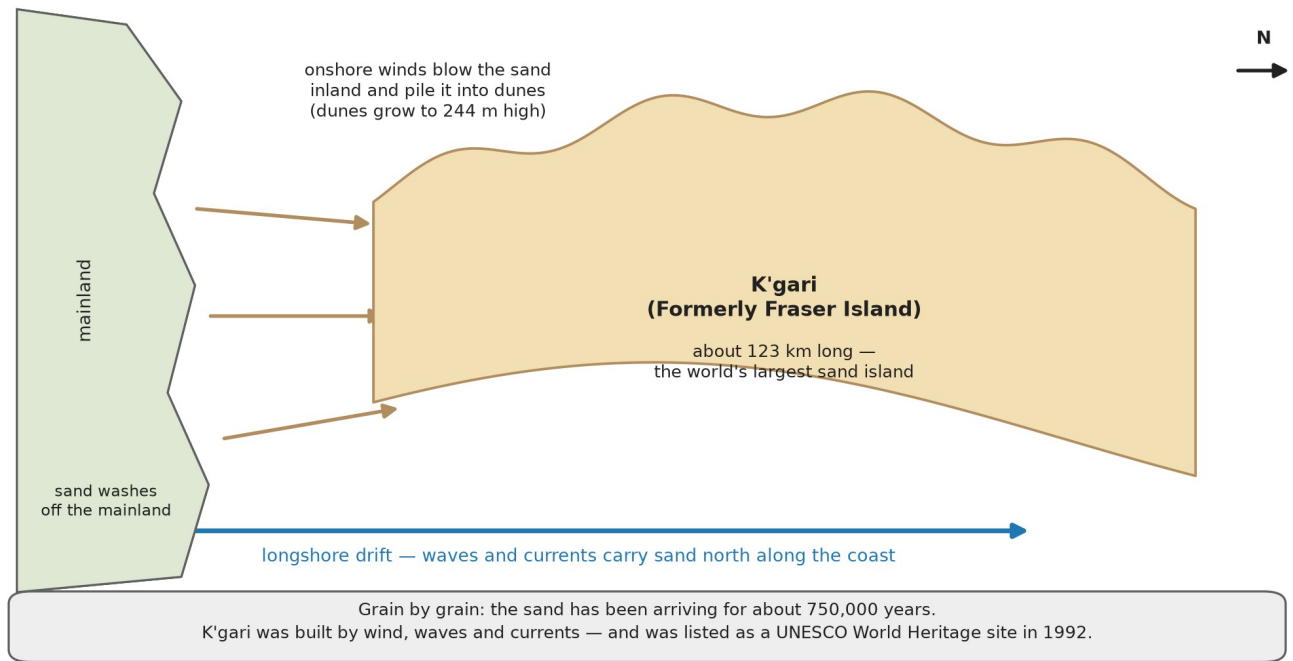


Figure 3C.7 — K'gari, Queensland: a landform built by deposition. Sand washed from the mainland is carried north along the coast by longshore drift (waves and currents moving sand along the shore). Onshore winds then pick the sand up and blow it inland, piling it into dunes that grow to 244 metres high. The sand has been arriving for about 750,000 years — long enough to build the world's largest sand island, about 123 kilometres long. Original figure for this workbook; the example follows VC2HG8K14.E04 (K'gari, built by wind, waves and currents). Data: Wikipedia, "K'gari", retrieved 25 August 2026.

The builders were waves, currents and wind. Sand washed off the mainland was carried north along the coast by **longshore drift** (the movement of sand along a shore by waves and currents arriving at an angle). Where the sand reached the shallows beside the island, onshore winds picked it up and blew it inland, piling it into **dunes** — hills of sand — that grow as high as 244 metres. The sand has been arriving for about 750,000 years, grain by grain, long enough to build an island. K'gari is so unusual — sand dunes, rainforest growing on sand, and lakes formed where dunes dammed the rain — that it was listed as a UNESCO World Heritage site in 1992.

The products: landscapes and landforms of the world (VC2HG8K14.E01)

Run the engines of Figure 3C.1 for long enough and the result is the variety of landscapes and landforms on Earth. A **landscape** is the whole view of the land — its landforms, plants and water together. Landscapes come in types — wetlands, grasslands, forests, cold deserts and hot deserts — and each type has landforms that suit it.

The products: landscapes and landforms of the world

Landscape types	Named landform examples
wetlands land covered or soaked with water grasslands open plains of grass forests land thick with trees cold deserts very dry places, bitterly cold hot deserts very dry places, fiercely hot <i>A desert is defined by how little rain falls — not by heat.</i>	mountains — the Himalayan Mountains, Nepal folded mountains, still rising as the Indian plate presses in; Mount Everest stands at 8,848.86 m (agreed by a 2020 survey) grasslands — the Steppe, Central Asia vast, flat, treeless plains — too dry for forest, not dry enough to be desert forests — the Daintree, Queensland tropical rainforest about 180 million years old — older than the Amazon hot deserts — the Gobi, China bone-dry, with bitterly cold winters; many sources call it a cold desert
Folding, faulting, volcanism, weathering, erosion and deposition made every one of these places.	

Figure 3C.8 — Landscapes and their landforms: the variety the processes produce. Landscape types — wetlands (land covered or soaked with water), grasslands (open plains of grass), forests (land thick with trees), cold deserts and hot deserts (very dry places; deserts are defined by how little rain falls, not by heat). Named landform examples — mountains: the Himalayan Mountains, Nepal, where Mount Everest stands at 8,848.86 m; grasslands: the Steppe, the great open plains of Central Asia; forests: the Daintree, Queensland, rainforest about 180 million years old; hot deserts: the Gobi, China, bone-dry but bitterly cold in winter. Original figure for this workbook; the types and examples follow VC2HG8K14.E01. Data: Wikipedia, “Mount Everest”, “Daintree rainforest”, “Gobi Desert”, retrieved 25 August 2026.

Four quick notes on the examples in Figure 3C.8. The **Himalayan Mountains** of Nepal are folded mountains, pushed up where the Indian plate is still pressing into Asia — and Everest, at 8,848.86 metres (the height agreed by a 2020 survey), is still rising slowly. **The Steppe** of Central Asia is a vast, flat, treeless grassland, too dry for forest but not dry enough to be desert. The **Daintree** in Queensland is a tropical rainforest about 180 million years old — older than the Amazon — grown on land shaped by those same slow processes. And the **Gobi** of China is the example named in the curriculum as a hot desert; in fact the Gobi has bitterly cold winters, and many sources describe it as a cold desert — because a **desert** is defined by how little rain falls, not by how hot it is. The processes of this section made every one of these places.

Reading the shape: contour maps and cross-sections (VC2HG8K14.E05)

You can see the shape of a local landform with your eyes — but maps let you see it from above, and a special kind of map line lets you measure it. A **contour line** is a line on a map joining all the places that sit at the same height above sea level. Each line is labelled with its height, and a map states its **contour interval** — the height step from one line to the next (for example, 20 metres).

Three rules let you read the shape from the lines:

1. **Close lines mean steep ground** — the height is changing fast over a short distance.
2. **Lines far apart mean gentle ground** — the height is changing slowly.
3. **Rings of closed lines mean a hill or a peak** — and the lines on one side of a valley form a V that points uphill.

A **cross-section** is a side view of the land, as if you cut it with a giant knife and looked at the cut face. You draw one by reading the contours along a straight line across the map and marking each height in order.

From contour map to cross-section

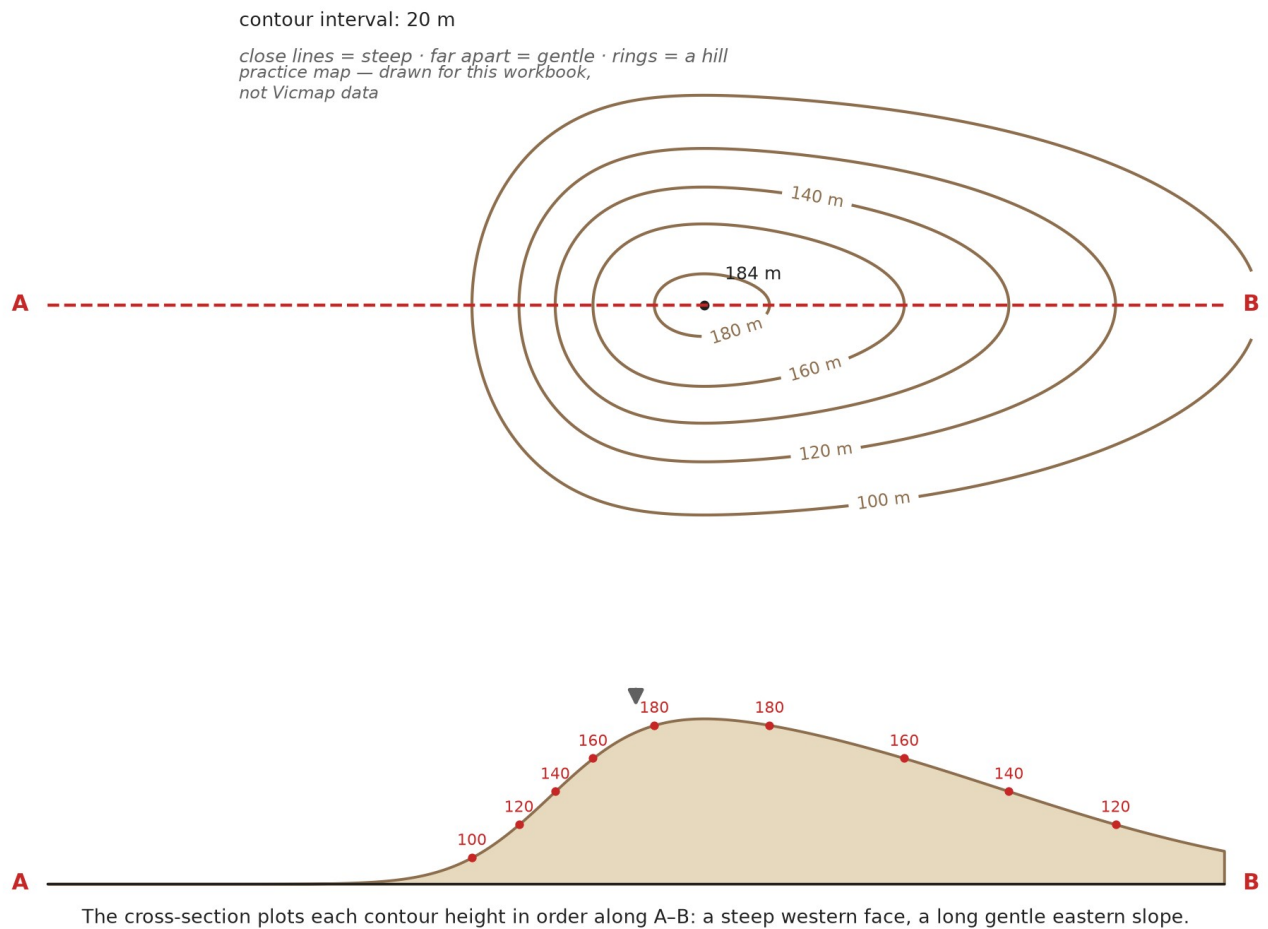


Figure 3C.9 — From contour map to cross-section. The practice map (drawn for this workbook — not Vicmap data) shows a hill with contour lines every 20 metres from 100 m to 180 m: the lines are close together on the west side (steep slope) and far apart on the east side (gentle slope), and the closed rings mark the 180 m summit. Reading the heights along the line A–B and plotting them in order gives the cross-section below — a profile with a steep western face and a long, gentle eastern slope. For the real contours of any Victorian locality, use Vicmap Topographic Maps, the Victorian Government’s official topographic map product (Land Use Victoria). Original figure for this workbook; the skill follows VC2HG8K14.E05.

In Victoria, the official source of contour maps is **Vicmap Topographic Maps** — the Victorian Government’s own topographic mapping, which shows contours, roads, waterways and place names for every part of the state. Section 3D and Section 6C reuse these skills: in 3D you will map how people are changing your local landform, and in 6C you will report your findings.

Your local landform study (VC2HG8K14.E05, .E06)

The curriculum asks you to study a landform near you. First, the frame: in this section, **local** means *any place your class can reasonably reach* — a hill, a creek bank, a dune, a beach, a cliff, a valley, a quarry face, within or near your town. The study below works in any Victorian locality, because the questions are about *processes*, and the same processes operate everywhere.

Your local landform study — five steps

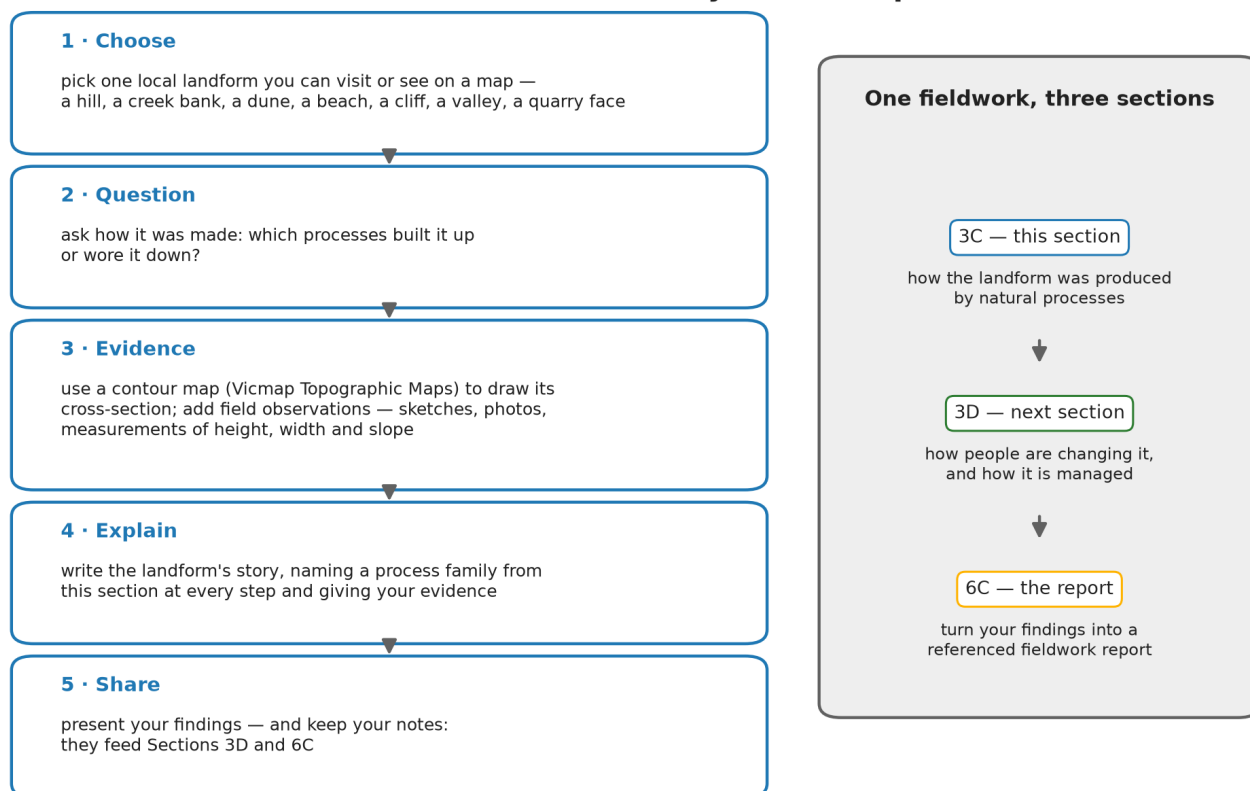


Figure 3C.10 — *Your local landform study: the five steps. Step 1 Choose: pick one local landform you can visit or see from a map. Step 2 Question: ask how it was made — which processes built it or wore it down? Step 3 Evidence: gather a contour map and cross-section of the landform (Vicmap Topographic Maps), plus field observations — sketches, photos and measurements. Step 4 Explain: write the landform's story, naming the processes from Figures 3C.1–3C.7 and giving evidence for each step. Step 5 Share: present your findings; Section 3D adds how people are changing the same landform, and Section 6C teaches the fieldwork report. Original figure for this workbook; the cycle supports VC2HG8K14.E05 and .E06 and the shared local study of 3C and 3D.*

Your study has five steps, shown in Figure 3C.10: **choose** one local landform; **question** — ask which processes made it; **evidence** — use a contour map to draw its cross-section and record field observations (sketches, photos, measurements of height, width and slope); **explain** — write its story, naming a process family from this section at every step; and **share** — present your findings. The explanation is the heart of the study: “it is made of soft rock and the sea is cutting it back” is the start of an answer; “waves exploit joints in the limestone, grinding caves that become arches and collapse into stacks” is a real one.

Worked examples

Example 1 — scaffolded (Figure 3C.9, contour map and cross-section)

(a) What is the contour interval of the practice map, and what height is the summit? (2 marks)

Step 1 — read the labelled lines. The lines are labelled 100 m, 120 m, 140 m, 160 m, 180 m. Each line is 20 m above the one before. **Answer: the contour interval is 20 m.** *Step 2 — find the innermost ring.* The smallest closed ring is labelled 180 m. **Answer: the summit is 180 m above sea level.**

(b) Which side of the hill is steeper — the west side or the east side? How do the contours tell you? (2 marks)

Step 1 — compare the spacing. On the west side the lines are close together; on the east side they are far apart. *Step 2 — apply the rule.* Close lines mean steep ground. **Answer: the west side is steeper, because its contour lines are closer together — the height is changing fast over a short distance.**

(c) Why does the cross-section below the map have a steep left-hand slope and a long, gentle right-hand slope? (2 marks)

Step 1 — read the heights along A–B from left to right: 100, 120, 140, 160, 180, then back down 160, 140, 120, 100.

Step 2 — read the spacing. The climb happens quickly (lines close = steep), while the fall is spread over a longer distance (lines far apart = gentle). **Answer: the cross-section simply plots each contour height in order, so the steep western contour spacing becomes a steep slope and the wide eastern spacing becomes a gentle one.**

Example 2 — scaffolded (Figures 3C.5 and 3C.6, the Twelve Apostles process story)

Explain how one stack of the Twelve Apostles was made, from sea-floor rock to standing pillar. (4 marks)

Step 1 — name the rock and where it came from. The stacks are Port Campbell limestone, formed from shell and sand layers on an old sea floor roughly 15 to 5 million years ago. *Step 2 — name the attacking process.* Waves, tides and ocean currents erode the rock, especially where natural cracks (joints) give them a way in. *Step 3 — put the sequence in order.* Waves grind joints into **caves**; a cave worn through a headland makes an **arch**; the arch roof collapses, leaving an isolated **stack** standing in the sea. *Step 4 — show the change is still happening.* Of the original nine stacks, seven remain; the tallest reach about 50 m, and the cliffs are still being cut back. **Answer: a stack is what is left when erosion — wave attack along joints, working through cave and arch stages — removes a headland around one pillar of rock.**

Example 3 — unscaffolded (Figure 3C.7, K’gari)

Using Figure 3C.7, explain how K’gari was built by deposition. (4 marks)

K’gari is a deposition landform: it is made of material that was carried in and dropped, not of rock that rose up in place. Sand washed from the mainland was carried north along the coast by longshore drift — waves and currents moving sand along the shore. Where the moving sand met the island’s shallows, it was dropped; onshore winds then picked the sand up and blew it inland, piling it into dunes as high as 244 m. The process has been running for about 750,000 years, grain by grain, long enough to build an island about 123 km long — the world’s largest sand island. The story is the mirror image of the Twelve Apostles: there, erosion is taking rock away; here, deposition is building land up.

Example 4 — unscaffolded (classifying processes, Figures 3C.1–3C.4)

For each landform below, name (i) its engine — inside-the-Earth or at-the-surface — and (ii) the main process involved: folding, faulting, volcanism, weathering, erosion, transportation or deposition. (4 marks)

(a) The MacDonnell Ranges, Northern Territory. (b) The granite outcrops of the You Yangs, Victoria. (c) The basalt columns of Organ Pipes National Park, Victoria. (d) A sand dune on K’gari, Queensland.

Model answer. (a) Inside-the-Earth engine; folding (rock squeezed into waves and lifted — later shaped by erosion). (b) Both engines, in order: inside-the-Earth first (granite cooled from magma underground), then at-the-surface processes (erosion removed the rock above; weathering rounds the exposed granite along its cracks). (c) Inside-the-Earth engine; volcanism (lava erupted and cooled into basalt, cracking into columns as it shrank). (d) At-the-surface engine; deposition (wind-carried sand dropped and piled up).

Practice questions

Scaffolded

Q1. Using Figure 3C.1, sort these processes into the two engines — *building up* (inside the Earth) or *wearing down and rebuilding* (at the surface). (3 marks)

(a) erosion (b) folding (c) deposition

Q2. Copy the sentences and fill each gap with *weathering*, *erosion*, *deposition* or *sediment*. **(4 marks)**

(a) The breaking down of rock where it lies is _____. **(b)** The picking up and carrying away of broken rock by water or wind is _____. **(c)** The dropping of carried material when the water or wind slows is _____. **(d)** The sand, silt, mud and gravel that eroded rock is broken into is _____.

Q3. Put the coastal erosion sequence of Figure 3C.6 in order by numbering the steps 1–4. **(2 marks)**

Step	Number
An arch is left where a cave has worn right through the headland.	
Waves grind joints in the headland into caves.	
A stack is left standing in the sea.	
The arch roof becomes too thin and collapses.	

Q4. Read Figure 3C.8. **(3 marks)**

(a) What makes a desert a desert — heat, or something else? **(b)** Which named place is a grassland, and where is it? **(c)** Give one fact from the figure that shows the Himalayas are still changing.

Q5. Read Figure 3C.9. **(3 marks)**

(a) What height is the contour line halfway between the 120 m line and the 160 m line? **(b)** A walker climbs from 100 m to the summit. How many metres of height are climbed? **(c)** You want to walk up the gentler side of the hill. Which side do you choose, and what do the contours look like there?

Q6. Read Figure 3C.2. **(3 marks)**

(a) Which kind of fault is made by squeezing forces that push one block up over another? **(b)** What kind of movement happens along the Great Sumatran Fault? **(c)** What force makes folds?

Unscaffolded

Q7. The Himalayan Mountains are folded mountains that are still rising. Explain what is pushing them up, and name the inside-the-Earth process involved. **(3 marks)**

Q8. “Weathering and erosion are not the same thing.” Explain the difference in your own words, giving one example of each from this section. **(3 marks)**

Q9. “Erosion in one place is deposition somewhere else.” Explain this sentence using either the Twelve Apostles and K’gari, or any other pair of examples from this section. **(3 marks)**

Q10. Victoria’s landforms are made by the processes of this section. For each — the Organ Pipes basalt columns, the You Yangs granite, the Twelve Apostles stacks — name the main process that made it and say which engine (inside-the-Earth or at-the-surface) that process belongs to. **(4 marks)**

Evidence-based response

Q11. Your local landform study. Using the cycle in Figure 3C.10, choose one landform within easy reach of your school — a hill, a creek bank, a dune, a beach, a cliff, a valley, a quarry face.

(a) Describe the landform's shape in two specific sentences — what you could see or measure, not just "it is big". **(2 marks)** **(b)** Name the geomorphological process or processes you think made it, chosen from the families in Figures 3C.1–3C.4, and say which engine each belongs to. **(2 marks)** **(c)** Plan your evidence: name one map source (for example, a Vicmap Topographic Map of the area) and one field observation you would make, and say what each would tell you about the landform's shape. **(2 marks)** **(d)** Name one source you would check to test your explanation (for example, a map, a park notice, a council or museum page). **(1 mark)**

Your notes from this study feed the next section — 3D studies how people are changing and managing the same landform — and the fieldwork reporting you will learn in Section 6C.

Answers

Q1. (a) wearing down and rebuilding. (b) building up. (c) wearing down and rebuilding.

Q2. (a) weathering. (b) erosion. (c) deposition. (d) sediment.

Q3. 2 An arch is left where a cave has worn right through the headland. 1 Waves grind joints in the headland into caves. 4 A stack is left standing in the sea. 3 The arch roof becomes too thin and collapses.

Q4. (a) How little rain falls — a desert is defined by dryness, not heat (the Gobi is a dry place with bitterly cold winters). (b) The Steppe, the great open plains of Central Asia. (c) Mount Everest is still rising slowly (the Indian plate is still pressing into Asia); Everest stands at 8,848.86 m, agreed by a 2020 survey.

Q5. (a) 140 m. (b) 80 m (from 100 m to 180 m). (c) The east side — the contour lines there are far apart, which means gentle ground.

Q6. (a) A reverse fault. (b) The two sides slide sideways past each other (strike-slip movement). (c) Squeezing forces, where plates press together.

Q7–Q11. See fully-worked solutions.

Fully-worked solutions

Q7. (3 marks) The Indian plate is pressing into Asia, and where the two plates squeeze together the rock between them is pushed up in folds (1 mark). The inside-the-Earth process is folding (1 mark). Because the plate is still moving, the squeezing has not stopped, so the range is still rising slowly (1 mark).

Q8. (3 marks) Weathering breaks rock down *where it lies*, without carrying it away — for example, frost wedging ice in a crack, or weak acids in rainwater dissolving limestone (1 mark). Erosion *picks the broken material up and moves it* — for example, waves hammering pieces off the Port Campbell cliffs, or wind lifting sand (1 mark). The clean test: if the rock stayed in place while it broke, that is weathering; if something carried it away, that is erosion (1 mark).

Q9. (3 marks) Pick a pair and follow the material. Example — the Twelve Apostles and K’gari: waves erode the Port Campbell limestone, carrying the ground-away sand and shell away from the cliffs (1 mark). That same kind of moving material must be dropped when the water or wind slows, and deposition builds new landform somewhere else — K’gari is built of exactly this: sand carried by longshore drift and wind and piled into dunes (1 mark). So the material lost from one coast becomes landform on another: one journey, two ends (1 mark).

Q10. (4 marks) Organ Pipes: volcanism — lava erupted and cooled into basalt, cracking into columns as it shrank; inside-the-Earth engine (1 mark). You Yangs: the granite cooled from magma underground (inside-the-Earth), but its present rounded outcrop shape was made by at-the-surface processes — erosion removed the rock above it and weathering rounds it along its cracks (1 mark). Twelve Apostles: erosion by waves, tides and ocean currents — cave, arch, stack — at-the-surface engine (1 mark). Award the fourth mark for noticing that the You Yangs needed *two* engines, in order: building underground, then uncovering and shaping at the surface (1 mark).

Q11. (7 marks) *Model response (a creek valley behind a suburban school).* **(a)** “The creek has cut a valley about 4 m deep into the flat ground, with steep bare banks on the outside of bends and a low mound of sand and gravel on the inside of each bend.” — specific, measurable (2 marks). **(b)** Erosion (the creek cutting down and into its banks) and deposition (the sand and gravel mounds dropped where the water slows on the inside of bends), both at-the-surface engine (2 marks — one for each named process with its engine). **(c)** Map: a Vicmap Topographic Map of the area, to read the contour spacing and confirm the valley’s depth and steepness; field: a sketch and pace-measurement across the valley, plus a photo of the gravel mound, to record shape and deposited material (2 marks — one for each evidence item with what it shows). **(d)** One checkable source, e.g. the council’s waterway or open-space page, a park notice, or a museum/geoscience page about the local rock (1 mark).

Figures: all ten figures in this section are original, drawn from primitives for this workbook (diagrams/3c_two_engines.png, 3c_folds_faults.png, 3c_volcanism.png, 3c_weathering.png, 3c_sediment_journey.png, 3c_coastal_sequence.png, 3c_kgari.png, 3c_landscapes.png, 3c_contours.png, 3c_local_study.png). Real-world figures carry their source in the caption. Victorian examples in the theory text (the Organ Pipes, the You Yangs, the Newer Volcanics Province): Wikipedia, retrieved 25 August 2026. The practice contour map in Figure 3C.9 is invented for teaching; real contours for any Victorian locality are on Vicmap Topographic Maps.

How people change landforms, how the change is managed, and a local landform study

Where this section comes from: content description VC2HG8K15 (Victorian Curriculum F–10 Version 2.0, Geography, Levels 7 and 8, VCAA). One elaboration, VC2HG8K15.E06, is not taught in this series (Content Policy Rule 1; see the notice at the front of the book), and VC2HG8K15.E05 is kept with the item naming Traditional Owners cut from its list of groups. Tasks in this section draw on VC2HG8K15.E01, VC2HG8K15.E02, VC2HG8K15.E03 and VC2HG8K15.E04 whole, and on VC2HG8K15.E05 in that trimmed form. This is the fourth section of Chapter 3, *Landforms and landscapes*: 3A described Australia’s landscapes, 3B asked what they mean to people, 3C showed how natural processes **make** landforms; this section asks how **people** change those same landforms, and how the change is managed — and it ends with a study of a landform near your own school. Hazards (3E) and the concept capstone (3F) follow. Section 3C studies how your local landform was produced; this section studies how people are changing and managing it; the same study feeds the fieldwork report in 6C.

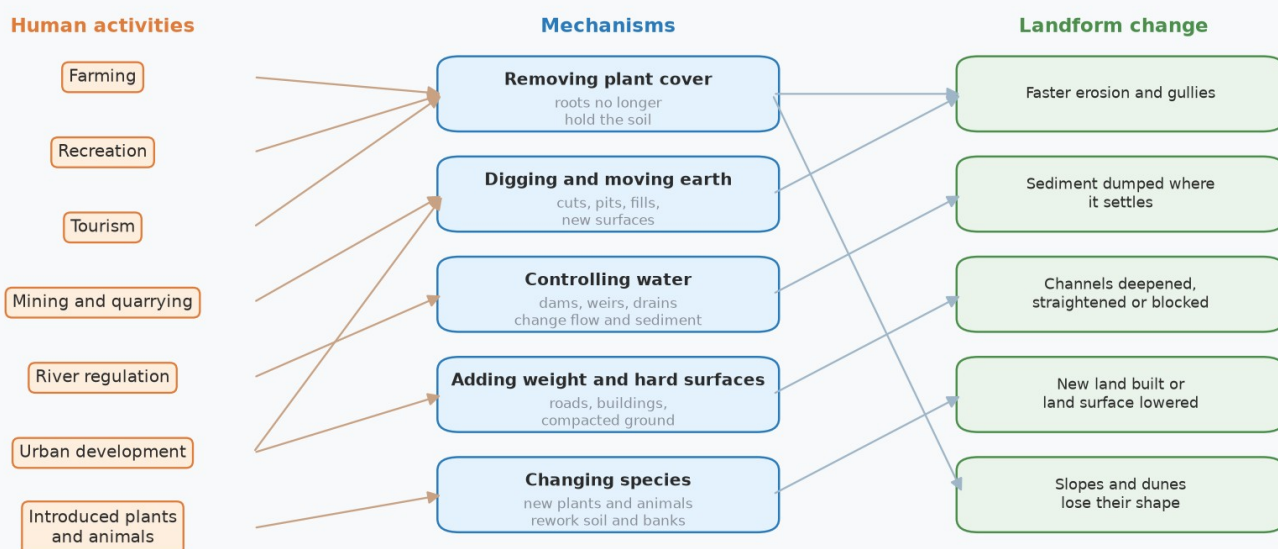
Key ideas

1. People change landforms through seven kinds of activity. A **landform** is a shape made by nature on the Earth’s surface — a hill, a dune, a cliff, a river valley, a plain. Section 3C showed the natural engines that build them (folding, volcanism, weathering, **erosion** — the wearing away and moving of soil, rock and sand by water, wind or waves — and **deposition**, the dropping of that material in a new place). People are now a second engine of change. The curriculum names seven activity families: **farming, recreation, tourism, mining and quarrying, river regulation, urban development, and introduced plants and animals**. **Quarrying** is digging stone, sand or gravel out of the ground; **introduced plants and animals** are species people brought to Australia that now live wild.

Each activity works through a small number of **mechanisms** — the ways the change actually happens: removing plant cover, digging and moving earth, controlling water, adding weight and hard surfaces, and changing which species live there. The mechanism then produces the visible change: faster erosion and gullies, **sedimentation** (sediment dumped and building up where it settles), channels deepened or blocked, new land built or ground lowered, and slopes and dunes losing their shape. Most activities use more than one mechanism at once.

How people change landforms

Seven activity families, five mechanisms, visible landform change



Each activity usually works through more than one mechanism — urban development, for instance, both removes plant cover and adds hard surfaces.

Original diagram for this section. Activity list from VC2HG8K15 elaboration E01.

Diagram linking the seven human activity families — farming, recreation, tourism, mining and quarrying, river regulation, urban development, and introduced plants and animals — through five mechanisms (removing plant cover, digging and moving earth, controlling water, adding weight and hard surfaces, changing species) to visible landform change such as faster erosion, dumped sediment, changed channels, new built land and lost dune shape

2. The phrase this section judges everything by: environmental quality. The curriculum asks how human activities affect the **quality of the environment**, but it never defines that phrase, so this section fixes one meaning up front and says so openly: **environmental quality means how clean the water and soil are, how well plant cover holds the ground, and how well a place keeps working for the plants, animals and people who depend on it.** Every impact in this section is measured against that meaning — and because impacts land on *particular* people and places, every claim says where. The big linking idea is **interconnections** — the ways people, places and environments affect each other, near and far, at small and large scales (3F makes this the formal concept language of the band).

3. Worn tracks and cleared forest: how use becomes erosion. The easiest human change to see is a walking track. Feet crush and kill the plants; bare soil is left **compacted** (pressed hard), so rain runs off instead of soaking in; the running water cuts a channel; the channel grows into a gully; the gully washes sediment downslope and the slope loses its shape. The same chain runs at famous Victorian parks — at Wilsons Promontory, for example, popular walking tracks cross dunes and headlands that are easily worn (Parks Victoria, retrieved 25 August 2026) — and it runs at a much bigger scale where forest is cleared for farming.

How a walking track can wear a landform down

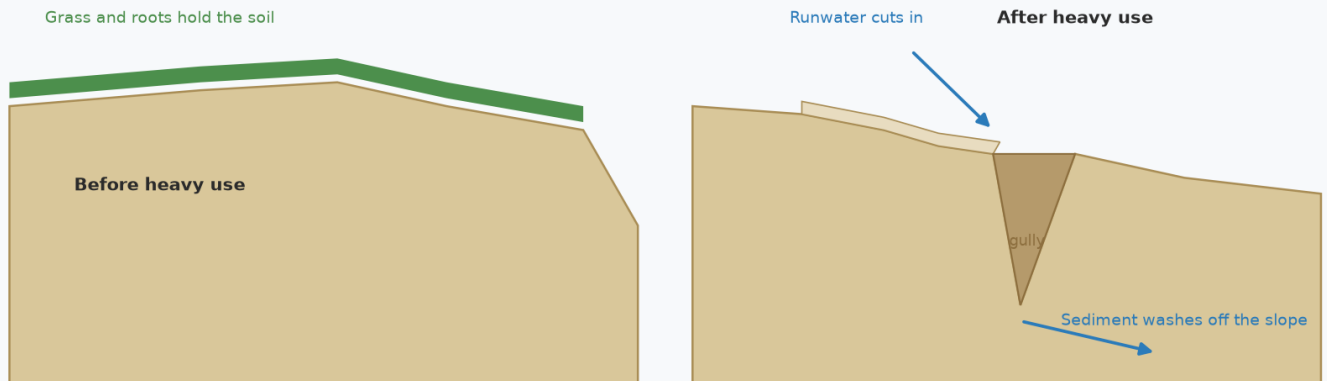
A cross-section model of trampling, runoff and gullying — and three ways to manage it

Manage it:

Boardwalk over wet ground

Drains that move water off gently

Close a track so it can recover



Cause chain: many feet -> plants crushed and killed -> bare, compacted soil -> rain runs off instead of soaking in -> a channel forms -> the gully grows

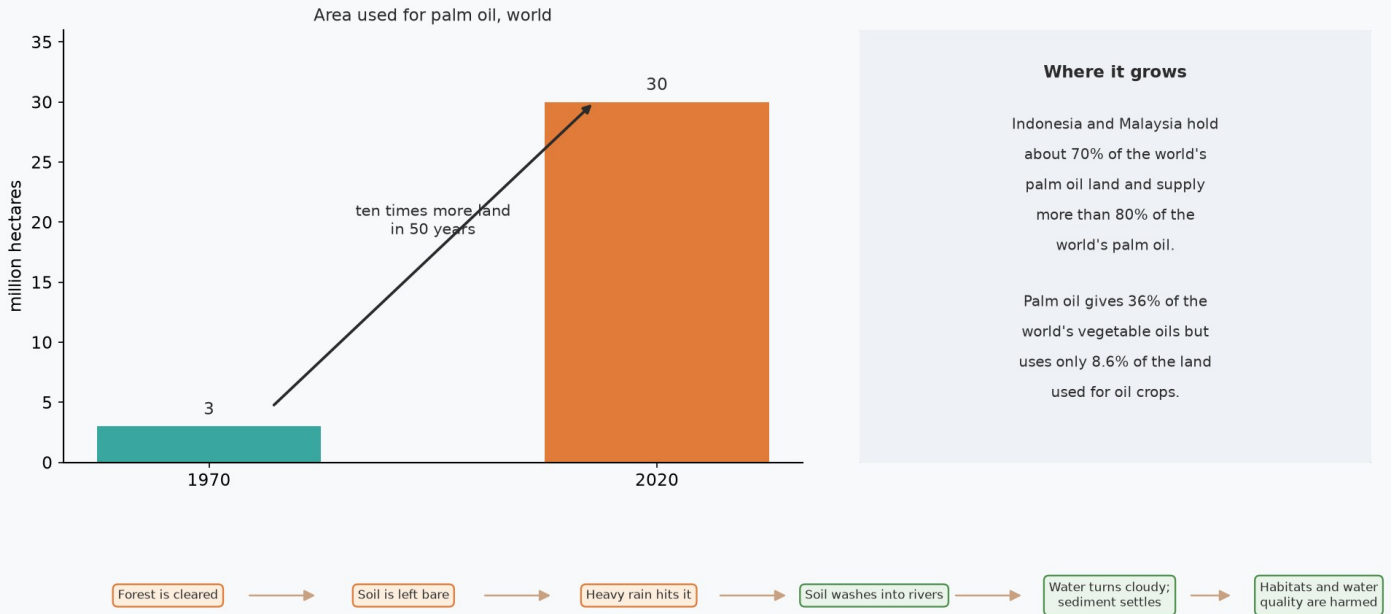
Original model diagram for this section, after common patterns of track wear in bushland parks.

Cross-section model comparing a grassy hillslope before heavy use with the same slope after heavy use, showing a worn bare track, a gully cut by runwater, sediment washing off the slope, the cause chain from trampling to gullying, and three ways to manage it: a boardwalk over wet ground, drains that move water off gently, and closing a track so it can recover

The large-scale version of the same chain is land-clearing for **palm oil**, chiefly in Indonesia and Malaysia. The land used for palm oil around the world grew ten times in fifty years — about 3 million hectares in 1970 to about 30 million hectares in 2020 — and Indonesia and Malaysia hold about 70% of that land and supply more than 80% of the world's palm oil (Our World in Data, 'Palm oil', retrieved 25 August 2026). When forest is cleared, the soil is left bare; heavy tropical rain hits it; soil washes into rivers; the water turns cloudy and sediment settles; habitats and water quality are harmed. Palm oil is also highly efficient: it supplies 36% of the world's vegetable oils from only 8.6% of the land used for oil crops — a number that matters when people argue about what should change (the same source).

Palm oil: growth with an erosion cost

Land clearing for palm oil — chiefly in Indonesia and Malaysia — is one of the world's largest drivers of erosion and sedimentation



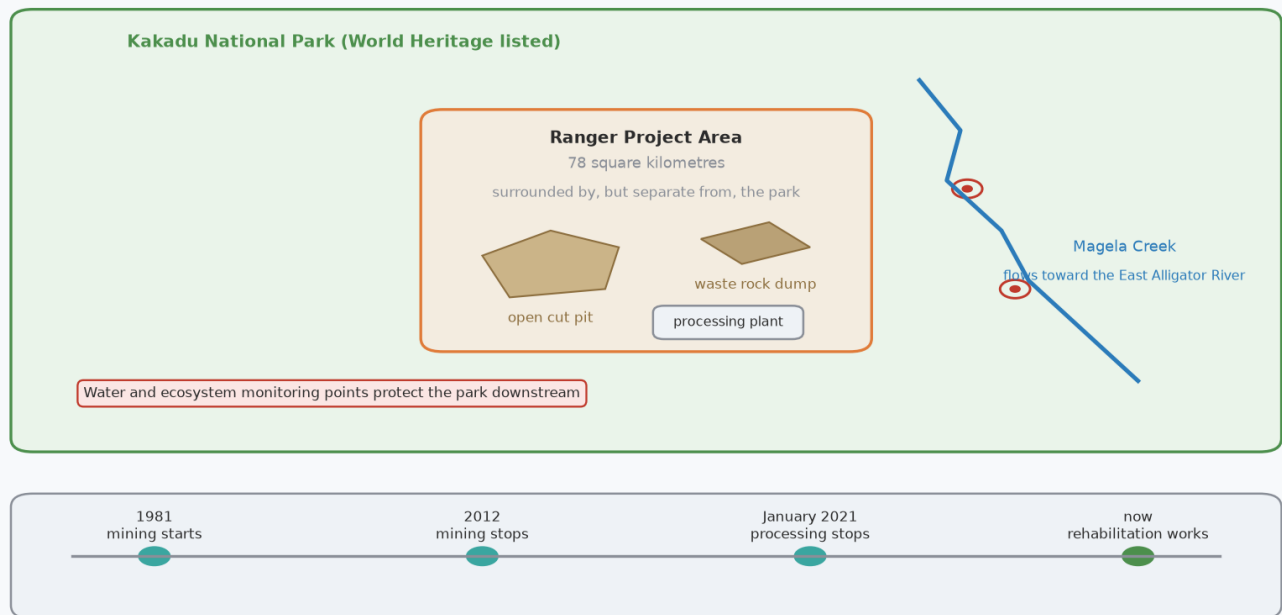
Data: Our World in Data, 'Palm oil' (palm oil area 1970 and 2020; shares for Indonesia and Malaysia), retrieved 25 August 2026.

Bar chart showing world palm oil area growing from 3 million hectares in 1970 to 30 million hectares in 2020, a panel noting that Indonesia and Malaysia hold about 70% of the land and supply over 80% of the oil and that palm oil gives 36% of vegetable oils from 8.6% of oil-crop land, and an impact chain from forest clearing to bare soil, heavy rain, soil washing into rivers, cloudy water and settled sediment, and harmed habitats and water quality

4. Mining, quarrying and cities that build land. Mining digs the land surface itself, so its interconnections are close and tight. The Ranger **uranium** mine (uranium is a metal used as fuel in some power stations) sits 8 km east of Jabiru in the Northern Territory, inside a 78 square kilometre project area that is surrounded by, but separate from, Kakadu National Park — a World Heritage listed park. The mine is **open-cut** (dug as an open pit at the surface); Magela Creek, which flows toward the East Alligator River, runs past it, so any erosion or dirty water at the mine could reach the park's rivers. Mining started in 1981 and stopped in 2012; stockpiled ore was processed until January 2021; the site is now in **rehabilitation** — work to return a changed place toward the condition of the land around it. The closure goal set by the Australian Government is that the site must end up similar to the surrounding land, so that it could one day be added back into Kakadu. An independent Supervising Scientist, set up in 1978, monitors water and ecosystems, and that monitoring shows the park has been protected (Australian Government Department of Climate Change, Energy, the Environment and Water, retrieved 25 August 2026). Read against our fixed meaning: the environmental quality of the creek and the park is the thing being watched, year after year.

Mining next to a World Heritage park: the Ranger uranium mine

Site model (not to scale) and timeline, from Australian Government monitoring

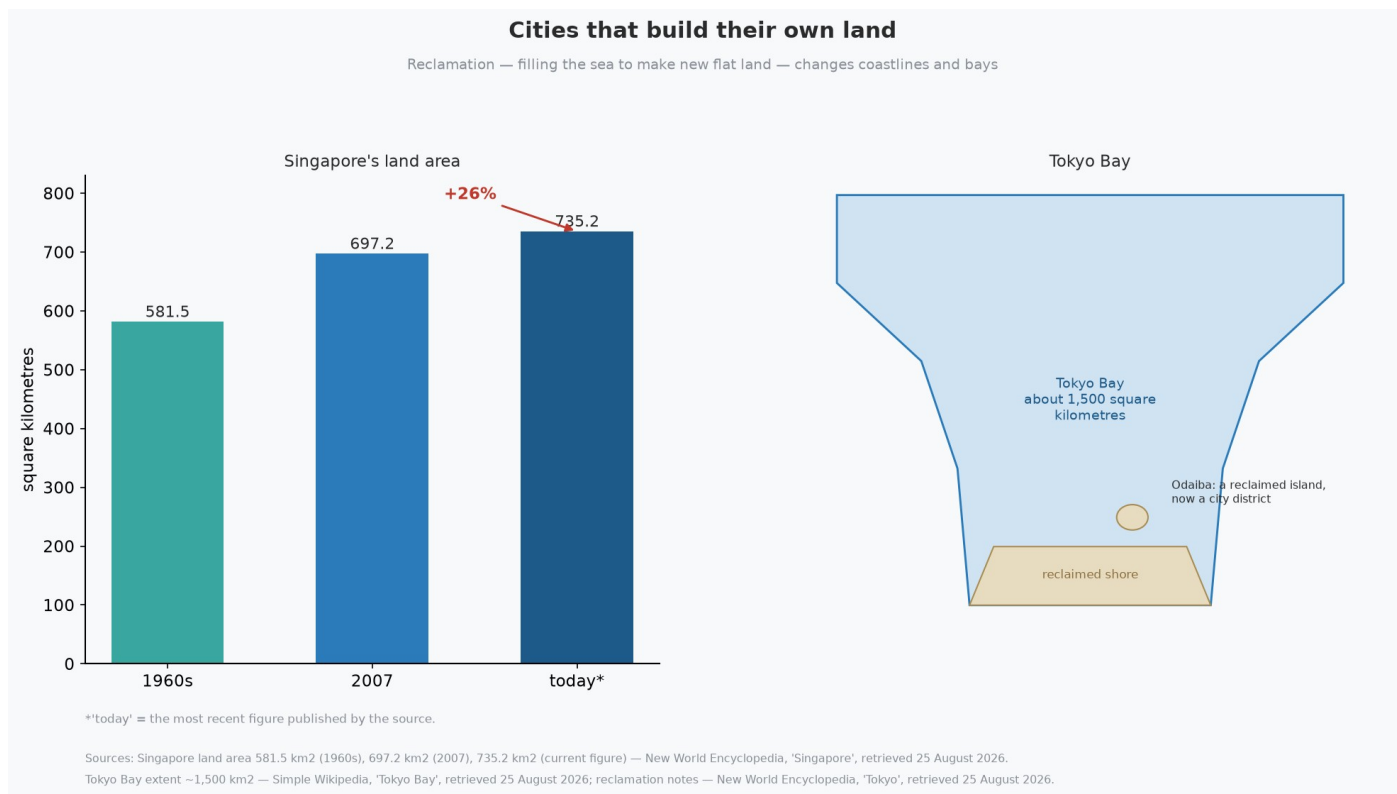


Closure goal (set by the Australian Government): the site must end up similar to the land around it, so that it could one day be added back into Kakadu National Park.

Source: Australian Government Department of Climate Change, Energy, the Environment and Water, 'Ranger uranium mine' pages, retrieved 25 August 2026.

Site model of the Ranger uranium mine showing the 78 square kilometre Ranger Project Area surrounded by but separate from Kakadu National Park, the open cut pit, waste rock dump and processing plant, Magela Creek with water and ecosystem monitoring points, and a timeline: mining starts 1981, mining stops 2012, processing stops January 2021, rehabilitation works now, with the closure goal that the site must end up similar to the surrounding land

Urban development changes landforms in the other direction — cities sometimes build brand-new land. **Reclamation** is filling the sea (or a lake or bay) with sand and rock to make new flat land. Singapore's land area grew from 581.5 square kilometres in the 1960s to 697.2 in 2007 and 735.2 in the source's most recent figure — about 26% more land than it started with (New World Encyclopedia, 'Singapore', retrieved 25 August 2026). Tokyo Bay in Japan — about 1,500 square kilometres of water — has been narrowed by centuries of reclamation; Odaiba, now a city district of Tokyo, began as a reclaimed island (Simple Wikipedia, 'Tokyo Bay'; New World Encyclopedia, 'Tokyo'; retrieved 25 August 2026). Reclamation changes the shape of a coast, the depth and currents of a bay, and the environments that lived along the old shore.



Bar chart of Singapore's land area growing from 581.5 square kilometres in the 1960s to 697.2 in 2007 and 735.2 in the source's most recent figure (about 26% more), beside a sketch of Tokyo Bay, about 1,500 square kilometres, showing the reclaimed shore and Odaiba, a reclaimed island now a city district

5. River regulation: controlling the water changes the land. **River regulation** means controlling a river with dams, **weirs** (low walls across a river that raise the water so it can be stored or taken), locks, straightened channels and drains. (Direction words used from here on: **upstream** means toward the river's source; **downstream** means toward its mouth.) Regulation is built for good reasons — water for towns and farms, flood control, power — and it changes riverine and wetland environments at the same time.

The largest example in the world is the Three Gorges Dam in China — a wall across the Yangtze River, 2,335 m long and 181 m high, holding a reservoir about 600 km long with 39.3 cubic km of water at a normal level of 175 m above sea level, and generating 22,500 MW of hydro-electric power — the world's largest power station by capacity. Work started in December 1994; the dam began working in 2009; all 34 generators were running by 2012; more than 1 million people were moved to make room for the reservoir (New World Encyclopedia, 'Three Gorges Dam', retrieved 25 August 2026).

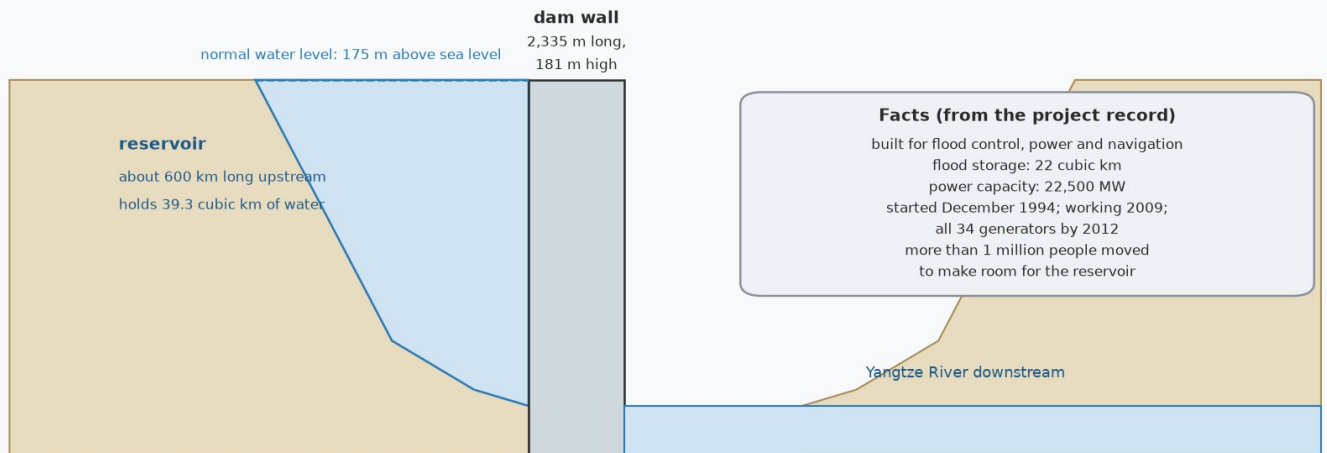
Three Gorges Dam — Yangtze River, China

The world's largest power station by capacity — built for flood control, power and navigation

Flood control

Hydro-electric power

River navigation



Source: New World Encyclopedia, 'Three Gorges Dam', retrieved 25 August 2026. Diagram not to scale.

Labelled cross-section of the Three Gorges Dam (Yangtze River, China) showing the reservoir about 600 km long holding 39.3 cubic km of water at a normal level of 175 m, the dam wall 2,335 m long and 181 m high, the river downstream, the three purposes (flood control, hydro-electric power, river navigation) and a facts card: flood storage 22 cubic km, capacity 22,500 MW, started December 1994, working 2009, all generators by 2012, more than 1 million people moved

The dam repays genuine analysis, not a list. For each benefit, ask who gains and where; for each cost, ask who carries it and where:

One dam, two sets of consequences

The strongest case for the Three Gorges Dam — and the strongest case about its costs

What it was built to do

Flood control: 22 cubic km of storage
to hold back the Yangtze's worst floods

Power: 22,500 MW of hydro-electricity,
the world's largest power station

Navigation: deeper, calmer water upstream
lets larger ships travel inland

These were the reasons more than
1 million people agreed to move

What changed around it

Sediment: hills upstream shed about 40 million
tonnes of soil into the river each year;
much of it now settles in the reservoir

Downstream gets less sediment, so banks
may become more open to flooding

Rising water triggered landslides (300,000
people evacuated) and thousands of small quakes

Forest cover in the area fell from 20% (1950)
to under 10% (2002); rare fish are harmed
by changed flows and turbines

Analyse, don't just list: for each benefit, ask who gains and where; for each cost,
ask who carries it and where. Notice that the benefits and the costs land in different places —
that is an interconnection across space and scale.

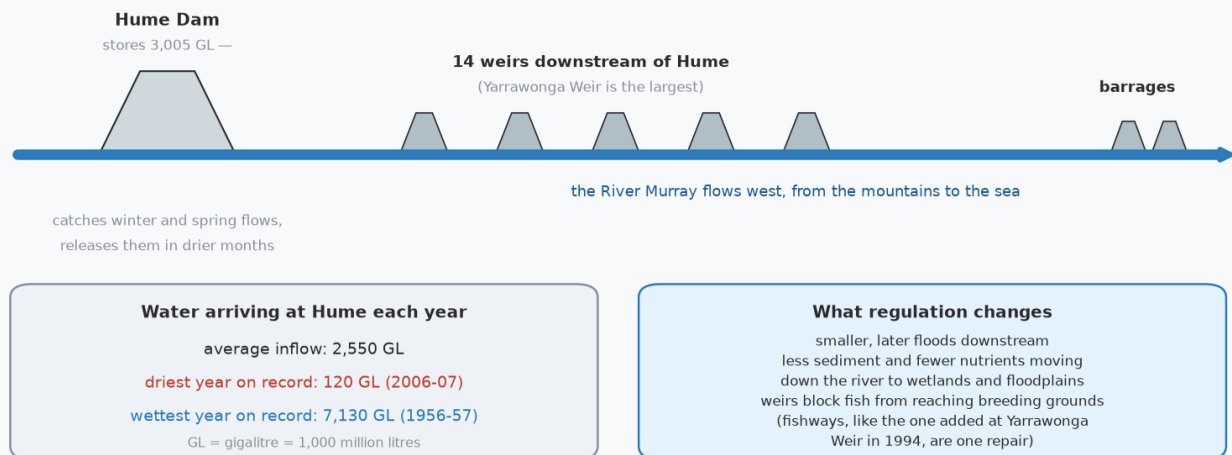
Source: New World Encyclopedia, 'Three Gorges Dam', retrieved 25 August 2026. Both positions are stated in their strongest form so the judgement between them is fair.

Two-column analysis card for the Three Gorges Dam — 'What it was built to do' (flood control with 22 cubic km of storage, 22,500 MW of power, deeper calmer water for navigation) and 'What changed around it' (about 40 million tonnes of soil a year settling in the reservoir, sediment-starved banks downstream more open to flooding, landslides and small quakes, forest cover falling from 20% to under 10%, rare fish harmed by changed flows and turbines) — with the rule: analyse by asking who gains and who carries each consequence, and where, because the benefits and the costs land in different places

Australia's example is the Murray–Darling river system. Hume Dam, on the upper River Murray, stores 3,005 gegalitres — a **gigalitre (GL)** is 1,000 million litres — and fourteen weirs sit downstream of it, the largest being Yarrawonga Weir. Near the river's mouth, **barrages** (gate-like barriers) stop salt water moving upstream. Hume was built after the droughts of the 1890s and the record dry year of 1902; the water arriving at it varies a lot — an average of 2,550 GL a year, but only 120 GL in the driest year on record (2006–07) and 7,130 GL in the wettest (1956–57) (Murray-Darling Basin Authority, retrieved 25 August 2026). Dams store the winter–spring flows that once flooded the river's forests and wetlands most years, so downstream floods are smaller and later, less sediment and fewer **nutrients** (the substances living things need to grow) move down the river, and weirs block fish from reaching breeding grounds — fishways, like the one added at Yarrawonga Weir in 1994, are one repair.

Regulating Australia's biggest river system: the River Murray

Dams and weirs store water for towns and farms — and in doing so change the river itself



Built after the droughts of the 1890s and the record dry year of 1902.

Source: Murray-Darling Basin Authority, 'Hume Dam', 'Weirs and locks' and 'Yarrawonga Weir' pages, retrieved 25 August 2026.

Line diagram of the regulated River Murray showing Hume Dam (stores 3,005 GL), the 14 weirs downstream of Hume with Yarrawonga Weir the largest, and the barrages near the mouth, with cards for the water arriving at Hume each year (average 2,550 GL; driest year 120 GL in 2006-07; wettest 7,130 GL in 1956-57) and what regulation changes (smaller later floods, less sediment and fewer nutrients moving downstream, weirs blocking fish, fishways as one repair)

The clearest Australian story of impact and repair is the Barmah–Millewa forest on the Victoria–New South Wales border — the world's largest river red gum forest, with wetlands of international importance. With fewer floods, its wetlands dried out and some native fish died out locally during the Millennium Drought. The response is water for the environment, delivered through regulators on the River Murray to give the forest some of its old floods back. The 2023–24 report card scores the forest an A: waterbirds bred at five wetlands, with the most species counted in 25 years of monitoring; Moira grass and Warrego summer-grass came back strongly after the 2022–23 floods; and fish that had died out locally were released again into forest lagoons (Murray-Darling Basin Authority, 'Barmah-Millewa Forest Report Card 2023-24', retrieved 25 August 2026).

A forest that lives on floods: Barmah-Millewa

River regulation starved the forest of floods — water for the environment is bringing them back

What regulation changed

Dams store the winter-spring flows that once flooded the forest most years

The forest is the world's largest river red gum forest, on the Victoria-New South Wales border, with wetlands of international importance

With fewer floods, wetlands dried out and some native fish died out locally during the Millennium Drought

What water for the environment is doing

Environmental water is delivered through regulators on the River Murray

2023-24 report card score: A

Waterbirds bred at five wetlands; the most species counted in 25 years of monitoring

Moirra grass and Warrego summer-grass came back strongly after the 2022-23 floods

Fish that had died out locally were released again into forest lagoons

The management lesson: once the cause is understood (less flood water), the response is to give the river some of its old flow back — and to monitor whether the forest answers.

Source: Murray-Darling Basin Authority, 'Barmah-Millewa Forest Report Card 2023-24', retrieved 25 August 2026.

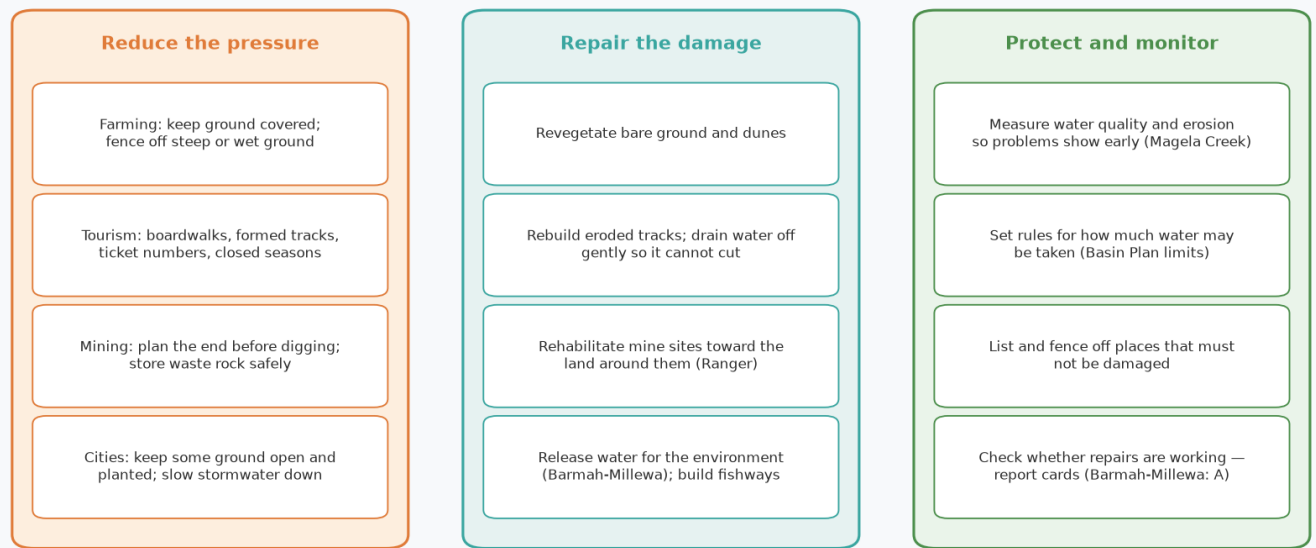
Two-column card for the Barmah-Millewa river red gum forest: what regulation changed (dams store the winter-spring floods, wetlands dried out, some native fish died out locally during the Millennium Drought) and what water for the environment is doing (delivered through regulators, 2023-24 report card score A, waterbirds bred at five wetlands with the most species in 25 years of monitoring, Moirra grass and Warrego summer-grass recovered, locally extinct fish released again), with the lesson that once the cause is understood the response is to return some of the old flow and monitor whether the forest answers

6. Managing the change: three moves, and a word about sustainability. Every management strategy in this section is one of three moves — **reduce the pressure** on the landform, **repair the damage** already done, or **protect and monitor** what is left. Most real cases use all three at once, and almost all involve a **trade-off** — giving up one good thing to get another: land that is protected is land that cannot be farmed, mined or built on.

Judging trade-offs is where **sustainability** enters. This section uses the word in the sense fixed by the World Commission on Environment and Development in 1987: using places and resources so that they meet the needs of people today **without using up or damaging what people in the future will need**. A forest that still floods, a creek that stays clean, a mine site returned to working land — those are sustainability in action under that meaning. Because reasonable people weigh the two sides in different ways, this section also fixes a rule of argument: before you judge a trade-off, **steelman** each side — state the view you disagree with in its strongest form, the form its own holders would accept — and then judge. Marks in this section reward the quality of that reasoning, never the side you reach.

Managing human change to landforms: three moves

Every strategy in this section is one of these — reduce the pressure, repair the damage, protect what is left



Most real cases use all three moves at once — and most involve a trade-off: land that is protected is land that cannot be farmed, mined or built on. Steelman both sides before judging.

Original framework diagram for this section; examples drawn from the case studies in this section.

Framework diagram of the three management moves — reduce the pressure, repair the damage, protect and monitor — each column carrying four example actions drawn from the section's case studies (ground cover and fencing on farms, boardwalks and track closures, mine closure planning, revegetation, environmental water and fishways, water-quality measurement, water-taking rules, listing and fencing protected places, report cards), with a note that most real cases use all three moves and involve a trade-off, so both sides are steelmanned before judging

7. Your local landform study: the same five steps in any Victorian town or district. The CD ends with the local landform study — yours. 3C studied how your local landform was produced; this section adds the human layer. The fieldwork is one connected activity across the book: the methods are taught in 5B, the local study is hosted here and in 3C, and the finished report is written in 6C. Whatever town or district your school is in, the study runs through five steps: choose one landform near school and map it; find the human fingerprints on it; collect evidence; judge the management already there; and propose its future. Your teacher chooses the site, or helps you choose it.

Your local landform study — five steps

The same fieldwork, whatever town or district your school is in

1. Choose and map it

Pick one landform near school: hill, creek valley, dune, cliff or plain. Map it: north, scale, features (3C shows how it formed).

2. Find human fingerprints

Walk the site (or use photos and maps). Where is soil bare, cut or moved? Where are tracks, drains, plants, animals, buildings, farms?

3. Collect evidence

Photos from the same spot, simple measures (gully width, slope), rubbish or wear counts, interviews or council pages (5B has methods).

4. Judge the management

What is done now: signs, fences, boardwalks, drains, rules, replanting? Is it working? What is missing?

5. Propose its future

Weigh the views of the groups who use or protect the landform, then recommend actions with their likely effects (6C formats it).

Keep it fair and safe: get permission for the site, stay where it is safe, take only photos, leave the site as you found it, and record exactly where and when each piece of evidence came from.

Tasks are written for any Victorian locality; your teacher chooses (or helps you choose) the local site.

Five-step board for the local landform study — 1 choose and map it, 2 find human fingerprints, 3 collect evidence, 4 judge the management, 5 propose its future — each step with a short description, a keep-it-fair-and-safe panel (get permission, stay where it is safe, take only photos, leave the site as found, record where and when each piece of evidence came from), and a note that the tasks are written for any Victorian locality

The proposal step is the curriculum's VC2HG8K15.E05: a proposal of your own about what should happen to your local landform, built on the views of the different groups who use it or care about protecting it. This section works with four such groups — **farmers and graziers** (a **grazier** runs cattle or sheep), **visitors and tourism businesses**, **conservation groups**, and the **local council**. Before you judge any proposal, steelman each group's view. The shared facts every view must accept are the evidence your step-3 collection produced, and what money and rules allow.

Steelman cards: who has a stake in your local landform?

Before you judge a proposal, state each group's view in the strongest form its own members would accept
Shared facts every card must accept: what the evidence from step 3 shows, and what money and rules allow.

Farmers and graziers

Our family works this land; erosion costs us
soil, feed and income.

We will protect the land if the fix is one
we can afford and keep running.

Visitors and tourism businesses

People come here because this place is
beautiful; that beauty is our livelihood.

Access and care can live together — tracks,
boards and limits keep both.

Conservation groups

Some damage cannot be undone; prevention
is cheaper than repair.

Native plants, animals and waterways have
value whether or not they pay.

Local council

We answer to everyone: ratepayers, farmers,
visitors and future residents.

We need rules that are fair, affordable and
possible to enforce.

Rule of the task: argue the view you disagree with at its strongest before you argue against it.

Marks go to the quality of the reasoning — terms defined, evidence used, both sides stated fully — not to the side reached.

Four steelman cards for the local proposal task — farmers and graziers, visitors and tourism businesses, conservation groups, and local council — each card stating the strongest form of that group's view, with the rule of the task: argue the view you disagree with at its strongest before you argue against it, and marks go to the quality of the reasoning, not the side reached

Worked examples

Worked example 1 — analysing the Three Gorges Dam: who gains where, who carries what where (source-led)

Method. Analysis is not a list. For each benefit, ask *who gains, and where*; for each cost, ask *who carries it, and where*. Then look at the two answers together.

Step 1 — the benefits, with their who and where. Flood control: the dam holds 22 cubic km of flood storage, so the people and farms of the middle and lower Yangtze — downstream — are safer from the river's worst floods. Power: 22,500 MW of electricity flows into China's national grid, gaining power for cities and factories far from the dam. Navigation: deeper, calmer water upstream lets larger ships travel inland, gaining for ports and businesses along the 600 km reservoir.

Step 2 — the costs, with their who and where. The hills upstream shed about 40 million tonnes of soil into the river each year, and much of it now settles in the reservoir — a cost carried at the dam itself. Downstream gets less sediment, so river banks may become more open to flooding — a cost carried by people far below the dam who gained none of the reservoir's benefits. The rising water triggered landslides (300,000 people evacuated) and thousands of small quakes, and forest cover in the area fell from 20% (1950) to under 10% (2002); 361 fish species are harmed by the changed flows and turbines — costs carried upstream, around the new reservoir (New World Encyclopedia, 'Three Gorges Dam', retrieved 25 August 2026).

Step 3 — the analysis sentence. The benefits land downstream and far away (flood safety, power, shipping); a large share of the costs lands upstream and at the dam (moved people, landslides, settling sediment, lost forest and fish). One structure moves benefit in one direction and cost in another — that is an interconnection across space and scale, and it is exactly what "analyse" means here.

Worked example 2 — reading the Ranger mine as a chain of interconnections (data-led)

Method. Follow the chain link by link, then sort the management into the three moves.

Step 1 — the chain. An open-cut pit and waste rock dumps change the land surface (link 1). Rain on bare ground can cause erosion and dirty water (link 2). Magela Creek runs past the mine toward the East Alligator River, inside the World Heritage park (link 3). So the environmental quality of a park the mine does not even sit in depends on how the mine is run — interconnection does not stop at a boundary on a map.

Step 2 — the management, sorted into the three moves. *Protect and monitor:* water and ecosystem monitoring points on the creek, run by the independent Supervising Scientist since 1978, so problems show early — and the monitoring record says the park has been protected. *Repair:* rehabilitation of the pit and dumps toward the condition of the surrounding land, under the government's closure goal. *Reduce:* rules on how waste rock and water are stored, and after closure, weed control, erosion management and keeping fire out of the recovering site (DCCEEW, retrieved 25 August 2026).

Step 3 — the analysis sentence. The mine's owners planned the end before the beginning: a closure goal fixed in 1978-era agreements, monitoring that runs for decades, and rehabilitation measured against the land around the site. Judged against this section's fixed meaning of environmental quality, the strategy's whole job is that the creek, the park and the recovering site keep working for the living things that depend on them — and the report of that is the monitoring data, not an opinion.

Practice questions

Scaffolded

Q1. Using Figure 1: (a) name two activities that work through *removing plant cover*; (b) which activity works through *adding weight and hard surfaces*? (c) Figure 1 gives urban development two arrows leaving it. Why?

Q2. Using Figure 2: (a) put these in order: *a channel forms*; *plants crushed and killed*; *rain runs off*; *bare, compacted soil*; *the gully grows*; (b) name the three ways Figure 2 shows to manage the track; (c) which one works by letting the plants return?

Q3. Using Figure 3: (a) how many times larger was the world's palm oil area in 2020 than in 1970? (b) which two countries hold about 70% of the land? (c) complete: palm oil gives ...% of the world's vegetable oils but uses only ...% of the land; (d) give the first two links of the impact chain.

Q4. Using Figure 4: (a) in what year did mining start, and in what year did it stop? (b) until when was stockpiled ore processed? (c) state the closure goal in your own words; (d) what do the monitoring points on Magela Creek protect?

Q5. Using Figure 5: (a) give Singapore's land area for the 1960s, 2007 and the source's most recent figure; (b) what percentage increase does the chart mark? (c) define *reclamation* in your own words; (d) which reclaimed island is now a city district of Tokyo?

Q6. Using Figure 8: (a) how much water does Hume Dam store? (b) give the average inflow, and the driest and wettest years on record; (c) how many weirs sit downstream of Hume, and which is the largest? (d) name one change regulation causes and one repair Figure 8 shows.

Unscaffolded

Q7. Analyse the Three Gorges Dam using Figures 6 and 7: give two benefits and two costs, each with a number from the figures, and for each say *who gains or carries it, and where*. Finish with one sentence on the interconnection across space and scale.

Q8. Explain the interconnections at the Ranger mine: how does one human change to the land surface (the open cut) connect to Magela Creek, to a park the mine is not part of, and to the rules and monitoring now in place? Use the closure goal in your answer.

Q9. At Barmah–Millewa, explain the cause → response → evidence chain: what did regulation change, what does water for the environment do about it, and what evidence in Figure 9 says the forest is answering? Sort the response into the three moves of Figure 10.

Q10. Steelman both sides of palm oil expansion in Indonesia and Malaysia: state the strongest case *for* it (use the 36% and 8.6% numbers) and the strongest case *against* it (use the impact chain), then say which side you find stronger and why. Marks reward reasoning, not conclusion.

Extend — evidence-based response

E1. *Your local landform proposal (VC2HG8K15.E05, trimmed form).* Carry your local landform through the five steps of Figure 11, then write a proposal of 180–220 words (or a multimodal equivalent — a short video or slide deck with the same parts) that:

- names and describes the landform and how 3C's processes made it;
- uses at least **two pieces of evidence** you collected in step 3, each with its where-and-when recorded;
- **steelmans two of the four groups** in Figure 12 (state each view in its strongest form before you respond to it);
- recommends at least **two actions**, each named as *reduce*, *repair* or *protect and monitor*, and each linked to a cause your evidence showed;
- states **one trade-off** your proposal creates, and who carries it.

Marking guide (reasoning steps, not conclusion): 1 mark for defining the key words you use (including environmental quality as this section fixes it); 2 marks for evidence used correctly with its source recorded; 2 marks for both sides stated fully and at their strongest; 2 marks for actions linked to causes and sorted into the three moves; 1 mark for naming the trade-off and who carries it. A proposal that reaches a conclusion your teacher disagrees with can still score full marks — the reasoning is what is marked. The same fieldwork feeds the report format in 6C.

Answers

Q1. (a) Any two of farming, recreation, tourism. (b) Urban development. (c) Because it works through two mechanisms at once — it removes plant cover *and* adds weight and hard surfaces. **Q2.** (a) Plants crushed and killed → bare, compacted soil → rain runs off → a channel forms → the gully grows. (b) Boardwalk over wet ground; drains that move water off gently; close a track so it can recover. (c) Closing the track. **Q3.** (a) Ten times (3 to about 30 million hectares). (b) Indonesia and Malaysia. (c) 36%; 8.6%. (d) Forest is cleared → soil is left bare. **Q4.** (a) 1981; 2012. (b) January 2021. (c) The site must end up similar to the land around it, so it could one day be added back into Kakadu. (d) The World Heritage park downstream. **Q5.** (a) 581.5 km²; 697.2 km²; 735.2 km². (b) About 26%. (c) Answers vary — filling the sea with sand and rock to make new flat land. (d) Odaiba. **Q6.** (a) 3,005 GL. (b) Average 2,550 GL a year; driest 120 GL (2006–07); wettest 7,130 GL (1956–57). (c) Fourteen; Yarrawonga Weir. (d) Any one change (e.g. smaller, later floods downstream; weirs block fish) and one repair (fishways, e.g. Yarrawonga 1994; or environmental water, Figure 9). **Q7–Q10.** Answers vary (see solutions). **E1.** Answers vary (see marking guide).

Fully-worked solutions

Q7. Model analysis. Benefits: flood control — 22 cubic km of flood storage holds back the Yangtze's worst floods, gaining for the people and farms of the middle and lower river (downstream); power — 22,500 MW into the national grid, gaining for cities and factories far away; navigation — deeper calmer water over the ~600 km reservoir, gaining for inland ports. Costs: about 40 million tonnes of soil a year settles in the reservoir (carried at the dam); downstream banks, starved of sediment, may become more open to flooding (carried by people below the dam); landslides forced 300,000 people to evacuate and forest cover fell from 20% to under 10% (carried upstream, around the reservoir). Analysis sentence: the benefits flow downstream and far, while much of the cost sits upstream and at the dam — one structure, two directions of consequence, an interconnection across space and scale.

Q8. Model explanation. The open cut removes the land surface and plant cover and leaves bare ground and waste rock dumps (cause). Rain on that bare ground can start erosion and dirty water (process). Magela Creek flows past the mine toward the East Alligator River, so the park's water quality depends on a mine the park does not include (interconnection across a boundary). The management answers each link: monitoring points and the Supervising Scientist watch the creek so problems show early (protect and monitor); rehabilitation works the pit and dumps back toward the surrounding land under the closure goal (repair); storage rules for waste rock and water, and after closure weed control, erosion management and fire exclusion, keep the pressure down (reduce). The closure goal ties the chain together: the site must end up similar to the land around it, so the park's environmental quality is the measure of success.

Q9. Model explanation. Cause: dams store the winter–spring flows that once flooded the forest most years, so wetlands dried and some native fish died out locally in the Millennium Drought. Response: water for the environment is delivered through regulators to give the forest some of its old floods back — chiefly a *repair* move, with *protect and monitor* in the report card and *reduce* in the water-taking rules that make the environmental water possible. Evidence the forest is answering: the 2023–24 report card scores an A; waterbirds bred at five wetlands with the most species in 25 years of monitoring; Moira grass and Warrego summer-grass came back strongly after the 2022–23 floods; locally extinct fish were released again into forest lagoons.

Q10. Model steelman. *For expansion (strongest form):* palm oil gives 36% of the world's vegetable oils from only 8.6% of the oil-crop land — no other oil crop feeds so many people from so little ground, and swapping away from it would need far more land cleared somewhere else; for Indonesia and Malaysia it is farm income and jobs for millions. *Against expansion (strongest form):* the new land has mostly come from clearing forest, and the chain that follows — bare soil, heavy rain, soil in the rivers, cloudy water, settled sediment, harmed habitats and water quality — damages places and waterways that cannot be bought back; efficiency is a reason to value the land already planted, not a reason to clear more. *Position:* answers vary; a strong answer states both sides above (or better), then picks a side for reasons that answer the other side's best point — for example, raising yields on land already cleared answers the “we would have to clear more land somewhere else” argument while stopping the clearing that starts the erosion chain.

E1. A strong proposal reads like this skeleton (example site: a worn creek bank reserve in a Victorian town — swap in your own site and evidence). *Describe:* “Our site is a creek valley; 3C's processes (erosion and deposition) cut the bank and built the small floodplain.” *Evidence:* “(1) photos from the same spot show the bare bank widening; (2) our wear count recorded 40 informal tracks, recorded 12 May 2026.” *Steelman:* “The walking club's strongest case: formed tracks and open access keep people active and watching the reserve — closing everything helps nothing. The conservation group's strongest case: a bare bank sheds sediment into the creek in every rain, and a creek cannot be undirtied cheaply.” *Actions:* “(1) a formed track and boardwalk across the wettest ground — *reduce*; (2) replant the bare bank with local species — *repair*; (3) photo points re-shot each term so we know if it is working — *protect and monitor*.” *Trade-off:* “Fencing the steepest bank means walkers lose the shortest loop; the ones who carry that are the daily walkers, and the gain is a bank that holds.” Every one of the five marking-guide steps is visible in that skeleton.

Teaching sequence (teacher)

1. **Hook (5 min):** two photos of the same walking track — fresh and worn (or a local example). Ask: “What made this change?” Collect answers; announce: today people are the second engine of landform change.
2. **Direct teaching (10 min):** Figure 1 — the seven activity families, the five mechanisms, the visible changes. Define erosion, sedimentation, quarrying, introduced species; link back to 3C's natural engines.
3. **E02 (10 min):** Figure 2 — build the cause chain aloud, then the three management moves on the track. Figure 3 — palm oil data and the same chain at large scale. Fix the section's meaning of *environmental quality* here and write it on the board.
4. **E03 (10 min):** Figure 4 — Ranger as an interconnection chain (worked example 2); define open-cut, rehabilitation, and note the monitoring record. Figure 5 — Singapore and Tokyo Bay; define reclamation.
5. **E04 (15 min):** Figures 6–7 — model worked example 1 (who gains where, who carries what where); students try one benefit and one cost themselves. Figures 8–9 — the Murray–Darling story: cause → response → evidence at Barmah–Millewa. Define regulation, weir, barrage, gigalitre.
6. **Management frame (10 min):** Figure 10 — the three moves; sort every case study so far into them. Define sustainability with the 1987 attribution and trade-off; introduce the steelman rule.
7. **Local study launch (10 min):** Figures 11–12 — the five steps and the four groups; choose or confirm the local site; set E1. Remind students: methods live in 5B, the formation story in 3C, the finished report in 6C; marks reward reasoning, not conclusion.
8. **Check for understanding:** exit card — “one activity, one mechanism, one management move, and one group whose view you steelmanned.”

This section teaches the retained elaborations only (VC2HG8K15 .E01–.E04 whole, .E05 trimmed). Kakadu and the Ranger mine are taught strictly as an environmental-interconnection case — mining impacts, rehabilitation and monitoring; no Aboriginal and Torres Strait Islander content is taught anywhere in this section, in line with Content Policy Rule 1 and the §2A record in the TOC. Stakeholder groups for the proposal task are farmers and graziers, visitors and tourism businesses, conservation groups, and local council.

Sources (retrieved 25 August 2026 unless stated)

- Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW), Supervising Scientist — ‘Ranger uranium mine’ and ‘Closure and rehabilitation of Ranger mine’ pages: site location (8 km east of Jabiru), the 78 km² Ranger Project Area surrounded by but separate from Kakadu

National Park, Magela Creek and the East Alligator River, open-cut mining from 1981, mining ceased 2012, stockpiled ore processed to January 2021, the closure goal (similar to the surrounding land, able to be incorporated into Kakadu), the Supervising Scientist established 1978, monitoring showing the park protected, and post-rehabilitation care (weed control, erosion management, fire exclusion).

- Murray-Darling Basin Authority — ‘Hume Dam’, ‘Weirs and locks’ and ‘Yarrawonga Weir’ pages: capacity 3,005 GL, average inflow 2,550 GL a year, driest year 120 GL (2006–07), wettest 7,130 GL (1956–57), built after the 1890s droughts and 1902, fourteen weirs downstream of Hume with Yarrawonga the largest, fish lift added 1994.
- Murray-Darling Basin Authority — ‘Barmah-Millewa Forest Report Card 2023-24’: world’s largest river red gum forest, wetlands of international importance, report card score A, waterbirds breeding at five wetlands (most species in 25 years of monitoring), Moira grass and Warrego summer-grass recovery after the 2022–23 floods, locally extinct fish released again.
- New World Encyclopedia — ‘Three Gorges Dam’: dimensions (2,335 m long, 181 m high), reservoir (about 600 km, 39.3 km³, normal level 175 m, 22 km³ flood storage), 22,500 MW, construction started 14 December 1994, working 2009, all generators 2012, more than 1 million people moved, about 40 million tonnes of sediment a year settling in the reservoir, downstream sediment deficit, landslides (300,000 evacuated), thousands of small quakes mid-2003–2009, forest cover 20% (1950) to under 10% (2002), 361 fish species harmed.
- New World Encyclopedia — ‘Singapore’: land area 581.5 km² (1960s), 697.2 km² (2007), 735.2 km² (most recent figure in the source).
- New World Encyclopedia — ‘Tokyo’, and Simple Wikipedia — ‘Tokyo Bay’: bay extent about 1,500 km², centuries of reclamation, Odaiba as a reclaimed island district.
- Our World in Data — ‘Palm oil’: world palm oil area about 3 Mha (1970) and about 30 Mha (2020); Indonesia and Malaysia about 70% of area and more than 80% of production; 36% of vegetable oils from 8.6% of oil-crop land.
- Parks Victoria — Wilsons Promontory pages: walking tracks across dunes and headlands, Tidal River as the visitor hub (qualitative only).
- World Commission on Environment and Development — *Our Common Future* (1987): the sense of sustainability used here (definition paraphrased in Key idea 6).

All figures in this section are drawn from primitives for this workbook; no publisher’s map or diagram has been traced or copied.

Volcanoes, earthquakes, tsunamis and landslides: causes, impacts and the human response

Geography 8 · Chapter 3 — Landforms and landscapes · Section 3E

Curriculum focus: VC2HG8K16 (Victorian Curriculum F–10 Version 2.0, Geography, Levels 7 and 8, VCAA).

This section draws on **VC2HG8K16.E01**, **VC2HG8K16.E02**, **VC2HG8K16.E03** and **VC2HG8K16.E04** for MCQ and coverage linking.

Theory

Start with what you know

You have met hazards before. In Levels 5–6 you studied how climate hazards such as bushfires and heatwaves affect Australian communities, and you saw that the same event can be a big deal for one town and almost missed by another. Section 1E of this book runs that same thinking for the weather-and-water family — droughts, storms, cyclones and floods. This section runs it for the family that comes from the ground itself: **earthquakes, volcanic eruptions, tsunamis, landslides and avalanches** — the five the curriculum names for this study.

Australia is an interesting place to study them. It has no active volcanoes on its mainland, its earthquakes are fewer and smaller than at the world's busy plate edges, and yet its record holds an earthquake that killed 13 people, a landslide that killed 18, and tsunami warnings that closed its beaches as recently as 2022. Geographers ask three questions about every one of these events: what causes it and where it happens (VC2HG8K16.E01), what it does to people and places — and how people's own choices add to or cut that damage (VC2HG8K16.E02 and .E03) — and what communities and governments do about it (VC2HG8K16.E04). Those questions are the shape of this section.

Defining the terms first

geomorphological hazard — a hazard produced by the processes that shape the Earth's land surface: rock breaking and moving, molten rock rising, and water, soil or snow suddenly moving down a slope. Say it as *geo-morpho-logical*: Earth-shape-study. The five studied here are volcanic eruption, earthquake, tsunami, landslide and avalanche.

hazard versus disaster — this section uses these words the way the United Nations disaster risk office (UNDRR) does. A *hazard* is something that *could* harm people, property or places. It becomes a *disaster* when it actually does, and the community affected cannot cope on its own. A magnitude 8 earthquake under a deserted ocean is a hazard; the same shaking under a city can be a disaster. Other meanings of both words exist; these are the ones used here.

magnitude — the energy an earthquake releases, read on the moment magnitude scale (written Mw). The scale multiplies: each whole-number step means about 32 times as much energy, so a magnitude 6 quake is not “a bit bigger” than a magnitude 5 — it is a different order of event.

focus and epicentre — the *focus* is the point underground where the rock actually breaks; the *epicentre* is the point on the surface directly above it. Maps usually mark the epicentre.

plate boundary and intraplate — the Earth's hard outer shell is made of about a dozen big *plates* that move a few centimetres a year. A *plate boundary* is where two plates meet and push, pull or slide past each other. *Intraplate* means “inside a plate”, far from any boundary. Australia sits in the middle of its plate, so nearly all of its earthquakes are intraplate.

subduction — the process at some plate boundaries where the heavier oceanic plate sinks beneath the other plate down into the hot mantle. The sinking slab drags water down with it, which helps make melt (molten rock) that can rise to feed volcanoes, and the friction along it causes the world's biggest earthquakes.

seismic — to do with earthquakes and their waves. *Seismic instruments* record the shaking, and a *seismic instrument* network is how the warning chain in Section 6 detects events.

1. One family, five hazards

The five hazards in this section look different, but they belong together for one reason: all of them are material that was sitting still suddenly moving fast — rock, molten rock, water, soil or snow. What tells them apart is what moves, and how much warning people get.

This section's hazard family: five hazards, one idea

The idea that joins them: material that was sitting still starts moving fast — rock, molten rock, water, soil or snow.

Hazard	What it is	What starts it	How fast it starts	Where it happens
Earthquake	Shaking from rock suddenly cracking or slipping underground	Plates push and pull until rock can bend no further and breaks	No warning — the shaking arrives in seconds	Most near plate boundaries; Australia's happen within a plate
Volcanic eruption	Molten rock, ash and gas escape from inside the Earth	Deep rock melts and pushes up through cracks in the crust	Often hours to days of warning signs first	Mostly along plate boundaries
Tsunami	A train of large ocean waves	An undersea earthquake, eruption or landslide lifts or drops the sea floor	Hours of travel time across the ocean — time to warn	Coasts facing deep-ocean sources
Landslide	Rock, soil and debris sliding down a slope	Gravity wins when rain, shaking or digging weaken a slope	Minutes — sometimes less	Steep slopes around the world, including Australia
Avalanche	A mass of snow letting go on a steep slope	Deep or loose snow on slopes of about 30–45 degrees	Seconds to minutes	Snow mountains; in Australia, the Australian Alps

Family named in the curriculum: volcanic eruption, earthquake, tsunami, landslide and avalanche (VC2HG8K16.E01, VCAA).

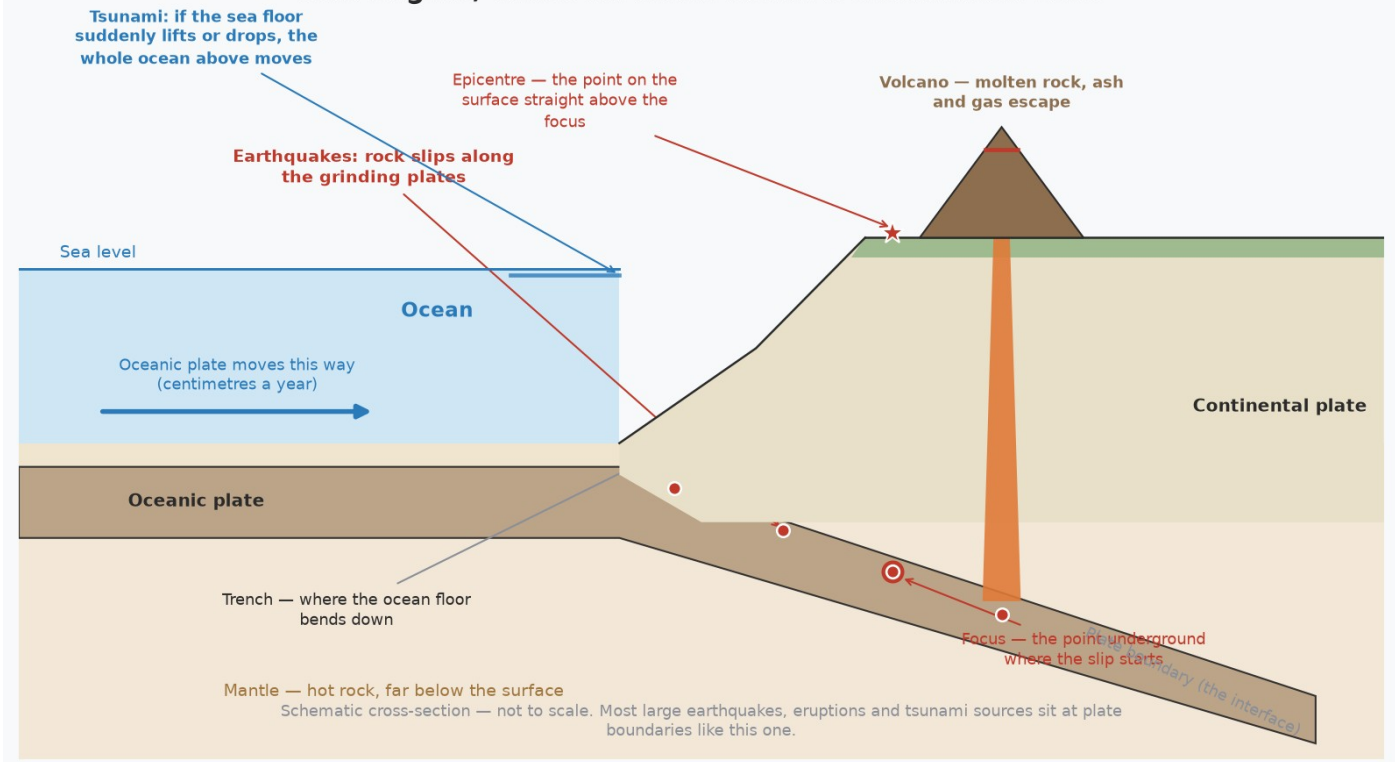
Table of this section's five-hazard family — volcanic eruption, earthquake, tsunami, landslide and avalanche — with what each one is, what starts it, where it is most likely to happen and how much warning it gives

Notice the warning times. An avalanche or a landslide can be on people in seconds once a slope lets go, and an earthquake gives no warning at all. A tsunami crosses an ocean in hours, which is why, as Section 6 shows, warning chains matter so much for that one member of the family.

2. The engine: plates, boundaries and subduction

Most of the world's earthquakes and volcanoes happen at plate boundaries, where plates push, pull or slide. The busiest boundary type for this hazard family is the **subduction zone**, and one cross-section explains a lot of the map in Section 3.

One engine, three hazards: inside a subduction zone



Labelled cross-section of a subduction zone: an oceanic plate sinking beneath a continent, earthquakes deepening along the sinking slab, melt rising to feed a volcano, and the sea floor lifting or dropping to start a tsunami

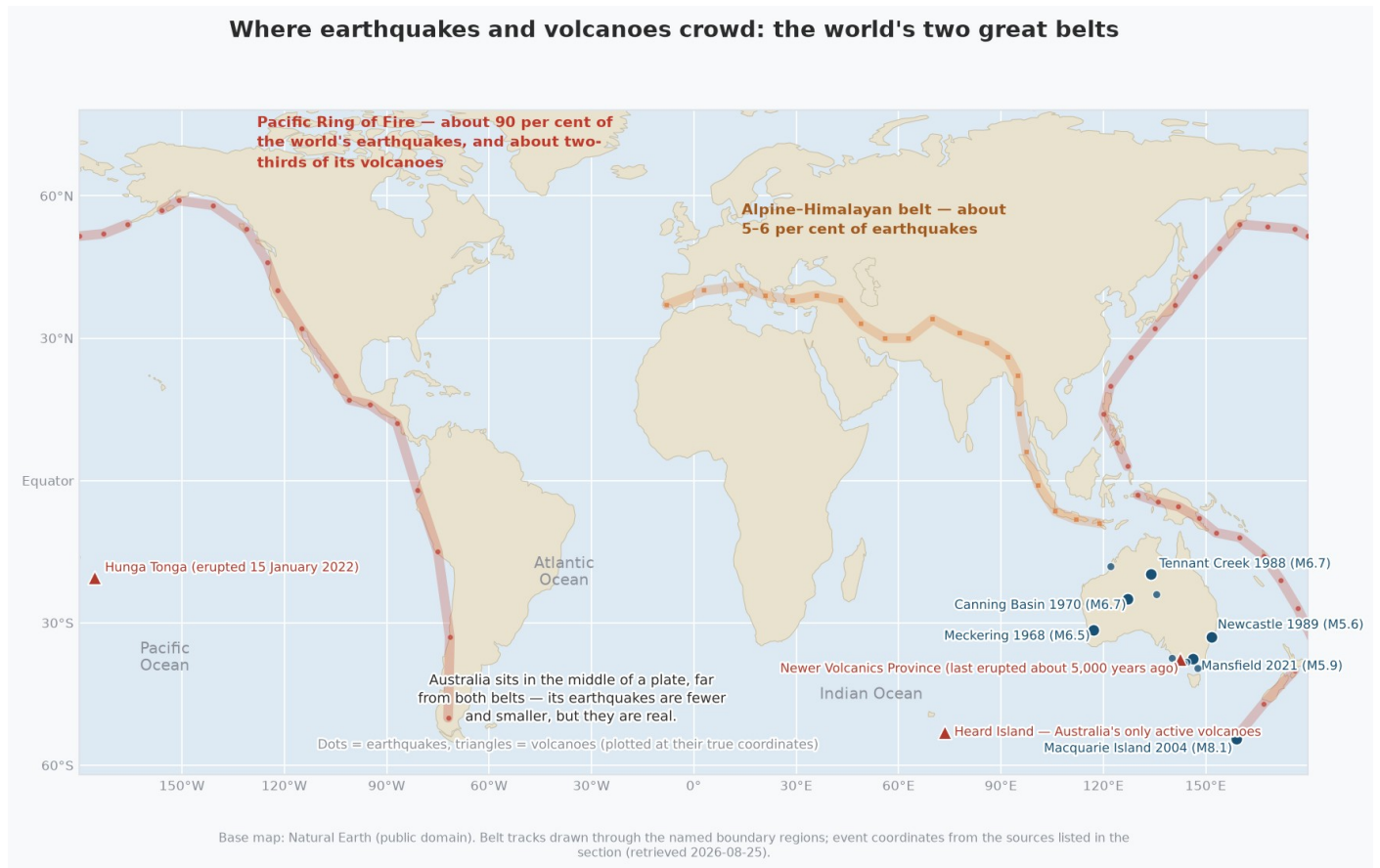
Read the cross-section in three passes:

- **Earthquakes:** the sinking slab sticks and slips as it goes down, so earthquakes trace the slab — shallow at the trench, deeper and deeper under the continent. The biggest ones, magnitude 9 and above, happen on the shallow contact between the two plates.
- **Volcanoes:** the slab carries sea water down into the hot mantle; that water helps make melt, which rises through the continent above and builds a line of volcanoes parallel to the trench.
- **Tsunamis:** when the shallow contact slips in a big quake, the sea floor itself lifts or drops by metres, and the water column above it goes with it. That sudden move launches the train of waves called a tsunami. A volcanic eruption or a landslide into the sea can do the same thing at a smaller scale — the 2022 Hunga Tonga event in Section 6 did.

Not everything fits the boundary picture. A few volcanoes, including Australia's youngest ones, sit inside plates, where melt rises through cracks in the plate itself; scientists still argue about the exact engine there. And intraplate earthquakes — Australia's kind — happen where old cracks in the plate slip as the plate is slowly squeezed. The squeeze is real but weak, which is why intraplate earthquakes are fewer and smaller, but not zero.

3. Where and when: the world's belts, and Australia's quieter record

Plot the world's earthquakes and volcanoes on a map and they do not scatter — they draw lines.



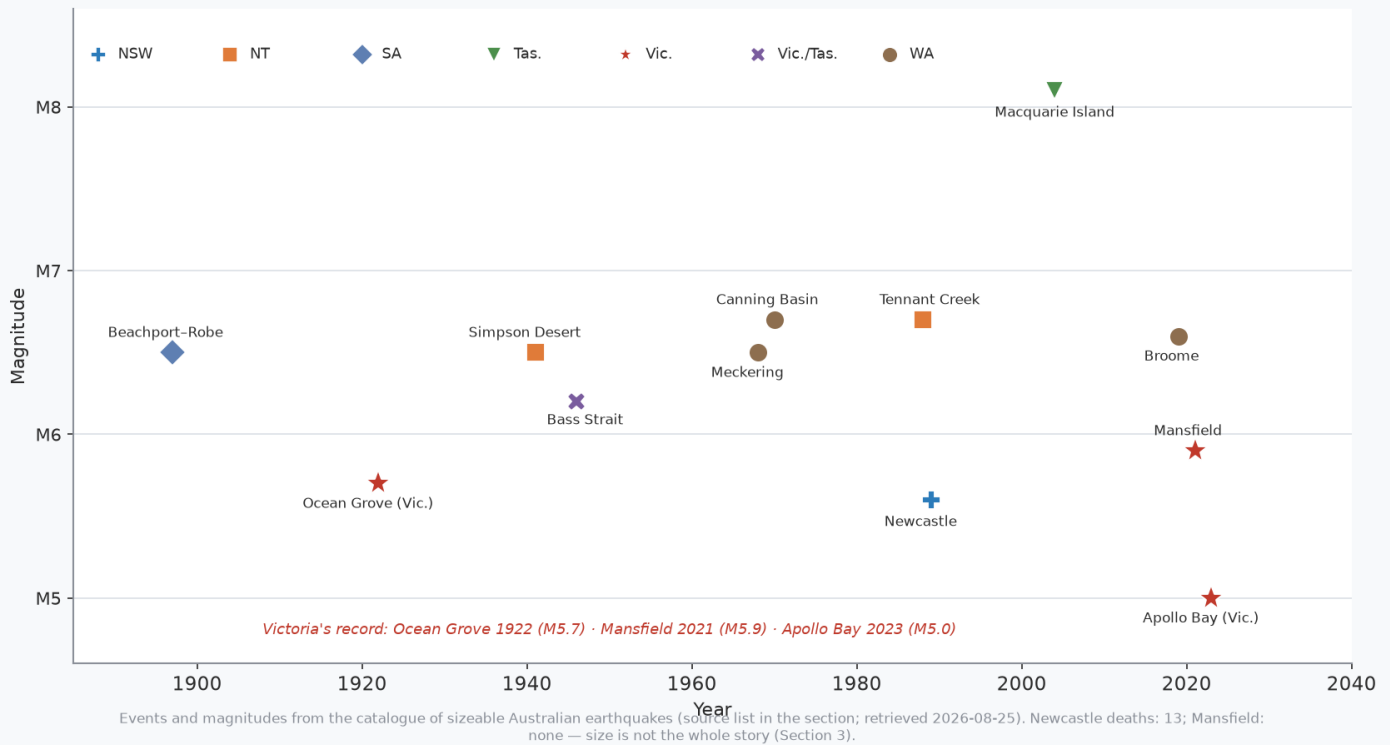
Simple world map with the Pacific Ring of Fire and the Alpine-Himalayan belt drawn through the named plate-boundary regions, and real Australian earthquakes and volcanoes plotted at their true positions, with a note that Australia sits in the middle of a plate

The Pacific **Ring of Fire** carries about 90 per cent of the world's earthquakes and about two-thirds of its volcanoes, and runs for about 40,000 km. The **Alpine-Himalayan belt** (also called the Alpid belt) carries another 5-6 per cent of earthquakes. Australia sits in the middle of its plate, far from both belts — so its earthquakes are fewer and smaller, but real.

Australia's recorded earthquakes make that "fewer and smaller, but real" plain. The dot chart below plots the major ones since 1897 by year and magnitude.

Sizeable Australian earthquakes, 1897–2023: when and how big

Each dot is a real event, plotted by year and magnitude; the colour and shape name the state



Dot chart of major Australian earthquakes from 1897 to 2023, plotting year against magnitude, with each dot marked by state or territory and a box listing Victoria's recorded earthquakes: Ocean Grove 1922, Mansfield 2021 and Apollo Bay 2023

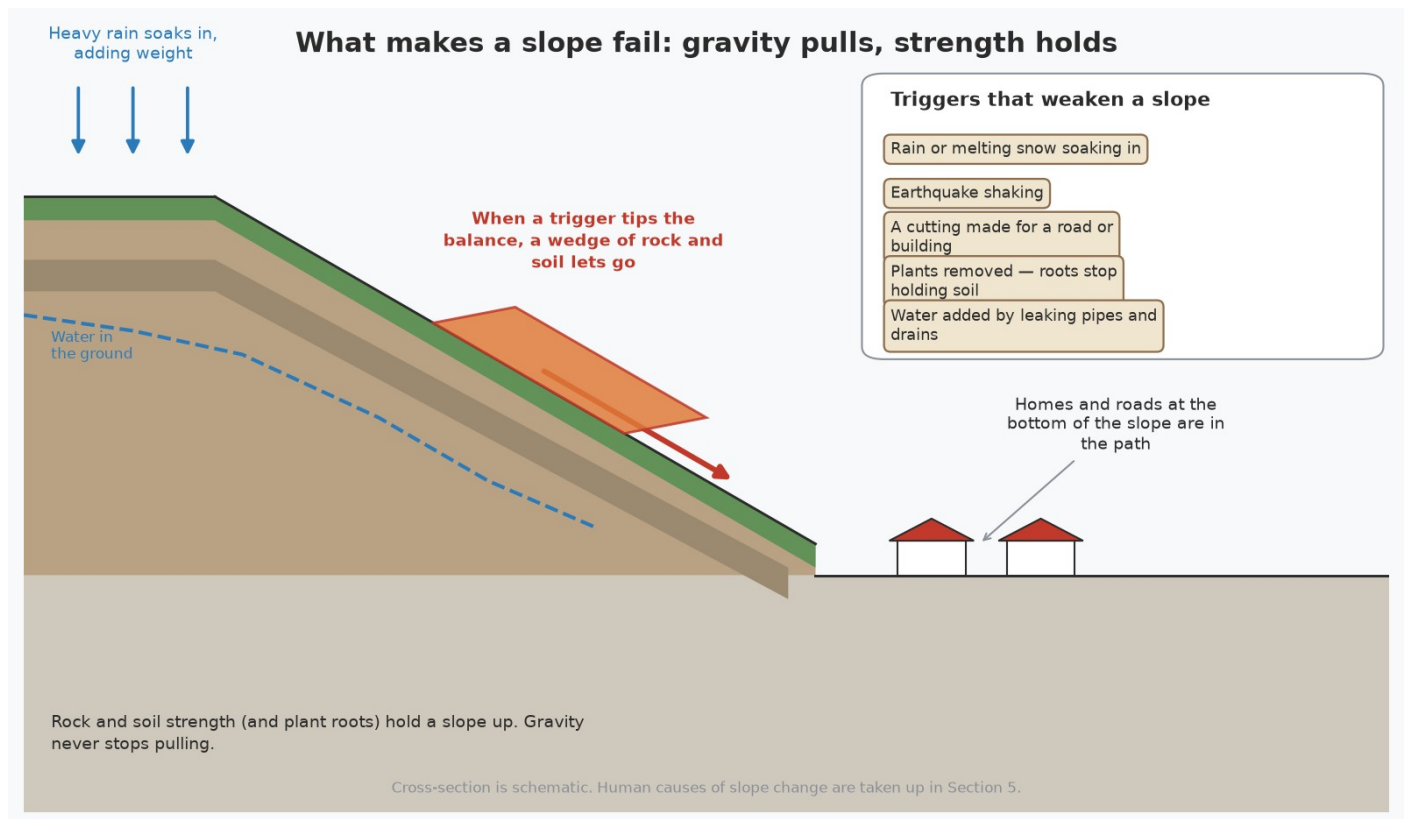
Read across the record:

- **1897, Beachport–Robe (SA), M6.5** — one of the strongest ever felt in South Australia.
- **1922, Ocean Grove (Vic.), M5.7** — for a century, the benchmark Victorian quake.
- **1968, Meckering (WA), M6.5** — left a 32 km long fault scarp (a step in the ground surface) up to 1.5 m high, and injured more than 20 people; nobody died.
- **1988, Tennant Creek (NT), M6.7** — the biggest of a three-quake sequence in one day.
- **1989, Newcastle (NSW), M5.6** — small by world standards, yet Australia's deadliest earthquake: 13 people died, more than 160 were injured.
- **December 2004, Macquarie Island, M8.1** — huge, but so far from anyone that it broke no windows and hurt nobody.
- **2019, Broome (WA), M6.6** — felt across five states, damage limited to cracked walls.
- **2021, Mansfield (Vic.), M5.9** — Geoscience Australia called it the strongest earthquake in Victoria in 50 years; one person was injured.
- **2023, Apollo Bay (Vic.), M5.0** — strong shaking on the Great Ocean Road coast, no serious injuries.

Two patterns matter. First, size alone does not set the damage: Macquarie Island's M8.1 hurt nobody, while Newcastle's M5.6 killed 13 people (Section 4 explains why). Second, Victoria has a record of its own — 1922, 2021 and 2023 — which is exactly why this section keeps a Victorian eye on every hazard in the family.

Volcanoes. Australia's mainland volcanoes are asleep, not dead. The **Newer Volcanics Province** in western Victoria — the plain of more than 400 small volcanoes that includes Mount Gambier and Tower Hill — last erupted about 5,000 years ago, which is young in geology. The only *active* Australian volcanoes today are the Heard and McDonald Islands, far south in the Indian Ocean. But eruptions beyond Australia can still reach it as tsunamis — Section 6's 2022 case.

Landslides. Any steep ground with weak or wet material can fail. The cross-section shows the usual ingredients: water soaking a weak layer until a wedge of rock and soil lets go, with homes and a road standing in the path at the bottom.



Cross-section of a hillside showing the making of a landslide — a weak layer, rain soaking in, ground water, a sliding wedge of rock and soil, homes and a road in the path at the bottom, and a list of triggers: heavy rain, earthquake shaking, a road cutting, removed plants, and leaking pipes

Australia's deadliest landslide was at **Thredbo (NSW) in 1997**, when two lodges were destroyed and 18 people died; one survivor, Stuart Diver, was reached after 65 hours. Victoria's own landslide country is the **Great Ocean Road** coast, where road cuttings and steep coastal slopes have a long record of slips — landslides near Lorne closed the road in 1964 and again in 1971, and a cutting collapsed there in January 2011.

Avalanches. Australia's avalanche country is the **Australian Alps** — the only mainland region with season-long snow, including Mount Kosciuszko (2,228 m) and Victoria's Mount Bogong (1,986 m). Avalanches start on slopes of about 30–45 degrees, and at the Victorian resorts — Mount Buller, Falls Creek, Mount Hotham — ski patrols watch and close the start zones above the pistes (the groomed ski runs). Australian avalanches rarely kill, for one clear reason: almost nobody lives in their path. Remember that sentence — it is Section 4's first factor at work.

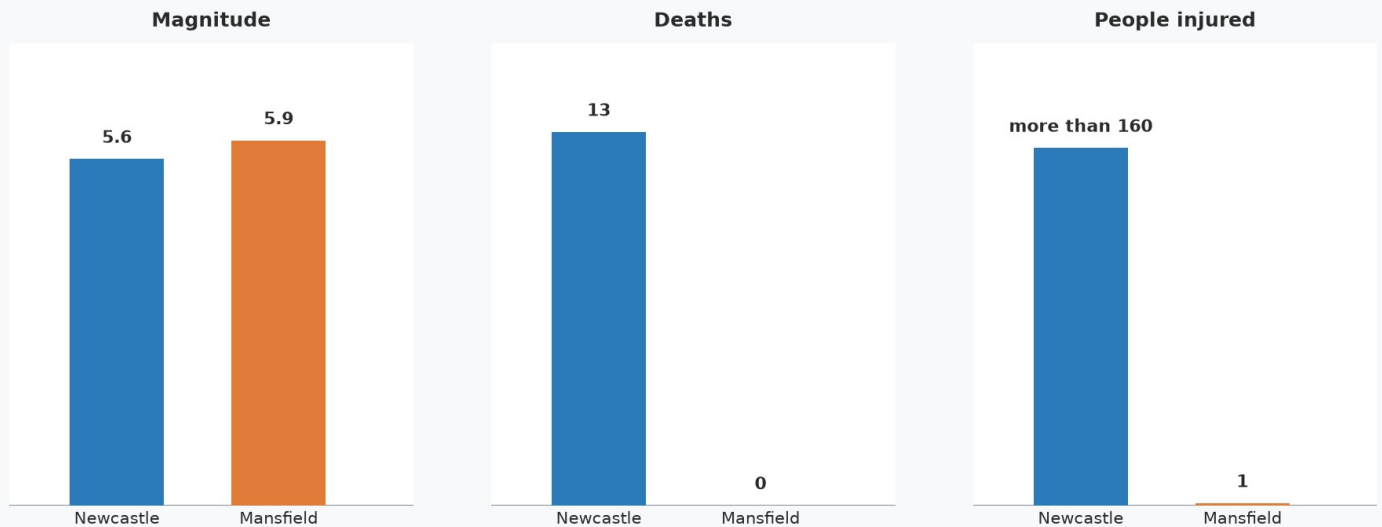
4. What shapes the impacts

Impacts come in three kinds — **economic** (damage bills, lost business), **environmental** (changed coastlines, scarred slopes, broken ground) and **social** (deaths, injuries, lost homes and the fear that stays after). This section's events supply real examples of each: Newcastle's roughly A\$4 billion bill (about A\$9.5 billion in 2022 values) is economic; Meckering's 32 km scarp is environmental; Thredbo's 18 deaths and Newcastle's 13 are social.

Yet the size of the event does not decide the impact on its own. Compare the two earthquakes in the figure below: almost the same magnitude, completely different outcomes.

Two earthquakes of similar size — very different impacts

Newcastle (NSW), 28 December 1989, and Mansfield (Vic.), 22 September 2021



Damage: Newcastle — about A\$4 billion (roughly A\$9.5 billion in 2022 values). Mansfield — minor: at least 46 reports of cracked chimneys and building fronts in Melbourne.

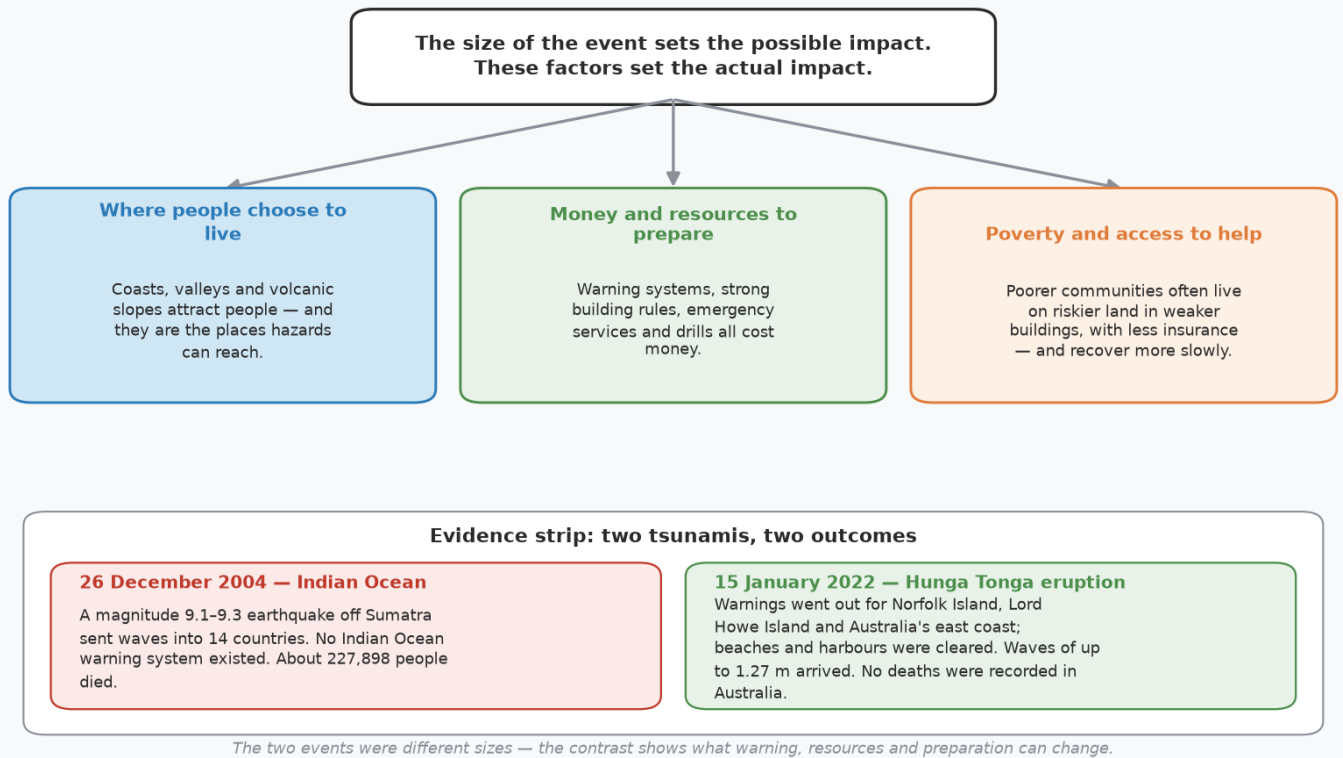
Data: recorded earthquake details and impact reports (source list in the section; retrieved 2026-08-25).

Three paired bar charts comparing the 1989 Newcastle earthquake with the 2021 Mansfield earthquake — magnitude 5.6 versus 5.9, deaths 13 versus 0, people injured more than 160 versus 1 — with a damage note: about A\$4 billion at Newcastle against cracked chimneys and building fronts after Mansfield

Newcastle in 1989 was a city of older unreinforced brick buildings standing directly above a shallow focus; when the shaking came, walls and brick fronts fell onto streets full of people. Mansfield's 2021 quake shook Melbourne's modern buildings, which are designed to sway rather than break, and the worst reports were cracked chimneys and falling building fronts. Same family, same size — different exposure and different buildings, different disaster.

The curriculum makes the general point at VC2HG8K16.E03: how hard a hazard hits people and places depends on social, cultural and economic factors — on where people choose to live, on poverty, and on the resources available to prepare and respond. The concept map below unpacks that idea.

What makes a hazard's impacts big — or small?



Concept map of the three factor groups that decide how big a hazard's impacts are — where people choose to live, money and resources to prepare, and poverty and access to help — with an evidence strip comparing the 2004 Indian Ocean tsunami and the 2022 Hunga Tonga tsunami in Australia

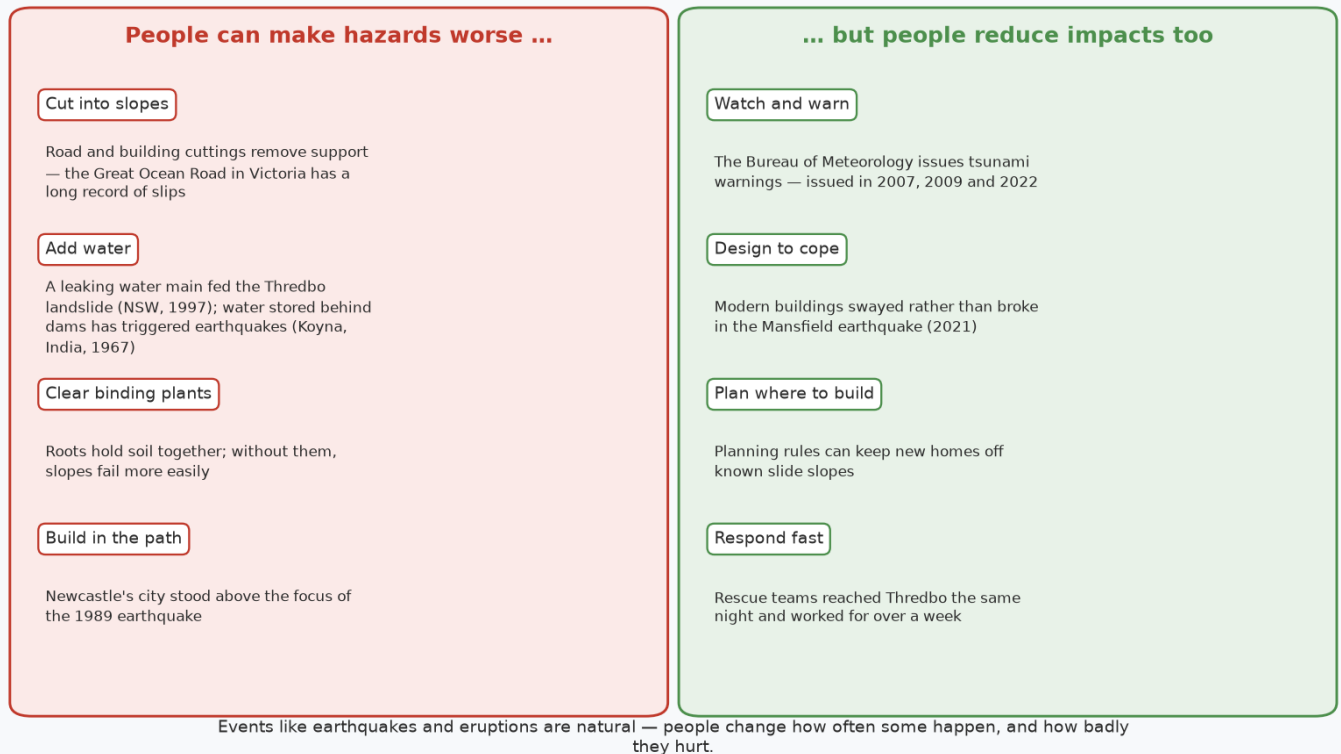
The evidence strip is the clearest single comparison in this section. In 2004 a magnitude 9.1 earthquake off Sumatra sent a tsunami into 14 countries and killed about 227,898 people; no Indian Ocean warning system existed, and many of the communities struck were poor, with homes and boats at the water's edge and no plan to leave. In 2022 the Hunga Tonga eruption sent tsunami waves towards Australia too — and because a warning system existed, and the resources to act on it existed, the event ended as a managed incident, not a disaster. The two events were different sizes, and the section's worked examples keep that honest; but hold the two outcomes side by side and you can see what warning, resources and preparation can change.

5. People change the story

Events like earthquakes and eruptions are natural. But the curriculum asks a second, harder question (VC2HG8K16.E02): how far has **human alteration of environments** helped cause these hazards, or made their impacts worse? The honest answer is: sometimes a little, sometimes a lot — and people cut impacts just as much as they add to them.

People and hazards: a two-way street

The curriculum question: *how far has human alteration of environments contributed?* (VC2HG8K16.E02)



Two-panel diagram: ways people make geomorphological hazards worse — cutting into slopes, adding water, clearing binding plants, building in the path — and ways people cut the impacts — watching and warning, designing buildings to cope, planning where to build, and responding fast

The left panel is the “occurrence” half of E02. Two cases carry real weight behind it:

- **Thredbo (1997).** The coroner and the courts found that a leaking water main had soaked the slope for years and that a badly supported road cutting had removed its support — human alterations that helped turn a natural slope process into Australia’s deadliest landslide.
- **Koyana, India (1967).** After a large dam was filled, the weight and pressure of the stored water is credited by scientists with triggering earthquakes in the rock below, including a magnitude 6.3 quake in 1967 that killed between 177 and 180 people — one of the clearest known cases of human activity setting off earthquakes.

One more claim belongs here, handled carefully because it is **disputed**. In 2007 a researcher proposed that decades of coal extraction under Newcastle had changed the stress in the rock enough to help trigger the 1989 earthquake. Most earthquake scientists do not accept that link — the mainstream view is that the quake was a natural intraplate event on an old fault — and this section treats the mining link as an unproven claim, not a fact. It is kept in the story because E02 asks you to *discuss the extent* of human contribution, and a disputed claim argued from both sides is exactly what “discuss” means. Question 9 in this section gives you that task.

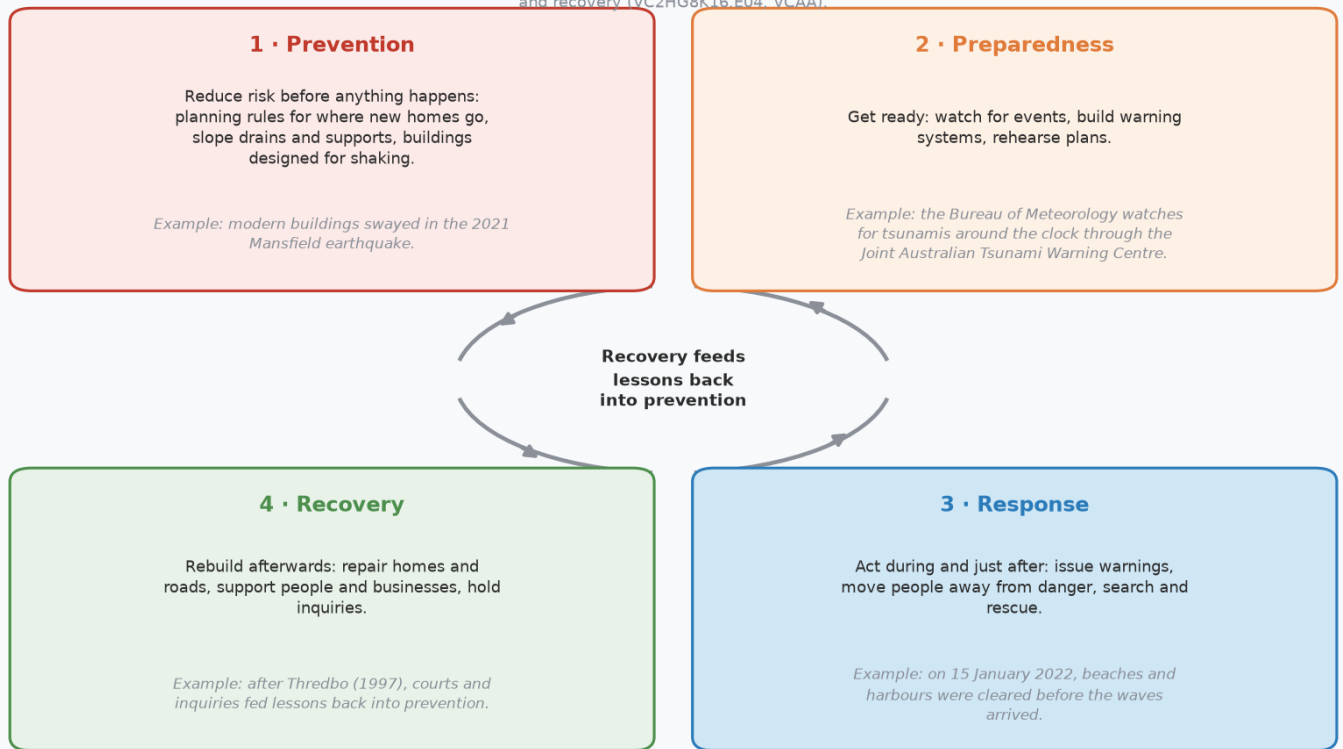
The right panel is the half people forget: human alteration also *reduces* impacts. Building rules that make brick tie together and towers sway, planning that keeps new homes off known slide slopes, warning centres that never close, and rehearsed rescue services — every one is a human alteration of the environment in the safer direction. Section 6 puts those alterations into a cycle.

6. Responses: the four-stage cycle and the warning chain

Australia manages hazards with the four-stage cycle the curriculum names directly: **prevention, preparedness, response and recovery** (VC2HG8K16.E04). The cycle runs for communities and governments alike, and each stage feeds the next.

The four stages of managing hazards — a cycle, not a list

The curriculum names these four principles: prevention, preparedness, response and recovery (VC2HG8K16.F04.VCAA).



Cycle diagram of the four stages of hazard management — prevention, preparedness, response and recovery — each with a definition and an Australian example, and recovery feeding lessons back into prevention

- **Prevention** is mostly government and mostly quiet: planning rules that keep new homes off known slide slopes, building rules that make structures sway rather than break, and slope drains and supports on cuttings.
- **Preparedness** is shared: the Bureau of Meteorology watching for tsunamis around the clock, ski patrols mapping avalanche start zones above the pistes, emergency services training, and households knowing what to do when the ground moves.
- **Response** is what the warning chain sets in motion — next figure.
- **Recovery** runs for months or years: repairs, support for people and businesses, then inquiries that ask what worked. After Thredbo, the coroner's findings and the court cases fed new rules for road cuttings and slope drainage straight back into prevention. That is the cycle closing its loop.

For tsunamis, the response stage runs through a dedicated warning chain, and the 2022 Hunga Tonga event shows it working end to end.

Australia's tsunami warning chain — as it ran on 15 January 2022

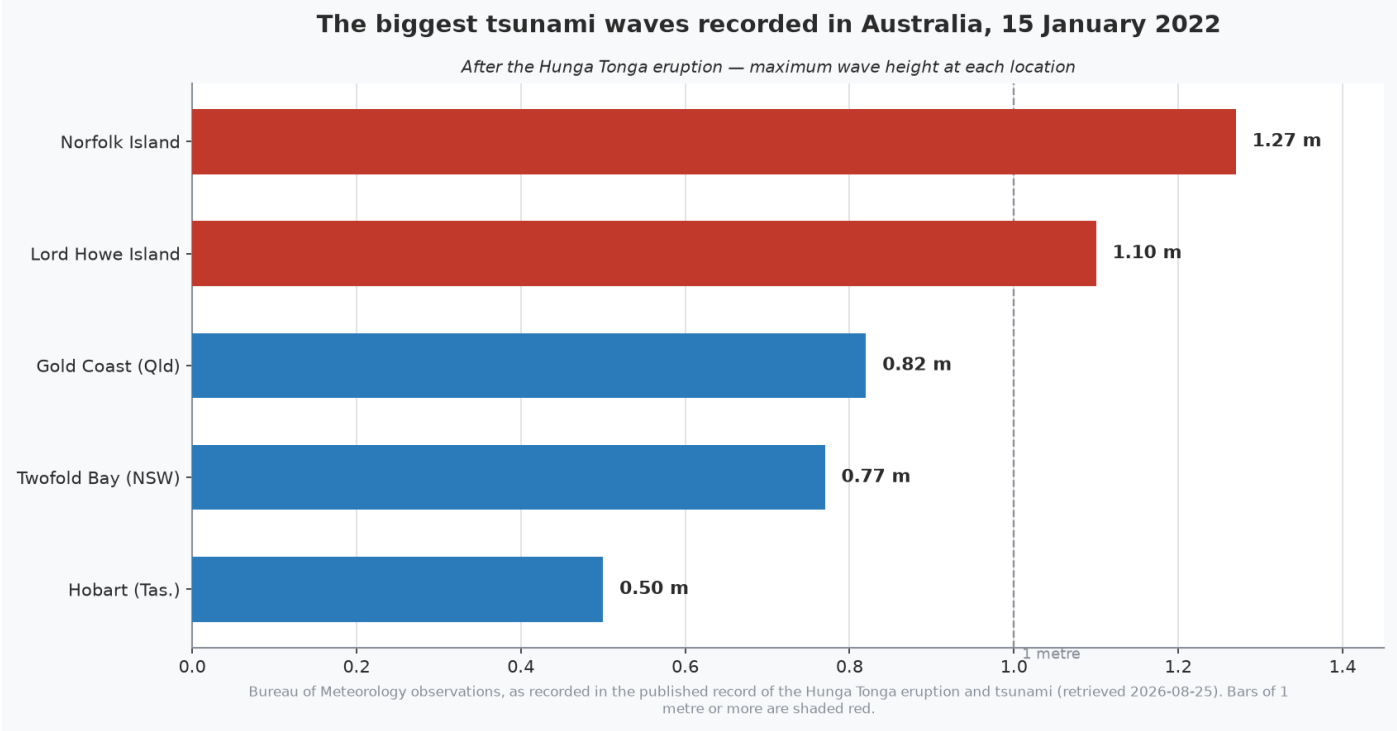


The chain exists because tsunami sources north and east of Australia are close enough that waves can reach the coast within hours — enough time to warn, if someone is always watching.

Event details from the published record of the Hunga Tonga eruption and tsunami (source list in the section; retrieved 2026-08-25).

Six-step flow chart of Australia's tsunami warning chain — trigger, detection, judgement, warning, response and outcome — with what happened at each step on 15 January 2022, from the Hunga Tonga eruption to cleared beaches and a highest recorded wave of 1.27 m at Norfolk Island

The chain has run before. After the 2007 Solomon Islands earthquake, tsunami warnings closed beaches as far south as Sydney; after the 2009 Fiordland (New Zealand) earthquake, about 50 people were moved off Lord Howe Island's shore and a 14 cm wave was recorded at Port Kembla. Each quiet run is the system rehearsing with the stakes turned down. And when the waves do arrive, the gauges show why the chain is worth keeping: on 15 January 2022 the largest wave recorded in Australia was 1.27 m at Norfolk Island — dangerous water for anyone in it, but a managed event for a coast that had been told to stand back.



Bar chart of the biggest tsunami waves recorded in Australia on 15 January 2022 — Norfolk Island 1.27 m, Lord Howe Island 1.10 m, Gold Coast 0.82 m, Twofold Bay 0.77 m and Hobart 0.50 m — with bars of one metre or more shaded red

The cycle also says where responses fail: warnings that do not reach people, or are not trusted, or arrive too late; buildings that were never required to cope; communities without the money to prepare. In 2004 the Indian Ocean had no warning chain at all. Every link in Australia’s chain exists because a hazard event somewhere taught the country what happens without it.

Worked examples

Example 1 — scaffolded

Compare the 1989 Newcastle and 2021 Mansfield earthquakes, then explain why the smaller quake had the worse human cost.

Question	Working
1. When, where and how strong was each quake?	Newcastle: 28 December 1989, magnitude 5.6, shallow focus under the city. Mansfield: 22 September 2021, magnitude 5.9, felt across south-eastern Australia. So Mansfield was the <i>stronger</i> quake.
2. Read the impacts from the figure.	Newcastle: 13 deaths, more than 160 injured, about A\$4 billion of damage (roughly A\$9.5 billion in 2022 values). Mansfield: one injury, at least 46 reports of cracked chimneys and building fronts in Melbourne, no deaths.
3. So can magnitude explain the difference?	No — the stronger quake produced the smaller disaster. The difference must sit in what stood in the path and what was in place.
4. Use exposure and the E03 factors.	<i>Where people stood:</i> Newcastle’s city sat directly above a shallow focus, with streets full of people on a summer afternoon; old unreinforced brick buildings dropped walls and brick fronts. <i>What was in place:</i> Melbourne’s buildings in 2021 were built to modern rules that make

structures sway rather than break, so the same family of shaking produced cracked chimneys, not collapsed walls.

Conclusion: magnitude sets the *possible* impact; exposure, building rules and resources set the *actual* impact. That is VC2HG8K16.E03 in one comparison — the social and economic factors (what people had built, and where) decided the outcome more than the physical event did.

Example 2 — scaffolded

Trace the 15 January 2022 Hunga Tonga event through Australia's tsunami warning chain.

Stage of the chain	What happened on 15 January 2022
1. Trigger	The Hunga Tonga–Hunga Ha'apai volcano erupted at 5:14 pm local time, lifting the sea surface and launching a tsunami.
2. Detection	Seismic instruments recorded the eruption and sea-level gauges across the Pacific watched the waves travel.
3. Judgement	The Bureau of Meteorology, through the Joint Australian Tsunami Warning Centre, judged the threat to Australia's coast.
4. Warning	A land warning was issued for Norfolk Island and Lord Howe Island; a marine warning covered the NSW, Queensland, Victorian and Tasmanian coasts.
5. Response	Beaches and harbours were cleared through Saturday night; boats were moved to deep water.
6. Outcome	Waves arrived small and managed — the largest recorded in Australia was 1.27 m at Norfolk Island. No deaths were recorded in Australia.

Conclusion: one real event, the whole chain — and the outcome was set by stages 3 to 5, not by the size of the waves. Hold this trace next to 26 December 2004 (no chain, about 227,898 deaths across 14 countries): the difference between the two outcomes is what a warning system, and the resources to act on it, can be worth.

Practice questions

Scaffolded

Q1. In your own words, write this section's working definitions for: (a) a geomorphological hazard; (b) the difference between a hazard and a disaster; (c) intraplate.

Q2. Name the five members of this section's hazard family. For each one, write one sentence saying what starts it.

Q3. Using the subduction cross-section: (a) which plate sinks at a subduction zone, and what does it drag down with it? (b) why do the earthquakes get deeper from the trench towards the continent? (c) how does a big slip on the shallow contact start a tsunami?

Q4. Using the world belts map: (a) name the two belts drawn on the map and give one statistic for each. (b) name one labelled Australian earthquake and one labelled volcano on the map. (c) explain in one sentence why Australia's earthquakes are fewer and smaller than the belt countries'.

Q5. Using the Australian earthquakes dot chart: (a) which event has the highest magnitude in the whole record, and where was it? (b) list Victoria's three recorded earthquakes from the chart's box. (c) which event killed the most people despite not being close to the largest magnitude?

Q6. Copy this table and sort each action into one stage of the cycle (prevention, preparedness, response or recovery): (a) planning rules keep new houses off a known landslide slope; (b) the Bureau of Meteorology watches for tsunamis around the clock; (c) beaches and harbours are cleared while a tsunami warning is current; (d) a coroner's inquiry into a landslide leads to new rules for road cuttings; (e) ski patrols map and close avalanche start zones above the pistes before the season opens.

Un scaffolded

Q7. "The Ring of Fire carries about 90 per cent of the world's earthquakes; Australia carries a M5.6 that killed 13 people." Using the subduction cross-section and the idea of intraplate stress, explain both halves of that sentence — why the belts are so busy, and why Australia's quieter record is not a zero record.

Q8. Choose a real Victorian place you know (a town, a suburb, a coastal village, an alpine resort). Which two or three members of this section's hazard family could reach it, and why? Use what Sections 2 and 3 say about causes and patterns — and name one member that is very unlikely to reach it, with a reason.

Q9. A classmate claims: "*The 1989 Newcastle earthquake was caused by coal mining, so it was not a natural disaster at all.*" Put that claim in its strongest form (the 2007 research; the idea that extracting coal changed the stress in the rock), then put the opposing view in its strongest form (the mainstream intraplate-fault explanation; the lack of accepted proof for the mining link). Use evidence and ideas from this section to say which view the balance of evidence supports better — and remember the mark is for the quality of both steelmanned views, not for which side you land on.

Q10. "The 2022 tsunami killed nobody in Australia; the 2004 tsunami killed about 227,898 people. So the only difference was the warning system." Discuss this claim using the three factor groups in the impact concept map. In your discussion, keep one honest limit in view: the two events were different physical sizes, and a good answer says how that matters *and* what the factors still explain.

Extended response — evidence-based written task

Q11. *Explain the causes, impacts and responses for one geomorphological hazard, using Australian evidence.*

Write about one page. Your response must:

- choose **one** hazard from this section's family and explain its physical cause and its spatial distribution in Australia and other regions (VC2HG8K16.E01);
- use **two** real events from this section (for example Newcastle 1989, Mansfield 2021, Meckering 1968, Thredbo 1997, the 2022 Hunga Tonga tsunami in Australia), covering economic, environmental and social impacts, and use at least one of the E03 factors — the places people choose to live in, poverty, or too few of the resources needed to get ready and respond — to explain why the impacts landed as they did (VC2HG8K16.E03);
- address how far **human alteration of environments** helped bring about, or worsened the impacts of, at least one of your events (VC2HG8K16.E02);
- run at least one of your events through **all four** stages of the prevention–preparedness–response–recovery cycle, naming a real community or government action at each (VC2HG8K16.E04);
- refer to at least one figure from this section and one entry from the source list;
- finish with a sentence stating which stage of the cycle you think matters most for Australia, and why.

Success checklist: cause and distribution explained with named places; both events described accurately with dates and at least one number each; all three impact kinds covered; at least one E03 factor doing real explanatory work; a human-alteration point argued with an extent word ("some", "much", "little" — not "all" or "none"); all four stages named with real actions; a figure and a source referred to; a reasoned closing choice.

Answers

Q1. (a) A hazard produced by the processes that shape the Earth's land surface — rock, molten rock, water, soil or snow moving fast. (b) A hazard *could* harm people; a disaster is when it does and the community cannot cope on its own. (c) Inside a plate, far from any plate boundary. **Q2.** Volcanic eruption (molten rock rising and breaking out); earthquake (rock suddenly cracking or slipping underground); tsunami (a sudden lift or drop of the sea floor, or an eruption or landslide into the sea); landslide (a slope letting go when its support or strength fails); avalanche (a snow slab releasing on a steep slope). **Q3.** (a) The heavier oceanic plate; it drags sea water down into the hot mantle. (b) The slab sinks at an angle, so its sticking-and-slipping points get deeper under the continent. (c) The slip lifts or drops the sea floor by metres, and the water column above moves with it, launching a train of waves. **Q4.** (a) The Pacific Ring of Fire — about 90 per cent of earthquakes and about two-thirds of volcanoes; the Alpine–Himalayan belt — another 5–6 per cent of earthquakes. (b) Any labelled pair, e.g. the Newcastle 1989 earthquake and the Newer Volcanics Province. (c) Australia sits in the middle of its plate, far from the boundaries where most of the world's breaking happens, so its earthquakes come from weaker intraplate stress. **Q5.** (a) Macquarie Island, December 2004, M8.1. (b) Ocean Grove 1922 (M5.7), Mansfield 2021 (M5.9), Apollo Bay 2023 (M5.0). (c) Newcastle 1989 — M5.6, yet 13 deaths. **Q6.** (a) Prevention. (b) Preparedness. (c) Response. (d) Recovery (feeding prevention). (e) Prevention (it removes the risk before the season) — preparedness is also defensible if you argue the patrols are getting ready rather than removing the hazard; say which reading you used. **Q7–Q10.** See fully-worked solutions for what a good answer contains. **Q11.** Marked against the success checklist.

Fully-worked solutions

Q7. Model answer: at a subduction zone, one plate sinks beneath another and sticks and slips as it goes, and the sinking slab also makes melt that feeds volcanoes — so a boundary like the Ring of Fire is a factory for both earthquakes and eruptions, which is why about 90 per cent of earthquakes cluster there. Australia sits in the middle of its plate: no sinking slab, no boundary factory. But the plate is slowly squeezed as it moves, and old cracks inside it slip when the squeeze overcomes them — fewer slips, smaller slips, which is why the record runs M5–M7 rather than M9. “Fewer and smaller” is not “none”: Newcastle's M5.6 killed 13 people because a city stood above the crack. A good answer explains the boundary engine, the intraplate engine, and why a small intraplate quake can still be a disaster.

Q8. Model answer (a coastal village on the Great Ocean Road, e.g. Lorne): earthquakes can reach it — Victoria's record includes Ocean Grove 1922 and Apollo Bay 2023 on the same coast; landslides can reach it — the road's own cuttings slipped near Lorne in 1964 and 1971 and a cutting collapsed in 2011; a far-source tsunami can reach its coast — the 2022 marine warning covered Victoria's coast. The very unlikely one is a volcanic eruption: the mainland volcanoes (the Newer Volcanics Province) last erupted about 5,000 years ago and sit to the west, and Australia's only active volcanoes are the Heard and McDonald Islands, far offshore. Marks are for choosing hazards that genuinely fit the place and giving the cause or pattern reason for each. (An alpine resort swaps the list: avalanche and landslide yes, tsunami no.)

Q9. Strongest form of the claim: Newcastle sat above a shallow quake in a coal-mining region; extracting coal removes material and changes the stress in the rock above and below the seams; the 2007 research put those ideas together, and E02 exists precisely because human alteration *can* trigger earthquakes — Koyna 1967 is a proven case of human activity setting off quakes, so the mechanism is real. *Strongest form of the opposing view:* intraplate Australia has old faults that slip on their own under the plate's slow squeeze; most of the world's earthquake scientists treat the 1989 event as such a natural slip; the mining link has not been accepted as proof, and a claim needs accepted proof before it reclassifies a natural disaster as a man-made one. The balance of evidence supports the mainstream view: a natural intraplate earthquake whose *impacts* were made by human choices (old unreinforced buildings above a shallow focus). The claim's lasting value is the question it forces — “how far?” — which is exactly the discussion E02 requires. Marks are for the quality of the two steelmanned views and the evidence used.

Q10. Model answer: the warning system is the biggest single difference — in 2022 the chain ran from detection to cleared beaches, and in 2004 no Indian Ocean chain existed at all. But “the only difference” overstates it. The events were different sizes: a Mw 9.1 earthquake-driven tsunami against a volcano-launched wave train that produced 1.27 m at Norfolk Island — size decides what even the best-prepared coast must survive. And the factor map adds two more groups: *where people live* (fishing and farming communities at the water's edge in 2004, against an Australian coast

cleared of people that night) and *poverty and resources* (the 2004 countries lacked not just sirens but the boats, roads, insurance and rebuilding money that turn a strike into a recoverable one). A good answer keeps all three: size sets the possible impact; warning, wealth and settlement set the actual one — and says plainly that the 2022 waves were smaller, so the comparison shows what preparation is worth *at that size* as well.

Q11. Model structure: Paragraph 1 defines the chosen hazard and gives its cause and distribution with real geography (for example: earthquake — slab stick-and-slip at subduction zones draws the Ring of Fire and the Alpidic belt; intraplate stress draws Australia's quieter scatter from Beachport–Robe 1897 to Apollo Bay 2023). Paragraph 2 runs event one through all three impact kinds with dates and numbers (for example Newcastle 1989: 13 deaths and 160+ injured, social; about A\$4 billion, economic; the event left no scarp but the falling buildings are the environmental signature of a built landscape). Paragraph 3 applies an E03 factor (the city stood above the focus — where people choose to live — and older unreinforced buildings turned M5.6 into a disaster) and the E02 extent point (the disputed 2007 mining claim: little accepted human contribution to the *occurrence*, large human contribution to the *impacts*). Paragraph 4 runs event two through all four stages with real actions (for example the 2022 tsunami: prevention and preparedness in the standing warning centre, response in the cleared beaches, recovery in the reviews that keep the chain funded). Paragraph 5 names the figure and source used. Closing sentence picks a stage with a reason — preparedness is a defensible pick for Australia, because our most likely geomorphological events (intraplate quakes, far-source tsunamis) give seconds to hours of warning, and what a community does with those seconds to hours is what turns a hazard into a managed event.

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- Wikipedia, *Avalanche* (start zones on slopes of about 30–45 degrees) and *Australian Alps* (Mount Kosciuszko 2,228 m; the only mainland region with season-long snow; Victoria’s Mount Bogong 1,986 m); retrieved 2026-08-25.
 - Wikipedia, *Reservoir-induced seismicity* (Koyna, India — magnitude 6.3 earthquake in 1967 after dam filling, 177–180 deaths, among the clearest accepted cases of human-triggered earthquakes); retrieved 2026-08-25.
 - Natural Earth, *ne_110m_land* (public domain) — land shapes for the world map figure; event points from the sources above. All figures original, computed from the values shown.
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Teaching sequence (teacher note — not student-facing)

1. **Hook and terms (1 lesson).** Open on the Newcastle–Mansfield chart: “the stronger quake killed nobody; the weaker one killed 13 — how?” Define the boxed terms; use the hazard family table to settle what belongs in the family and why (land-surface processes), and lean on the hazard concept from VC2HG6K05 (Levels 5–6) rather than re-teaching it (D1).
2. **Causes and distribution (1–2 lessons).** The subduction cross-section as the engine; the world belts map and the Australian dot chart as the E01 pair — *where*, with the intraplate idea doing the explaining; the volcano, landslide and avalanche paragraphs as the family’s spread beyond earthquakes. Q2–Q5, Q7.
3. **Impacts and human alteration (1–2 lessons).** The three impact kinds with the real numbers; the impact-factor map (E03) with the 2004-versus-2022 evidence strip; the two-way street (E02) with Thredbo and Koyna as the proven human-alteration cases and the 2007 Newcastle mining claim handled explicitly as disputed. Q8, Q10. Q9 is the section’s steelman task — run it as a structured discussion before writing.
4. **Responses and assessment (1–2 lessons).** The four-stage cycle; the tsunami warning chain and the 2022 wave chart; Worked Example 2 (the 2022 event traced through the whole chain) and Worked Example 1 (the E03 comparison made method). Q1, Q6. Q11 is the assessed evidence-based response — the CD’s three demands (causes, impacts, responses) made visible as a checklist.

Links: 3E mirrors 1E exactly (causes and distribution → impacts → prevention, preparedness, response, recovery), so the hazard reasoning transfers between the two families; the physical processes (folding, faulting, volcanism, erosion) belong to 3C and are used here, not re-taught; the hazard concept itself is assumed from VC2HG6K05 (Levels 5–6), not from any Level 7 book (D1). The skills CDs are *not* taught here (D11); no fieldwork is required by this CD (D11).

§2A: no exclusions apply to VC2HG8K16; no First Nations material is used or required. **Coverage keys:** VC2HG8K16.E01, VC2HG8K16.E02, VC2HG8K16.E03, VC2HG8K16.E04.

Chains of cause and effect: making sense of a changing environment

Geography 8 · Chapter 3 — Landforms and landscapes · Section 3F

Curriculum focus: VC2HG8K17 (Victorian Curriculum F–10 Version 2.0, Geography, Levels 7 and 8, VCAA).

This section draws on VC2HG8K17.E01 and VC2HG8K17.E02 for question and coverage linking.

Theory

The chapter's capstone

In Chapter 3 you have already done five jobs. You described Australia's landscapes and where they are found (3A). You examined what landscapes and landforms are worth to people (3B). You explained the processes that produce landforms (3C). You analysed how human activities change landforms and how that change is managed (3D). You investigated the hazards that form when landforms change fast and dangerously (3E).

This section does a sixth job. It takes all five and asks one bigger question:

How does a geographer make sense of something that is happening in the environment?

The curriculum's answer: follow the **interconnections**, and track the **change**. Those are two of geography's seven big concepts — place, space, environment, interconnection, sustainability, scale and change — and by the end of this section you will be using the whole set of seven as one toolkit. This is the second of the book's three concept capstones (2E applied the concepts to liveability; 4E will apply them to urbanisation). Because Level 8 is the year the band's achievement standard is stated, the work here is done at full depth: you are not just naming the concepts, you are reasoning with them.

Defining the terms first

environmental phenomenon — the Victorian Curriculum uses the term *phenomenon* but does not define it. This section therefore treats it as: *something that happens in the environment that we can observe and then try to explain*. A wetland drying out, a river reach losing its fish, a cliff face collapsing, a new sand bar growing in a stream — all are environmental phenomena. Other meanings of the word exist and are not interchangeable with this one.

interconnection — one of the seven geographical concepts: the links between people, places and environments, so that what happens in one place can shape what happens in another.

change — as a geographical concept: the ways places and environments are altered over time, by natural processes, by people, or by both at once.

environmental system — an environment thought of as a set of connected parts: the rock and soil, the water, the air and climate, the plants and animals, and the people.

cause-and-effect chain — a run of changes in which each change triggers the next. *The ground is cleared of plants → rain washes soil away → the creek runs muddy* is a three-link chain.

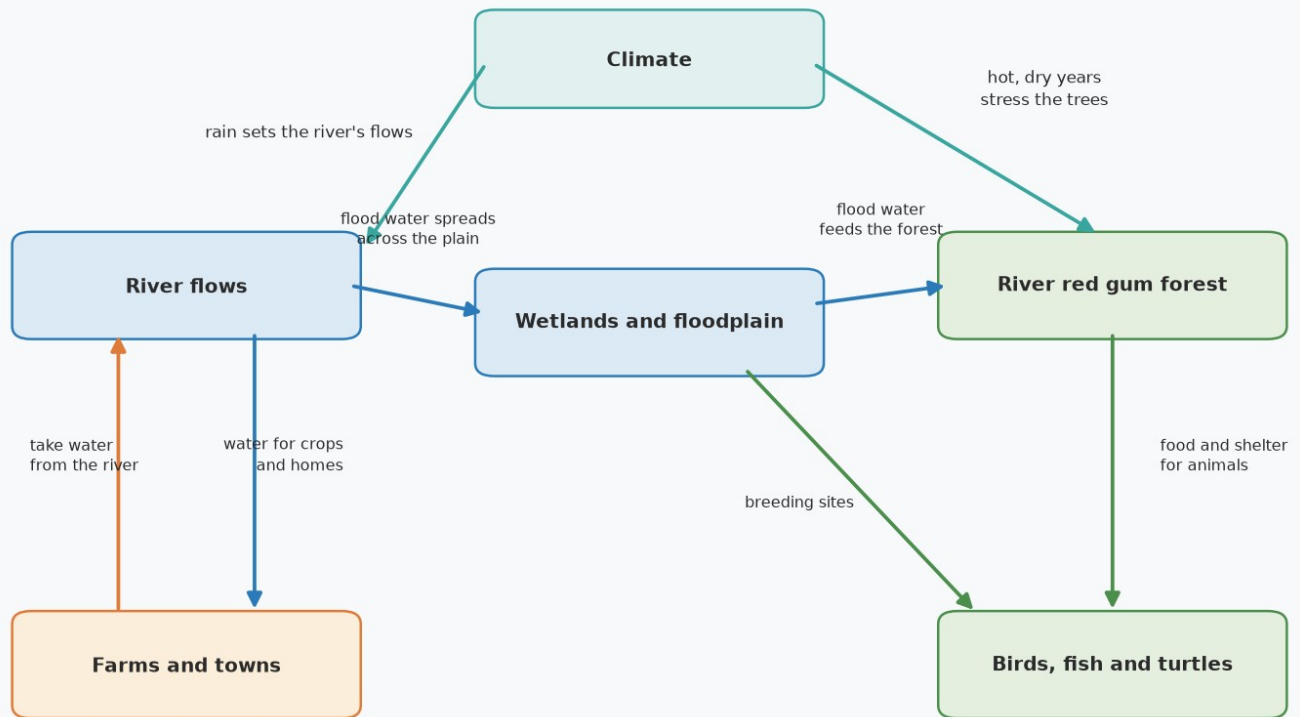
feedback — a loop in which the effects of a change circle back and act on the change itself. A **reinforcing** feedback pushes a change further and further in the same direction. A **balancing** feedback pushes back and steadies the system.

geomorphological — the curriculum's own word for the processes that produce landforms: weathering (rock breaking down), erosion (rock being picked up and carried), and the transport and deposition of rock material. You met all of these in 3C.

1. Thinking in systems

Every environmental phenomenon happens inside a system of connected parts. The model below shows one real system — the Barmah–Millewa Forest, where the River Murray straddles the border of Victoria and New South Wales — with some of its links labelled.

An environmental system: the Barmah-Millewa Forest



Each part is linked to the others. Change one part and the rest feel it.

A model diagram of one environmental system, the Barmah–Millewa Forest: six boxes named river flows, river red gum forest, wetlands and floodplain, birds, fish and turtles, farms and towns, and climate, joined by labelled links such as “flood water feeds the forest” and “farms and towns take water from the river”

Read the links and notice what they mean together: no part of this system stands alone. The forest waits on the river. The river waits on the climate. The farms and towns wait on the river too, and the birds and fish wait on the floods. Because the parts are connected, a change to one part never stays in that one part. That single idea is the heart of VC2HG8K17.E01: change one element of an environmental system and other elements change as well.

2. Change travels three ways

When one element of a system changes, the effects rarely appear right beside it, right away, at the same size. They travel. The three ways they travel are the three shifts of this section:

- **A different time.** Effects can land days, years or centuries after the change that set them going. The gap between a cause and its effects is called a **time lag**. Some lags are short (hours, after a storm); some are long (decades, after a dam is built).
- **A different place.** The cause can sit in one place while the effect lands in another, carried by water, wind, trade, travel or migrating animals.
- **A different scale.** A small, local cause (one dam’s gates, one cleared hillside) can reshape something far bigger (a whole floodplain, a whole river system). A large cause (a basin-wide drought) can come to rest on one small spot (a single bend of a river).

Change travels three ways

A different time

Effects can land days, years or centuries after the change that set them going.

a dam opens in 1936;
the forest feels it for decades

A different place

The cause sits in one place; the effect lands in another, carried by water, wind, trade or moving animals.

gates far up the river;
a forest hundreds of km
down the river

A different scale

A small, local cause can reshape something much bigger. A big cause can land on one small spot.

one dam's gates
to a 66,600 ha floodplain

The geographer's three questions: Later? Somewhere else? At what scale?

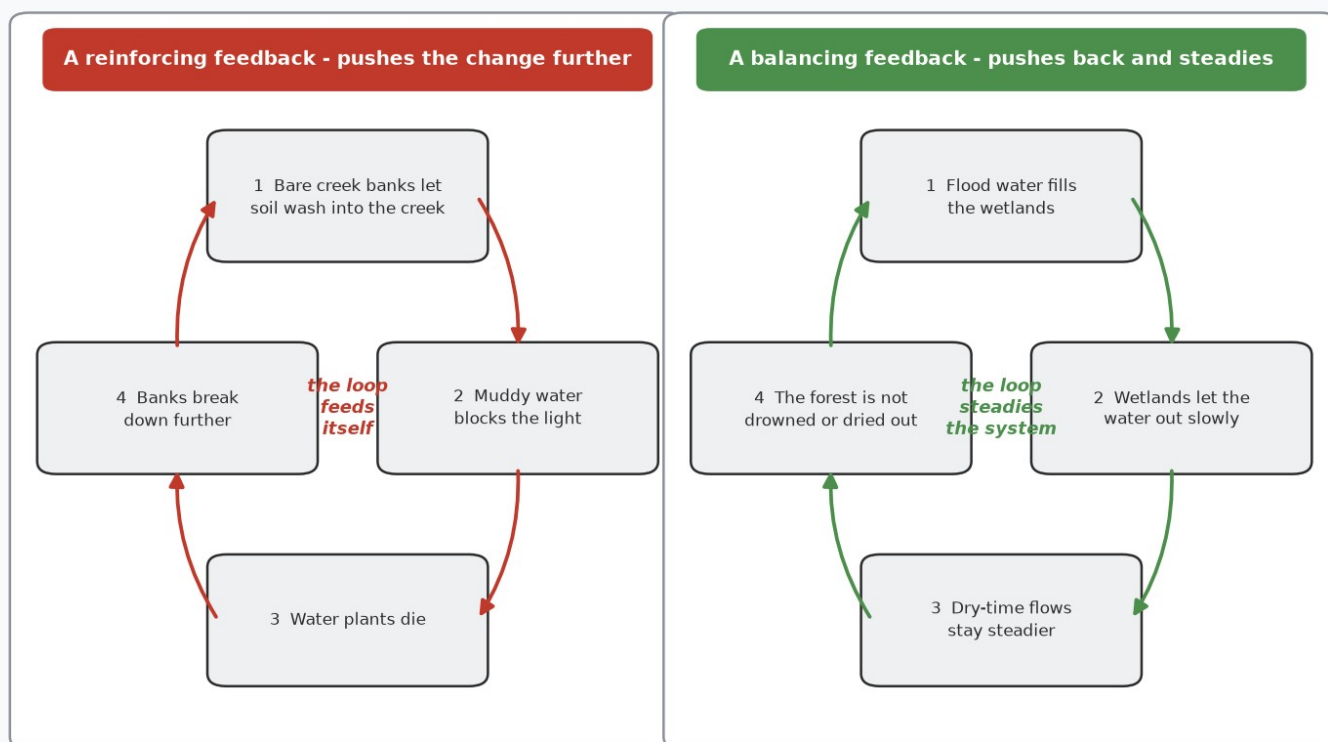
A model diagram of the three ways change travels: three panels named a different time, a different place and a different scale, each with a short explanation, and a bottom row of the geographer's three questions - later, somewhere else, at what scale

Those three questions at the bottom — *later? somewhere else? at what scale?* — are the geographer's checklist for every effect you will ever trace.

3. Feedbacks: loops that grow and loops that steady

Chains are only the start. In a system, effects often loop back and become causes again. There are two kinds of loop, and they behave in opposite ways.

Feedbacks: loops that grow and loops that steady



Two feedback loop diagrams side by side: a reinforcing loop in which bare creek banks let soil wash in, muddy water blocks light, water plants die, and banks crumble further; and a balancing loop in which flood water fills wetlands, the wetlands release water slowly, dry-time flows stay steadier, and the forest is not drowned or dried out

- A **reinforcing feedback** drives a change further in the same direction. On the figure, once soil starts washing into the creek, the murky water blocks light, water plants die, the banks crumble more, and still more soil washes in. A small push can snowball.
- A **balancing feedback** pushes back against a change and steadies the system. On the figure, wetlands fill in flood time and release their water slowly in dry time, so flows downstream do not swing so far, and the forest is neither drowned nor dried out.

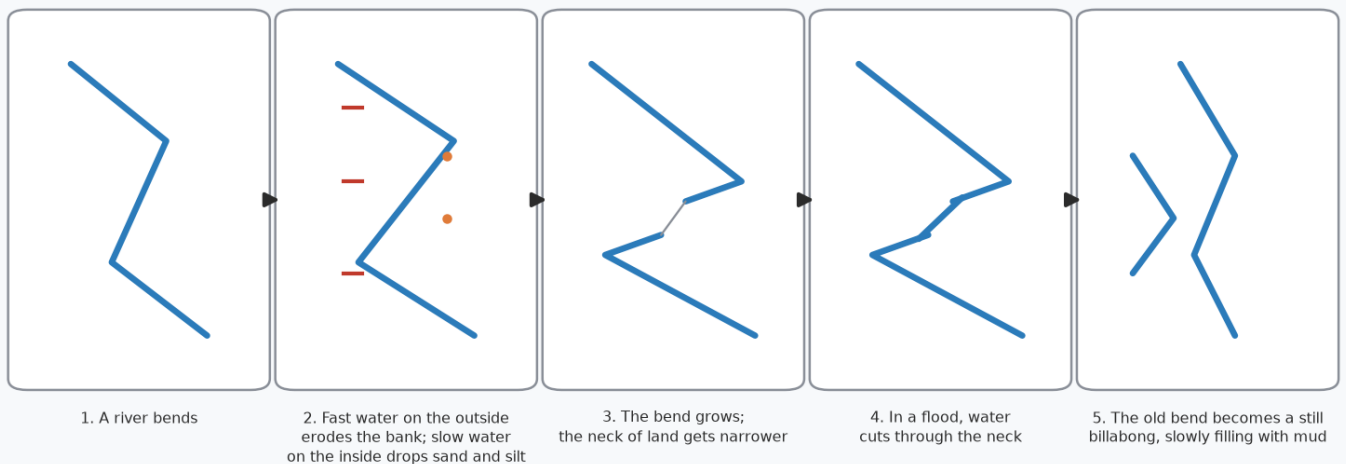
Anyone who manages a place needs to know which loops are running. If a reinforcing loop is under way, fixing one symptom at the end of it may change nothing; the loop keeps feeding itself. If a balancing loop is doing useful work, the smartest move is often to protect that loop, not to build something new.

4. Landforms are chains too

VC2HG8K17.E02 applies the same reasoning to the land itself: geomorphological processes are **chains of cause and effect, link after link**. A landform is not just a thing sitting in a landscape; it is one stage in a chain. Here are two chains at very different speeds.

A fast chain: how a billabong forms. A billabong is a curved, often still, waterhole cut off from a river. On big lowland rivers such as the Murray, the chain runs like this:

How a billabong forms: a chain of cause and effect



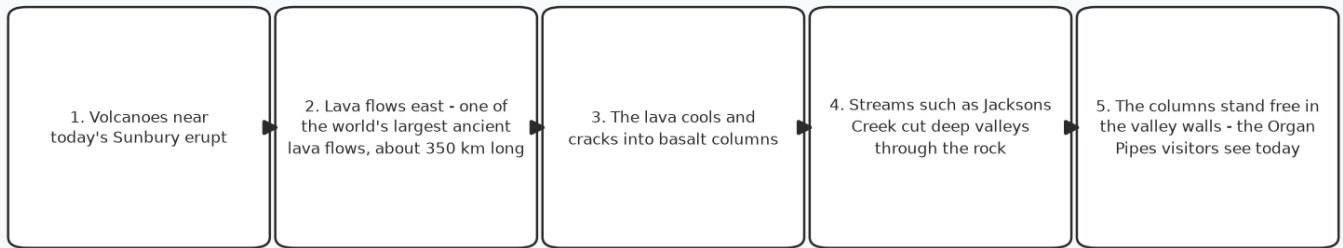
This chain runs over decades to centuries - and it is still running today.

A five-panel labelled sequence showing how a billabong forms on a river like the Murray: a river bends, fast water on the outside of the bend erodes the bank while slow water on the inside drops sand and silt, the bend grows and the neck of land narrows, flood water cuts through the neck and leaves the old bend as a still billabong, and the billabong slowly fills with mud

The landform you can visit today — the billabong — is the second-last stage of that chain. The chain is still running: the river is still bending, and the billabong is still slowly filling with mud. In places such as the Barmah–Millewa reach, the same patient work of erosion and deposition has built natural banks called levees, narrows known as chokes, and a tangle of small channels that spread flood water across the forest (you will meet the Barmah Choke in the worked demonstration below).

A slow chain: how the Organ Pipes formed. The Organ Pipes National Park sits beside the Calder Freeway about 20 km north-west of Melbourne, near Keilor North. Its best-known feature is a set of tall basalt columns that stand side by side like the pipes of a church organ. Parks Victoria describes them as basalt columns “formed by the cooling and cracking of molten lava”, and the chain behind them ran for a very long time:

How the Organ Pipes formed: a chain a million years long



The whole chain took about a million years.

Story built from Parks Victoria, Organ Pipes National Park (parks.vic.gov.au). Retrieved 25 August 2026.

A five-step labelled sequence showing how the Organ Pipes formed: volcanoes near today's Sunbury erupt, lava flows east in one of the world's largest ancient flows stretching about 350 km from the edge of Melbourne, the lava cools and cracks into basalt columns, streams such as Jacksons Creek cut deep valleys through the rock, and the columns are left exposed in the valley walls - a chain that took about a million years

Two chains, one logic. Whether the clock runs in decades or in millions of years, landforms are produced by cause-and-effect interconnections — and a geographer who can read the chain can read the landform.

5. The seven concepts, working as one toolkit

This is a concept capstone, so here is the whole toolkit. Each of the seven geographical concepts becomes a question you can aim at any environmental phenomenon. The table applies all seven to the one phenomenon this section keeps returning to — the changing Barmah–Millewa Forest.

Seven concepts, one toolkit: the changing Barmah-Millewa Forest

Concept	The question it asks	The answer for this forest
Place	What makes this place what it is?	The largest river red gum forest in Australia, on a wide floodplain beside the River Murray.
Space	Where is it, and how does it sit against the places around it?	It lies across the Victoria-New South Wales border; the river links it to places far up the river and far down the river.
Environment	What living and non-living things make up this place?	River, wetlands, floodplain, river red gums, waterbirds, native fish, turtles, frogs.
Interconnection	How are people, places and environments linked here?	Dams and weirs far up the river changed the flows that the forest depends on.
Change	How is this place changing, and why?	Its flow rhythm changed after the river was regulated; parts of the forest declined, then improved again when water for the environment arrived.
Scale	At what size do the causes and effects run?	From one dam's gates to a floodplain of 66,600 ha.
Sustainability	Can this place keep going for people and wildlife?	Only if the forest keeps getting the flood pulses it needs - which is why the lasting fix is water for the environment.

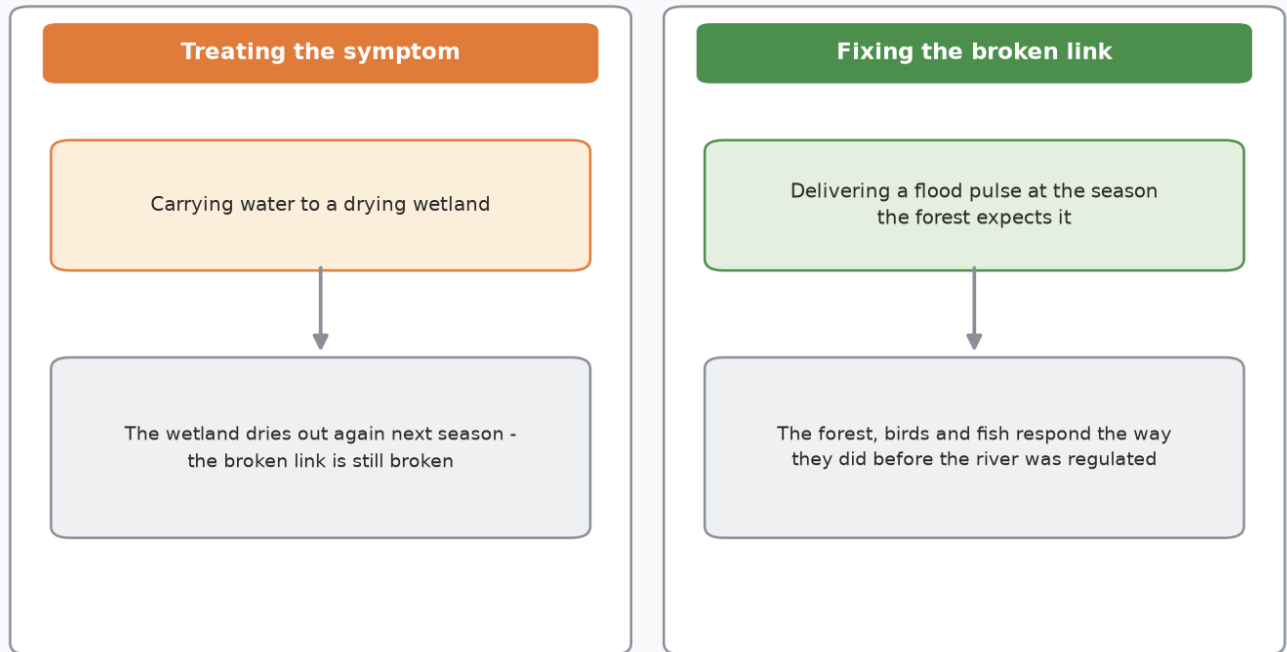
A table applying the seven geographical concepts to one phenomenon, the changing Barmah–Millewa Forest: each row names one concept - place, space, environment, interconnection, change, scale, sustainability - then the question the concept asks, then a worked answer about the forest

When you read or hear about any environmental phenomenon — a flood, a fish kill, a falling cliff, a drying lake — these seven rows are your checklist. A response that uses the concepts in this way is exactly what the band's achievement standard asks for when it expects students to explain how people, places and environments are interconnected, and how those interconnections change places and environments.

6. Why chains change the way places are managed

There is a payoff. If you understand a phenomenon as a chain, you can see where to act — and acting on a chain's weak link is usually cheaper and wiser than acting on its symptoms.

Where in the chain do you act?



Understanding the chain shows where action will last.

A two-column model diagram titled where in the chain do you act: the left column, treating the symptom, gives the example of carting water to a drying wetland, with the outcome that the wetland dries again next season; the right column, fixing the broken link, gives the example of delivering a flood pulse to the wetland at the right season, with the outcome that the forest, birds and fish respond the way they did before the river was regulated

Notice that the right-hand column is not automatically easy or free. River water is scarce, and farms, towns and the environment all need it. Reasonable people disagree about how much water should flow to forests and wetlands, especially in dry years. That makes it a genuine debate, and debates are won with defined terms and evidence, not with heat. Later in this section you will be asked to put each side of that debate in its strongest form and judge the evidence yourself. Marks are awarded for the quality of your reasoning, not for the side you land on.

Worked examples

Worked demonstration 1 (scaffolded) — tracing a real chain: the Barmah–Millewa Forest

Setting. The Barmah–Millewa Forest straddles the River Murray: Barmah Forest on the Victorian side, Millewa Forest on the New South Wales side. The Murray–Darling Basin Authority (MDBA) records that the icon site covers about 66,600 ha, that it supports the largest river red gum forest in Australia, and that it is the largest and mostly unbroken freshwater floodplain system along the Murray. It is protected as a wetland of international importance, and about 54 waterbird species have been recorded breeding there.

The chain, step by step.

Link	What happens	Source of the fact
1	Hume Dam, on the Murray far up-river from the forest, was officially opened on 21 November 1936 after 17 years of building. Yarrawonga Weir — a low wall built across the river to raise its level — sits between the towns of Yarrawonga (Vic.) and Mulwala (NSW) and is the largest of	MDBA, <i>Hume Dam</i> ; MDBA, <i>Yarrawonga Weir</i>

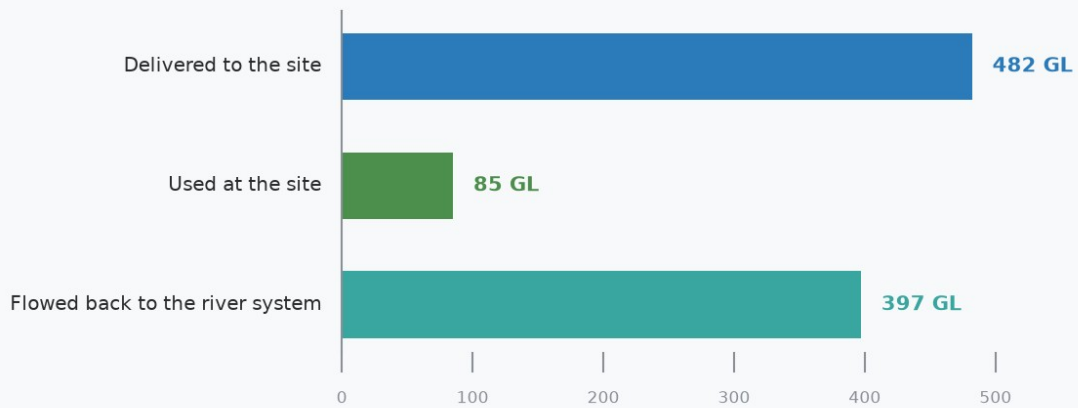
Link	What happens	Source of the fact
	the 14 weirs on the Murray below Hume.	
2	Storing water and releasing it when people need it changed the river's natural rhythm. The MDBA writes that seasonal flow patterns "have altered significantly": winter–spring flows decreased and summer–autumn flows increased.	MDBA, <i>Yarrawonga Weir</i>
3	River red gums need periodic flooding — "the trees need periods of flooding", Parks Victoria notes — but under regulation the forest is flooded more often at times of year when it would normally stay dry.	Parks Victoria, <i>Barmah National Park</i> ; MDBA, <i>Yarrawonga Weir</i>
4	Over decades the changed rhythm shows up across the system. The MDBA lists problems that follow reduced natural flows, including the loss of vegetation such as river red gums and grasses, on which animals depend for food and shelter. In some places, up to 50% of the water is taken for home, industry and farm use.	MDBA, <i>Water for the environment</i>
5	In very dry times the pressure builds further. During the Millennium Drought (roughly 1997–2009), three small native fish — the southern purple-spotted gudgeon, the olive perchlet and the southern pygmy perch — died out locally in the forest's wetlands.	MDBA, <i>Barmah–Millewa Forest Report Card 2023–24</i>

Label the three shifts.

Shift	Where it appears in this chain
Time	The dam opened in 1936; the forest's decline built up over the decades that followed. Causes in one generation, effects over many.
Place	The dam and the weir sit far up the river; the forest that feels them lies many hundreds of kilometres downstream.
Scale	Decisions made at one set of dam gates show up across a 66,600 ha floodplain — and a basin-wide drought can come to rest on one wetland.

The response: understanding the chain points to the fix. Because the missing piece is the flood pulse itself, the main response is **water for the environment** — water set aside and delivered to rivers, wetlands and floodplains to repair what regulation broke. At Barmah–Millewa in 2023–24, 482 GL of water for the environment was delivered to the site (one gigalitre, GL, is one thousand million litres); 85 GL was used at the site, and 397 GL flowed back to the river system.

Water for the environment at Barmah-Millewa Forest, 2023-24



One gigalitre (GL) is one thousand million litres.

Data: Murray-Darling Basin Authority, Barmah-Millewa Forest Report Card 2023-24. Retrieved 25 August 2026.

A horizontal bar chart of water for the environment at Barmah–Millewa Forest in 2023-24: 482 GL delivered to the site, 85 GL used at the site, and 397 GL flowed back to the river system. One gigalitre is one thousand million litres. Data source: MDBA Barmah-Millewa Forest Report Card 2023-24, retrieved 25 August 2026

Did it work? Each year the MDBA scores the site's response in a report card. The 2023–24 card gave an overall score of A:

Barmah-Millewa Forest Report Card 2023-24

Part of the system	Grade	What happened
Overall	A	the health of the forest improved
Vegetation	A	wetland plants recovered after the 2022-23 floods
Waterbirds	A	breeding at five wetlands; 83 woodland bird species counted, the most in 25 years of monitoring
Fish	B	native fish spawned, but few young of those species were detected
Other	B	mixed results for turtles; all six expected frog species found; only 17 Murray crayfish counted

Grades: A = excellent, B = good.

Data: Murray-Darling Basin Authority, Barmah-Millewa Forest Report Card 2023-24. Retrieved 25 August 2026.

A table of the Barmah–Millewa Forest Report Card 2023-24 scores: overall A, vegetation A, waterbirds A, fish B, other B, with one outcome per row - wetland plants recovering after the 2022-23 floods, breeding at five wetlands and the highest woodland bird count in 25 years of monitoring, native fish spawning but with few young of those species detected, and mixed results for turtles with only 17 Murray crayfish counted. Data source: MDBA Barmah-Millewa Forest Report Card 2023-24, retrieved 25 August 2026

Conclusion. One change — regulating the river — travelled to a different time (decades), a different place (hundreds of km downstream) and a different scale (a 66,600 ha floodplain). The response that works is the one aimed at the broken link (the missing flood pulse), not at the symptom. That is what it means, in practice, to understand an environmental phenomenon through interconnection and change.

Worked demonstration 2 (scaffolded) — reading a slow chain: the Organ Pipes

Task. Write the story of the Organ Pipes as a cause-and-effect chain and name the kind of process at each step.

Step in the chain	What happens	What kind of process?
1	Volcanoes near today's Sunbury erupt and pour out huge quantities of molten lava.	Volcanism — new rock is made (3C).
2	The lava flows east. It forms one of the world's largest ancient lava flows, stretching about 350 km from the edge of Melbourne.	Movement of the lava across the land.
3	The lava cools and cracks, forming the basalt columns of the Organ Pipes. Parks Victoria dates the rock at about a million years old.	Cooling and cracking of the rock.
4	Over a very long time, streams such as Jacksons Creek cut deep valleys through the rock.	Erosion by moving water (3C).
5	The columns are left exposed in the valley walls, where visitors can see	The landform is revealed — the chain's present stage.



Conclusion. The Organ Pipes look like a fixed object, but they are a stage in a chain: volcanism built the rock, and erosion uncovered it. Remove either half of the chain and there is nothing to visit — no eruption, no columns; no creek cutting down, and the columns would still be buried. A landform is a verb, written slowly.

Practice questions

Scaffolded

- Q1.** In your own words, write the working definitions this section gives for: (a) environmental phenomenon; (b) interconnection; (c) environmental system; (d) feedback.
- Q2.** Using the system diagram of the Barmah–Millewa Forest: (a) copy two of the labelled links; (b) add one link of your own between any two boxes; (c) predict two things that would happen in the forest if the “flood water feeds the forest” link were cut for many years.
- Q3.** For each effect below, say whether it arrives at (i) a different time, (ii) a different place, or (iii) a different scale from its cause — some effects show more than one shift: (a) a wetland dries out years after a dam is built higher up the river; (b) mud washed off cleared farmland smothers a sand bar many km downstream; (c) the gates of one dam change flooding across a 66,600 ha floodplain; (d) birds that breed in the forest spend their non-breeding season in lands far to the north.
- Q4.** Using the feedback figure: (a) which loop is the reinforcing feedback, and which is the balancing feedback? (b) the reinforcing loop is drawn with three steps; add a fourth step of your own that keeps the loop growing; (c) name a balancing loop you have seen for yourself — in a creek, a beach, a garden or a park — and describe it in one sentence.
- Q5.** Using the billabong sequence figure: (a) put these in order: billabong, bend grows and neck narrows, river bends, flood cuts the neck, erosion and deposition at the bend; (b) on a bend, which side is eroded and which side has sand and silt dropped on it? (c) why does a billabong slowly fill with mud over time?
- Q6.** Using the Barmah–Millewa report card figure: (a) which parts of the system scored A in 2023–24, and which scored B? (b) how much water for the environment was delivered to the site in 2023–24, and how much of it was used at the site? (c) give one outcome listed for waterbirds and one for fish; (d) suggest one reason why water that is delivered to the forest might flow back to the river system.
- Q7.** Using the seven-concepts table, choose the concept (place, space, environment, interconnection, change, scale or sustainability) that best fits each question about the Barmah–Millewa Forest: (a) Where does the forest sit, and what makes it different from other places on the river? (b) How does a decision made at Hume Dam end up changing the forest? (c) The same river works at the scale of one bend and at the scale of a whole basin. (d) Should the forest’s water needs count in dry years, so the forest is still there for people and wildlife in the future?

Un scaffolded

- Q8.** Choose one of these phenomena: a beach loses much of its sand in one big storm; a creek below a cleared hillside turns muddy and stays muddy; a sea stack collapses onto the shore. Write its story as a cause-and-effect chain of at least four steps, and name one time shift, one place shift and one scale shift inside it.
- Q9.** The Organ Pipes chain ends with Jacksons Creek cutting the columns free. Imagine the creek had never cut down. In two or three sentences, explain what a visitor would (or would not) see today, and why erosion is part of what makes this landform visible.
- Q10.** “In dry years, all the river’s water should go to farms and towns. The environment can wait.” Put that view in its strongest form, then put the opposing view in its strongest form. Use evidence from this section (for example, the report card results, the fish that died out locally during the Millennium Drought, and what the MDBA says about reduced natural flows) to say what evidence supports each view. Marks are for the quality of your reasoning and your use of evidence — not for which side you land on.

Q11. *“Fixing only the part you can see rarely works.”* Use the Barmah–Millewa chain to explain why a geographer who traces connections would agree with this claim. In your answer, name one way of treating the symptom and one way of fixing the broken link, and say why the second has a better chance of lasting.

Extended response — evidence-based written task

Q12. *Explain how tracing interconnection and change helps you make sense of an environmental phenomenon.*

Write about one page. Your response must:

- use **two** case studies from this section — the Barmah–Millewa Forest, and one landform chain (the billabong sequence or the Organ Pipes);
- trace each case as a cause-and-effect chain of at least three steps;
- name and apply all three shifts (a different time, a different place, a different scale) across your answer;
- use at least four of the seven geographical concepts as part of your explanation (for example, organise one paragraph around interconnection and one around change, and bring in scale and sustainability where they fit);
- refer to at least one source from the source list at the end of this section (for example, the MDBA report card or the Parks Victoria pages).

Success checklist: terms defined; chains traced step by step; all three shifts named; at least four concepts used; at least one source referred to; a closing sentence that states what the two case studies have in common.

Answers

Q1. (a) Something that happens in the environment that we can observe and then try to explain. (b) The links between people, places and environments, so that what happens in one place can shape what happens in another. (c) An environment thought of as a set of connected parts: rock and soil, water, air and climate, plants and animals, and people. (d) A loop in which the effects of a change circle back and act on the change itself — either pushing it further (reinforcing) or steadying it (balancing).

Q2. (a) Any two of the drawn links, e.g. “flood water feeds the forest”, “farms and towns take water from the river”. (b) Any sensible link, e.g. “birds carry seeds between wetlands”, “dry years lower the river’s flows”. (c) Any two of: trees stress and die back; wetlands dry out; waterbirds lose breeding sites; fish lose nursery water; the forest’s animals lose food and shelter.

Q3. (a) Time (and place, if the dam is named as far away). (b) Place (and time, if the mud arrives after the clearing). (c) Scale (and place). (d) Place.

Q4. (a) The creek loop is reinforcing; the wetland loop is balancing. (b) Any step that keeps the loop growing, e.g. “with no plants to hold the banks, the creek widens and more banks crumble”. (c) Any real, described balancing loop, e.g. “after rain fills the dam behind our farm, the creek keeps flowing in the dry weeks because the dam releases water slowly”.

Q5. (a) River bends → erosion and deposition at the bend → bend grows and neck narrows → flood cuts the neck → billabong. (b) The outside of the bend is eroded; the inside has sand and silt dropped on it. (c) Muds and silts settle in its still water, and its banks crumble in, so it fills from the edges and the bottom.

Q6. (a) Overall A: vegetation A, waterbirds A; fish B, other B. (b) 482 GL delivered; 85 GL used at the site. (c) Waterbirds: breeding was recorded at five wetlands (or: 83 woodland bird species were counted, the most in 25 years of monitoring). Fish: Murray cod, golden perch and silver perch all spawned, but few young of those species were detected. (d) The forest is flat and the water table is high, so water that is not held in wetlands drains back to the river; also, some of the delivered water is only passing through on its way down the system.

Q7. (a) Place. (b) Interconnection (with change). (c) Scale. (d) Sustainability (with environment also defensible if argued from the forest’s own needs).

Q8–Q11. See the fully-worked solutions for what a good answer contains.

Q12. Marked against the success checklist.

Fully-worked solutions

Q8. Model answer (muddy creek): (1) A hillside above the creek is cleared of plants; (2) rain now hits bare soil, and the soil washes downhill; (3) the creek runs muddy, and mud settles on the sand bar where turtles used to nest; (4) with the nesting sand smothered, fewer turtles hatch the next season. Time shift: the clearing and the turtle decline are a year or more apart. Place shift: the clearing is on the hillside; the smothering happens downstream. Scale shift: one cleared slope changes a whole stretch of creek. Any genuine four-step chain with the three shifts named earns full marks.

Q9. Model answer: Without the creek cutting down, the basalt columns would still be buried under the lava flow they formed in. The pipes are only visible because Jacksons Creek spent a very long time eroding a valley through the rock, cutting the columns free in the valley walls. So the landform visitors see is the product of two chains — volcanism building the rock and erosion uncovering it — and without the second chain there would be nothing to see.

Q10. Strongest form of the first view: in a dry year there is not enough water for everything, and food, jobs and towns’ drinking water depend on the river right now; a forest can survive a skipped season in a way a farm or a town cannot. Strongest form of the opposing view: the forest is not separate from the river’s usefulness — it depends on the same flows, and skipping the environment has already been shown to cost real things: during the Millennium Drought three small native fish died out locally in the forest’s wetlands, and the MDBA lists loss of river red gums and grasses among the results of reduced natural flows; the 2023–24 report card shows that when water for the environment is

delivered, breeding and recovery follow (overall score A). Evidence therefore supports the second view that the environment cannot simply “wait” without losses that are hard to undo; but the first view correctly says that in dry years the amounts must be balanced, not ignored. Marks are for the two views each in strongest form and for the evidence used — not for the side reached.

Q11. Model answer: The visible part of the Barmah–Millewa story is a stressed forest; the invisible part is the changed flow that stresses it. Treating the symptom — say, carting water to one drying wetland or planting seedlings by hand — may help that spot for a season, but the river’s rhythm stays broken, so the stress returns. Fixing the broken link — delivering a flood pulse of the right size at the right season, as water for the environment does — works on the cause: in 2023–24, after wet years and delivered water, the report card scored the site A overall, with waterbird breeding at five wetlands and river red gum food plants spreading. A geographer who traces chains expects the symptom fix to fade and the link fix to last, because only the link fix changes the system that produces the symptom.

Q12. Model structure: Paragraph 1 defines the terms (environmental phenomenon, interconnection, change, environmental system, the three shifts). Paragraph 2 traces the Barmah–Millewa chain (regulation → changed flow rhythm → forest stress → local losses), names its time, place and scale shifts, and points to the report card evidence for the response. Paragraph 3 traces one landform chain (for example, meander growth → neck cut-off → billabong, or eruption → flow → cooling and cracking → exposure by erosion) and notes its own shifts. Paragraph 4 organises the two cases by the concepts — interconnection (links between dam and forest, between volcano and valley), change (over decades, over a million years), scale (one set of gates to a 66,600 ha floodplain) and sustainability (why the flood pulse is the lasting fix). Closing sentence: both cases are only understood as chains of connected changes whose effects arrive later, somewhere else and at another scale — which is exactly what VC2HG8K17 asks us to show.

Sources used in this section

- VCAA, *Victorian Curriculum F–10 Version 2.0*, Geography, Levels 7 and 8 — VC2HG8K17 and its elaborations, via the VCAA export of 2026-07-29.
 - Murray–Darling Basin Authority (MDBA), *Barmah–Millewa Forest Report Card 2023–24* (mdba.gov.au) — the 2023–24 scores and outcomes; the 482 GL delivered, 85 GL used and 397 GL returned; the fish that died out locally during the Millennium Drought. Retrieved 2026-08-25.
 - MDBA, *Barmah–Millewa Forest icon site* (mdba.gov.au), last updated 2023-11-30 — the 66,600 ha area; the largest river red gum forest in Australia; the largest and mostly unbroken freshwater floodplain system on the Murray; its listing as a wetland of international importance; about 54 breeding waterbird species; the Barmah Choke and its channels. Retrieved 2026-08-25.
 - MDBA, *Water for the environment* (mdba.gov.au), last updated 2025-04-29 — the changed flow rhythm; problems following reduced natural flows, including loss of river red gums and grasses; water use of up to 50% in some places. Retrieved 2026-08-25.
 - MDBA, *Yarrawonga Weir* (mdba.gov.au) — the weir’s purpose and location; the largest of the 14 weirs below Hume; the statement that regulation decreased winter–spring flows and increased summer–autumn flows, flooding the forest more often in normally dry times. Retrieved 2026-08-25.
 - MDBA, *Hume Dam* (mdba.gov.au) — 17 years of building; first filled in December 1934; officially opened 21 November 1936. Retrieved 2026-08-25.
 - Parks Victoria, *Barmah National Park* (parks.vic.gov.au) — river red gums line the Murray; the trees need periods of flooding and can sit in water for months; the park protects 38 rare or threatened plants. Retrieved 2026-08-25.
 - Parks Victoria, *Organ Pipes National Park* (parks.vic.gov.au) — basalt columns formed by the cooling and cracking of molten lava, about a million years ago; one of the world’s largest ancient lava flows, about 350 km long from the edge of Melbourne; volcanoes near today’s Sunbury; Jacksons Creek cutting the valley; Rosette Rock. Retrieved 2026-08-25.
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Teaching sequence (teacher note — not student-facing)

1. **Terms and the system view (1 lesson).** Open on the system diagram: “which part of this forest depends on which other part?” Settle the five definition boxes, especially the contested-term definition of *phenomenon*

(the curriculum leaves it undefined; the section states its working definition per house rules). Introduce the capstone framing: 2E used the concepts on liveability, 4E will use them on urbanisation, this section uses them on environmental phenomena.

2. **The engine: shifts and feedbacks (1 lesson).** The three shifts and the geographer's three questions; the two feedback loops. Q1–Q4. Do not rush the feedback idea — it is the Level 8 depth beyond a simple chain, and it recurs in the extension questions.
3. **The chains (1–2 lessons).** Worked demonstration 1 (Barmah–Millewa) with the three data figures; worked demonstration 2 (the Organ Pipes). Q5–Q7. Keep the “where in the chain do you act?” model for the end of this block: it is the bridge from understanding to the achievement standard's strategy language.
4. **The capstone (1 lesson).** The seven-concepts table applied aloud to one fresh phenomenon chosen by the class (for example, a storm-damaged beach near the school). Q10 as a structured debate (each side in strongest form; marks for reasoning, not conclusion — the house contested-terms rules apply). Q12 as the assessed written response: it is the band standard's expectation — that students explain how people, places and environments are interconnected, and how those interconnections change places and environments — made visible.

Links: first concept capstone is 2E; third is 4E; 6A returns to concept-organised conclusions and ethical values. The skills CDs are *not* taught here (D11) — this section supplies the knowledge the skills sections draw on. **§2A:** no exclusions apply to VC2HG8K17; no First Nations material is used or required. **Coverage keys:** VC2HG8K17.E01, VC2HG8K17.E02.