Aoraki/Mount Cook National Park

AORAKI/MOUNT COOK EDUCATION RESOURCE 2009

Department of Conservation
Te Papa Atawhai

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Aoraki the mountain

Waitaki the river

Te Wai Pounamu the land

Ngāi Tahu the people.

Carving in Aoraki/Mount Cook Visitor Centre

The story of Aoraki

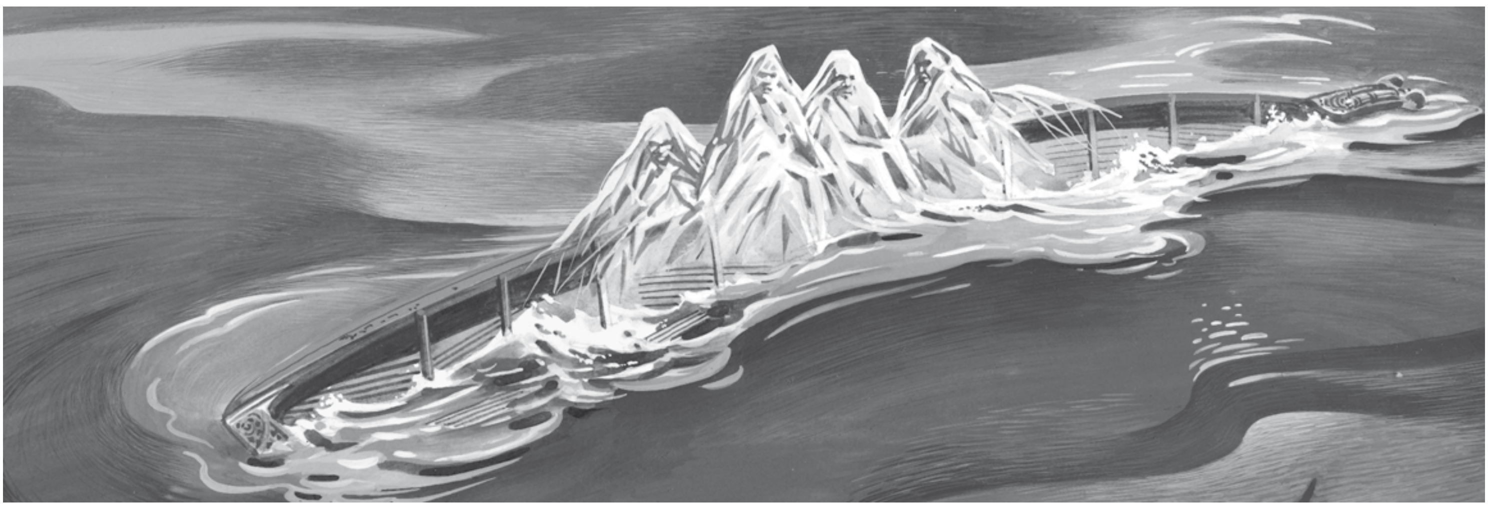
Legend has it that in early times there was no Te Wai Pounamu or Aotearoa. No sign of land existed – just ocean.

Raki (the Sky Father) named Papa-tūā-nuku (the Earth Mother). Some of the sky children came down to meet their father's new wife.

Amongst the visitors were four sons of Raki called Ao-raki (cloud in the sky), Raki-roa (Long Raki), Raki-rua (Raku the second) and Raraki-Roa (long unbroken line). They travelled in a canoe around Papa-tua-nuku who was a huge continent known as Hawaiki.

After greeting their new mother, they set off, keen to explore for new land. However, it eluded them and they decided to return to their celestial home, but the karakia (incantation/prayer) which should have lifted the waka (canoe) back to the heavens, failed and the waka fell back into the sea on its side, turning to stone and earth in the Tahu descent.

Aoraki is a tapu or sacred mountain, and is therefore respected. Its supreme status transcends all other protected natural areas. It is linked to creation and the nature of reality and meaningful life.



Even the melt-waters from Aoraki are sacred, and the mountain mist is the cloak of Aoraki, which denotes his power and influence that is beyond mortals. It symbolises his mana and indicates whether or not Aoraki wants to be 'on show'.

The **Tōpuni** concept extends over the national park, that is, it extends an overlay of Ngāi Tahu values over the park. It is a very public symbol of Ngāi Tahu's mana and rangatiratanga, and a symbol of their commitment to conserving values and taking part in the management of the park.

Kia tuohu koutou, Me he maunga teitei, ko Aoraki anake.

If you must bow your head, then let it be to the lofty mountain, Aoraki.

Tōpuni (dog skin cloak) – Canterbury Museum

This resource

Aoraki/Mount Cook National Park is a wonderful place to explore the rugged and awe-inspiring beauty of the glaciated environment. People have come to Aoraki/Mount Cook from early times, drawn by the majesty of the mountains – a reverence for them or a desire to explore or conquer them. This resource booklet supports an NCEA assessment and aims to provide information that will help you to understand this environment more fully. The resource is in three parts:

Section A: Glaciation

Section B: Climate and ecology

Section C: Tourism and human impacts

Te Wāhipounamu – *South West New Zealand* **World Heritage Area** in the south west of New Zealand is one the great natural areas of the world. It is internationally recognised as a UNESCO World Heritage site. Known to the original Māori inhabitants as Te Wāi Pounamu – the greenstone waters – the 2.6-million-hectare site encompasses Westland/Tai Poutini, Aoraki/Mount Cook, Mount Aspiring/Tititea and Fiordland national parks and covers almost 10% of New Zealand's total land area.

Aoraki/Mt Cook

Photo: M Cuddihy

Section A – The glaciated environment of Aoraki/Mount Cook National Park

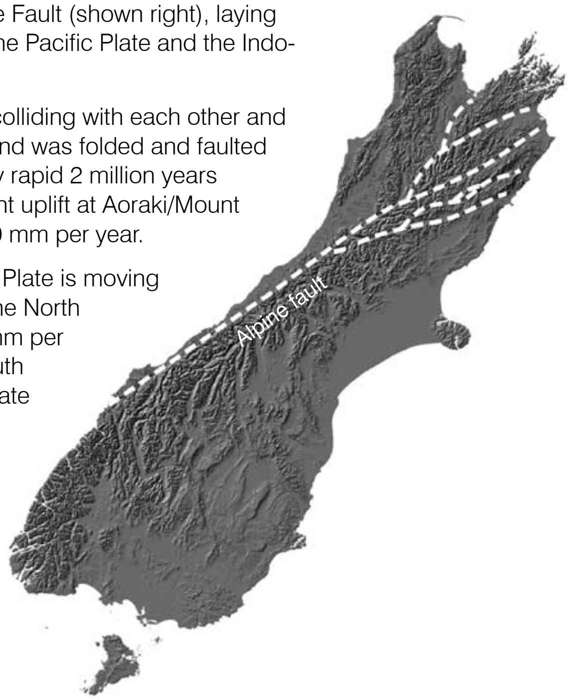
Geology

New Zealand was originally part of the large supercontinent known as Gondwanaland, where New Zealand was side by side with Australia, Antarctica, Africa and India. This was New Zealand – but not as we know it. It was the oldest part of New Zealand – the West Coast of the South Island from Fiordland to Nelson.

The rest of New Zealand started its formation about 200 million years ago when the sediments destined to become the Southern Alps/Kā Tiritiri o te Moana were slowly being eroded and deposited in large layers of sand and silt under the sea. As Gondwanaland started to move, intense heat and pressure changed and lifted the sedimentary sandstones into metamorphic rocks called schist. 120 million years ago 'ancestral' New Zealand had formed. It was approximately half the size of Australia, and was established with plant and animal life.

However, around 80 million years ago, the earth's convection currents caused Gondwanaland to break up. Although originally still attached to Australia, it eventually separated and created the Tasman Sea, which stopped spreading about 60 million years ago. New Zealand, at this stage, was a series of hilly islands (like present day New Caledonia). Limestone, sandstone and mudstone accumulated in the shallow island seas. While New Zealand is considered an island nation, the islands of New Zealand are recognised as part of the continent Zealandia. This continent stretches from New Caledonia to the subantarctic islands, with 93% of its land mass underwater.

Eventually, about 25 million years ago, the largely undersea New Zealand was split in two, length wise, by the Alpine Fault (shown right), laying New Zealand across two major plates – the Pacific Plate and the Indo-Australian Plate.



As these two plates rotated and moved, colliding with each other and forcing up new land above the sea, the land was folded and faulted upward at various speeds. It became very rapid 2 million years ago during the Kaikoura **Orogeny**. Present uplift at Aoraki/Mount Cook National Park is approximately 5–10 mm per year.

The plates continue to move – the Pacific Plate is moving down under the Indo-Australian Plate in the North Island (subduction zone) at a rate of 50 mm per year and this is also happening to the south west of the South Island, but at a slower rate of 30 mm per year. In between (i.e. where Aoraki/Mount Cook National Park is), the Pacific Plate and Indo-Australian Plate are moving past each other along the Alpine Fault at a rate of 45 mm per year. Sudden movement of the plates, as a result of built-up pressure, causes earthquakes.

Evidence of this uplift is apparent in Aoraki/Mount Cook National Park, where sand, mud and silt have been metamorphosed and folded, faulted and fractured into schist, forming the large mountains in the park, e.g. vertical beds of silt and sandstone are evident on Nun's Veil (GR:808201 Aoraki Park Map 273–10 Edition 5, 1999 DOC), (head of Gorilla Stream) on the Liebig Range and beds of sandstone and siltstone layers on the north west side of Aiguilles Gorge. (GR: 902304 Aoraki Park map 273–10.)

It is estimated that approximately 25 kilometres of uplift has occurred in the Aoraki/Mount Cook National Park (compared to 18 kilometres in Arthur's Pass) but erosion has kept pace with it – as fast as they are pushed up, they are worn down by agents of erosion. If it was not for water, wind and ice, in three million years Aoraki/Mt Cook would have been raised to five times its present height – or twice the height of Mt Everest.

Useful words to know . . .

Tōpuni – Tōpuni status confirms the overlay of Ngāi Tahu values on public conservation areas

kaitiaki – guardians

orogeny – a period of mountain building

orogenesis – process of mountain building

cirques – shallow depressions where snow has accumulated

névés – ice fields

firn – loose granules of ice

bergschrund – a deep crevasse created as ice pulls away from bedrock in the cirque or a crevasse at the back of a glacier in a cirque

seracs – towering blocks of ice

ablation zone – an area where annual loss of snow, through melting and evaporation for example, exceeds the annual gain of snow and ice on the surface

till – rock debris carried by a glacier

moraines – rock features made of till

moulin – a sinkhole that starts life as a pothole but increases in size with melt-water

fluvioglacial – landforms moulded by glacial melt-water

rock flour – tiny particles of rock from glacial erosion that become suspended in water making the water cloudy

icefall – a glacier waterfall

outwash plain – formed by sediment deposited by melt-water at the terminus of a glacier

tarn – a mountain lake or pool formed in a cirque made by a glacier

mass budget – accumulation/ablation

Glaciers

Glaciers are rivers of ice and highly effective agents of erosion, producing both small- and large-scale natural phenomena.

Glaciers are highly sensitive to any climatic change and certain criteria must be met for them to form. Within a glacier there are as many spatial variations as there are between a glacier's different advances. Human modification of the glacial processes is minimal.

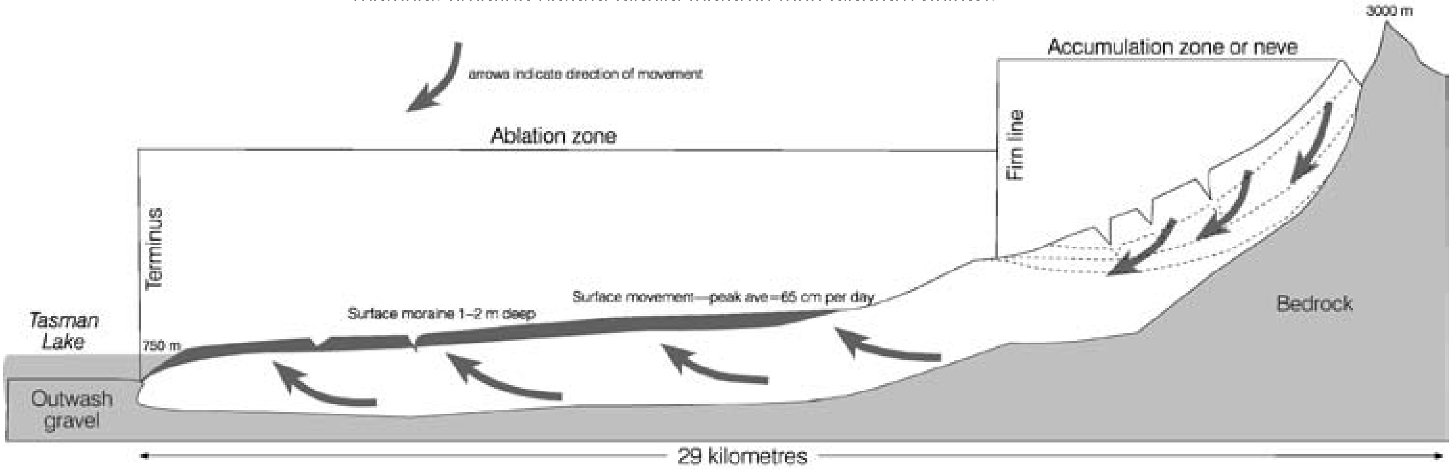
The glacial recipe

The elements that interact to form a glacial system are climate, altitude, relief (topography and orientation), gravity and orogenesis (the process of mountain building). These criteria are all easily met in Aoraki/Mount Cook National Park. Many of the mountains, forced up largely in the Kaikoura Orogeny, are over 3000 metres in height, easily meeting the minimum altitude requirement of 1500 – 2000 metres for a glacier to form at this temperate latitude. Moisture-laden westerlies roll in off the Tasman Sea and are forced to rise over the Main Divide, dumping approximately 8000 mm of rain and snow (see diagram below), and 4070 mm at Aoraki/Mount Cook village.

At Aoraki/Mount Cook village, the average rainfall is about 4000 mm, falling on 160 days a year. As much as 537 mm has fallen on one day and 1447 mm in a single month. The driest period is usually during June, July and August. Snow falls for about 21 days per year – the largest fall was 1200 mm (November 1967).

Aoraki/Mount Cook village's temperature has ranged from 32°C to –13°C, but the average is only 12°C (from 1.6°C in July to 13.6°C in January). Temperatures fall just over 1°C every 200 metres in altitude (interaction). This is called the lapse rate, and is obviously difficult to measure in remote mountainous regions.

About 2 million years ago, the earth began to cool down, signalling the start of the Pleistocene Ice Ages. Snow that had accumulated in **cirques** (shallow depressions) failed to melt over summer and began to accumulate further over winter, creating **névés** (ice fields). Over time, these delicate snowflakes compacted into loose granules of ice (**firn**) and then into hard, blue glacier ice. The glacier then spilled out and began to move down valley, eroding, transporting and depositing material, creating natural glacial features (see diagram below).



Longitudinal cross-section of the Tasman Glacier (a valley glacier) showing how a glacier works

Tasman Glacier facts and figures

27 kilometres long

101 sq. kilometres

Starts at 3000 metres and drops to 750 metres above sea level

Ice depth – 600 metres at maximum, 200 metres at terminus

50 metres of winter and spring snowfall accumulates in the névé, of which seven metres survives the summer melt

New Zealand's largest and longest glacier – highest point Mount Elie de Beaumont, 3117 metres

Hochstetter icefall (above the Tasman Glacier) is actually a hanging glacier, that flows rather than falls into the Tasman

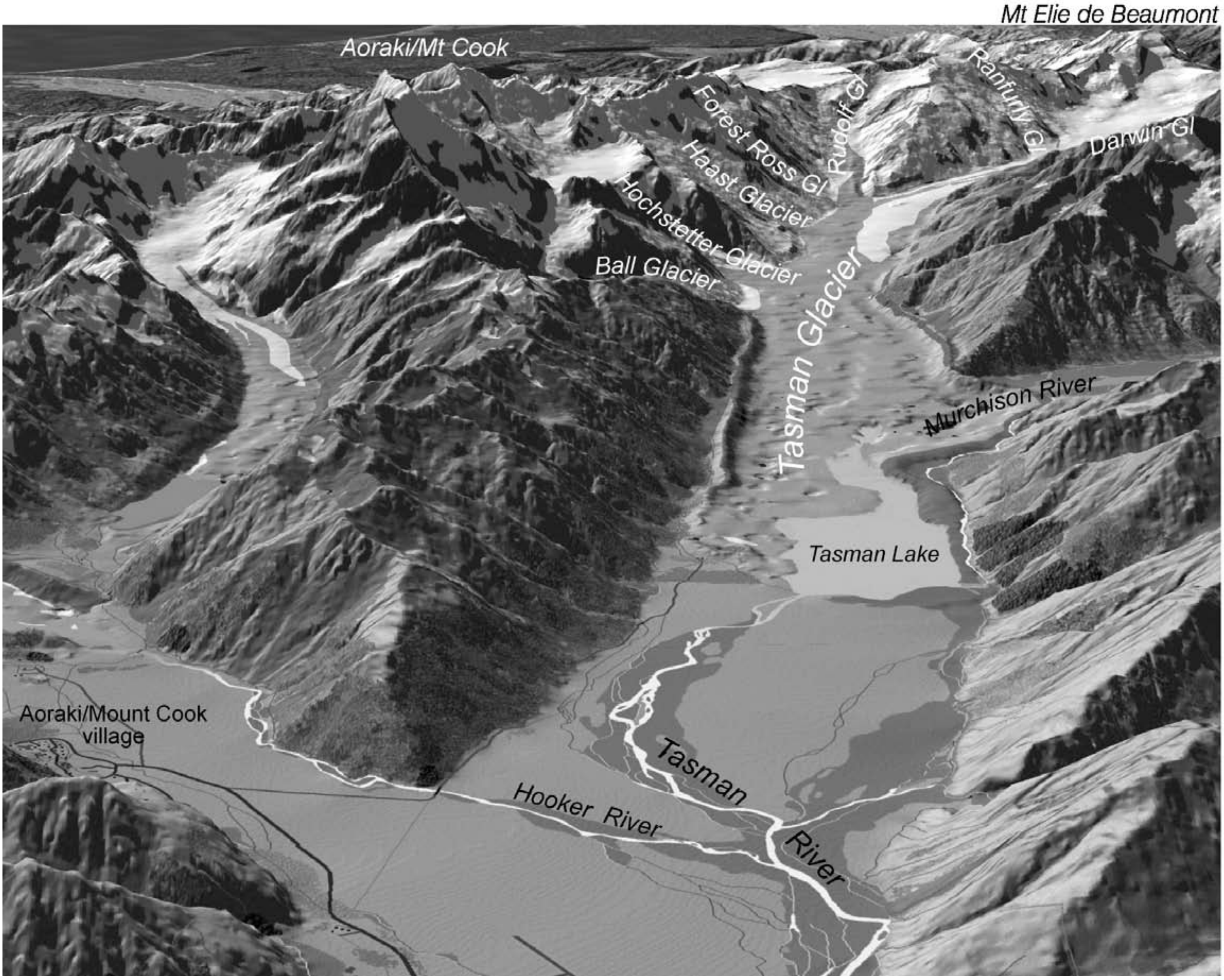
Speed of ice travel

firnline – 200 metres per annum
terminus – 50 metres per annum
icefall – up to 10 metres per day

Past size of the Tasman Glacier

At its largest – extended 85 kilometres down the valley
– 13 kilometres wide
– ice one kilometre deep (Aoraki/Mount Cook village would have sat 650 metres below the glacier's surface)

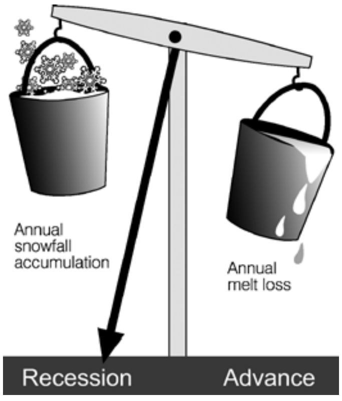
Photo: B Postill



Background model: Geographx

In Aoraki/Mount Cook National Park this change of snow to ice usually occurs within five years, and at less than 20 metres in depth. Compare this to Antarctica where the change can take up to 3000 years and requires a much greater depth. The colour transition of white firn to blue glacier ice is easily seen from Aoraki/Mount Cook village in the ice cliffs of Mt Sefton and on the south face of Aoraki/Mt Cook.

The glaciers advanced and retreated numerous times, with associated earth warming and cooling. The end of the last great ice-age began about 13,000 years ago where vast melt-water lakes formed and larger glacial sheets broke into smaller glaciers. The two main glacial systems were the Godley and the Tasman. As they retreated with earth warming, they separated into the smaller glaciers we are familiar with today. There are approximately 178 separate glaciers in Aoraki/Mount Cook National Park. The advance and retreat cycle of the main eastern glaciers differs from that of the Fox and Franz Josef glaciers on the West Coast. The Tasman Glacier lies in a wide gentle-sloped valley and moves slowly, whereas Fox and Franz Josef are in narrow steep-sided valleys so move quickly. Interestingly, there are also glaciers in the Northern Hemisphere at similar latitude, but the terminals sit at a higher altitude than the glaciers in New Zealand.



In the diagram (left), where annual melt is greater/heavier than annual snowfall accumulated; the glacier will be receding, such as the Tasman Glacier is today.

Shifts in temperature to put us back into another Ice Age are not huge. A 3°C fall in temperature would result in the snowline lowering by 300 metres and would place us at the beginning of another ice age. With predicted ongoing warming, the glaciers will continue to down-waste and the glacial lakes enlarge. This will have implications, as access for climbers will be more difficult and mountain huts could possibly be cut off. A cooling period could mean glacial advance and see Aoraki/Mount Cook village covered in ice!

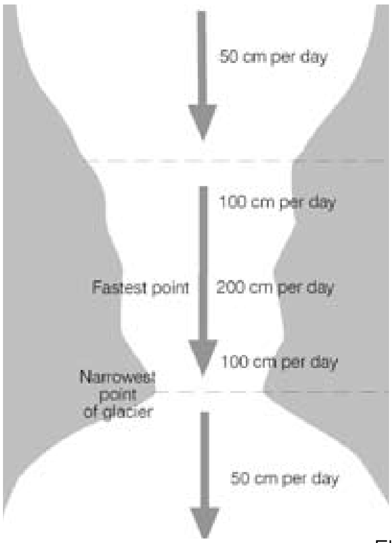
Glacial movement

Glaciers are rivers of ice, but these ice rivers flow down a valley slope about 100,000 times more slowly than water. However, not all parts of a glacier flow at the same speed and there are spatial variations which create glacial features that give us evidence of varying ice melt. Ice flows faster in summer, when there is more melt-water to lubricate the system, than it does in winter.

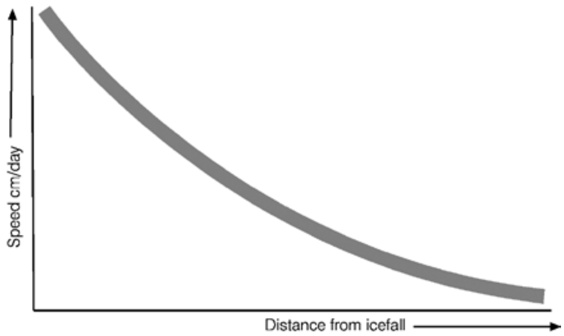
How does a hard, brittle substance like ice, 'flow' like a very viscous fluid? It is complex, involving many tiny changes within millions of ice crystals – a phenomenon called gliding.

Ice skaters move on a film of water, formed under their skates by the pressure of their blade on the ice. The movement of glaciers occurs in much the same fashion. Time is a major factor. For example, a toffee bar can be quickly snapped in two, or bent slowly. Scale is a major factor – a pencil 10 metres long would break if picked up at one end.

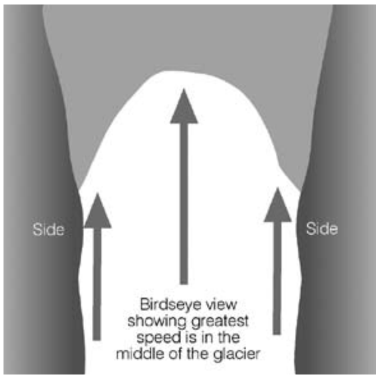
At the head of the glacier, in the cirque, ice pulls away from the bedrock, forming a deep crevasse called a **bergschrund**. Ice then starts to move downhill, sliding over the rock on a film of water, because of the plastic flow within the glacier itself.



Such variations in speed along the longitudinal cross-section of a glacier produce the phenomenon of *extending* and *compressing* flow.



The flow of ice is fastest in an icefall and decreases towards the terminus.



Glaciers move at varying speeds. The centre of the glacier moves faster than the sides.

Flows over steep bedrock drops form the icefalls often accompanied by towering blocks of ice called **seracs**. The Hochstetter Icefall is an example of this.

The direction of ice flow is also varied and is not parallel to the surface. In the névé, ice flows downhill and towards the bedrock. In the **ablation zone**, below the firnline, ice flows from the base of the glacier to the surface, where it maintains its downhill flow to replace ice melted from above.

Some features found on glaciers

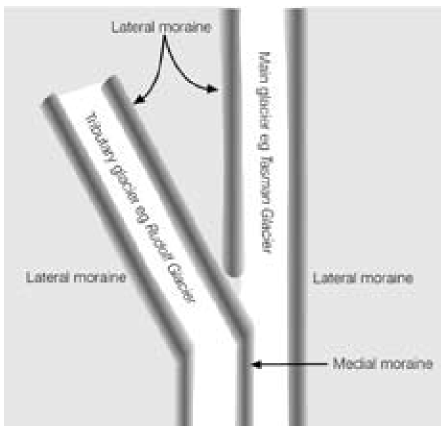
1 Crevasses

Ice flows under pressure, but cracks under tension, creating crevasses. Crevasses form particularly in areas of extending flow, or where the bedrock under the glacier is irregular. Between crevasses, large ice towers can form, called seracs.

Crevasses can be covered over by winter snow and are very dangerous. Usually they are about 70 metres deep and indicate variations in ice flow.

Crevasses can go across a glacier from side to side, called transverse crevasses. Some point 40° upstream, indicating change in speed close to the margin, and are called marginal crevasses. Whereas longitudinal crevasses are found near the terminus and they show that the glacier is spreading sideways, indicating ice loss along its edges. The fourth type of crevasse is the special bergschrund.

Photo: K J Davie



2 Moraine and till

Rock debris carried in some manner is known as **till**. Features made of till are called **moraines**. Moraines are categorised according to their 'place' in the glacier system.

Lateral moraines: are found at the sides of a glacier (left) and the rock and debris usually originate from the rockfalls and avalanches that come from the valley walls. The Tasman Glacier has impressive stranded lateral moraines along Ball Hut Route.

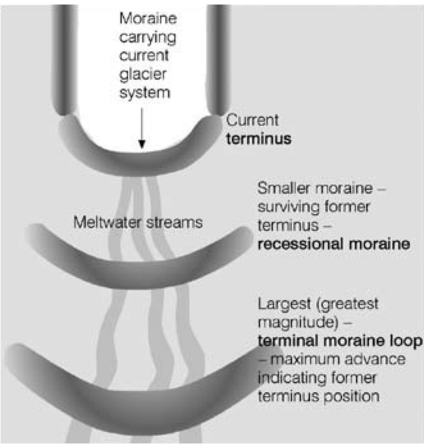
Medial moraines: are formed by coalescing lateral moraines that occur when a tributary glacier flows into the main glacier.

Surface moraines: are evident more at the terminus, where they are exposed, because ice melt is greatest at this point. The surface moraine of the Tasman Glacier is only about 1–2 metres deep, but covers a significant portion of the lower part of the glacier.

Englacial moraine and subglacial moraine: are carried within and under the glacier. The greatest bulk of debris carried by a glacier is in either of these forms.

Terminal moraine: When a glacier's terminus or snout remains at the same place for a long time, the till from the snout forms a curved ridge. Terminal moraines are useful for people who study glaciers because they indicate the glaciers down-valley maximum extent or magnitude. The ridges that remain are called terminal moraine loops. A series of these indicates the glacier is retreating because it hasn't eroded the loops away, as it would if it was advancing.

Firnline and equilibrium line: This is the transition area between the accumulation zone in the névé and melt zones.



Waiho River – the terminal loop moraine from Franz Josef Glacier

Photo: J Taylor

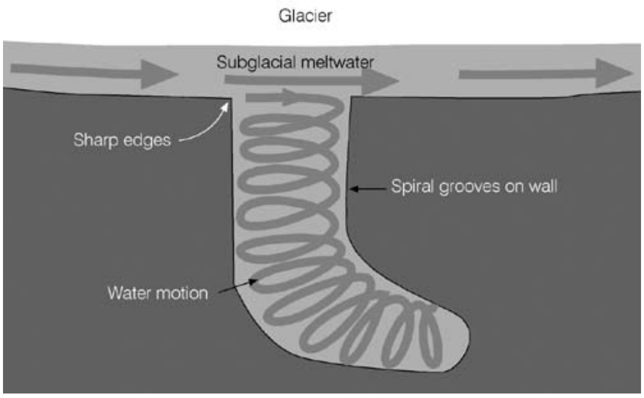
3 Melt-water features

One of the Blue Lakes on true right of Tasman Glacier. These lakes are kettle tarns trapped between lateral moraines.

Near the terminus of the Tasman Glacier the surface is characterised by surface moraine 1–2 metres deep, covering the ablating ice and sinkholes or moulins. Moulins start off as small potholes that eventually deepen to join up with melt-water conduits that form the maze of the glacial plumbing system. On the Tasman, these **moulins** (below right) have expanded into large grey circular lakes.

Eventually these systems find their way to the base of the glacier and out to the terminus where they discharge themselves into the **fluvioglacial** system, usually carrying **rock flour**. The amount of debris discharged is enormous. The present Tasman River is at work on a bed of outwash gravels 500–1000 metres deep. The river constantly shifts its pattern, often across tussock land, filling Lake Pukaki. The Hooker River alone transports 20,000 m^3 of sediment.

Icebergs in Tasman Lake melt-water. Photo: K J Davie



Moulin

4 Icefalls

Icefalls are the waterfalls of glaciers, and indicate great speed of ice. The icefall of the Tasman Glacier – the Hochstetter icefall – is actually above it. Some glaciers contain icefalls within themselves – usually just below the névé.

Erosion transportation and deposition – the three glacial processes

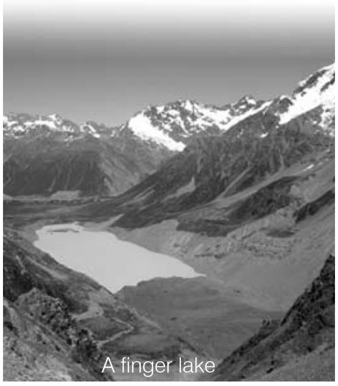
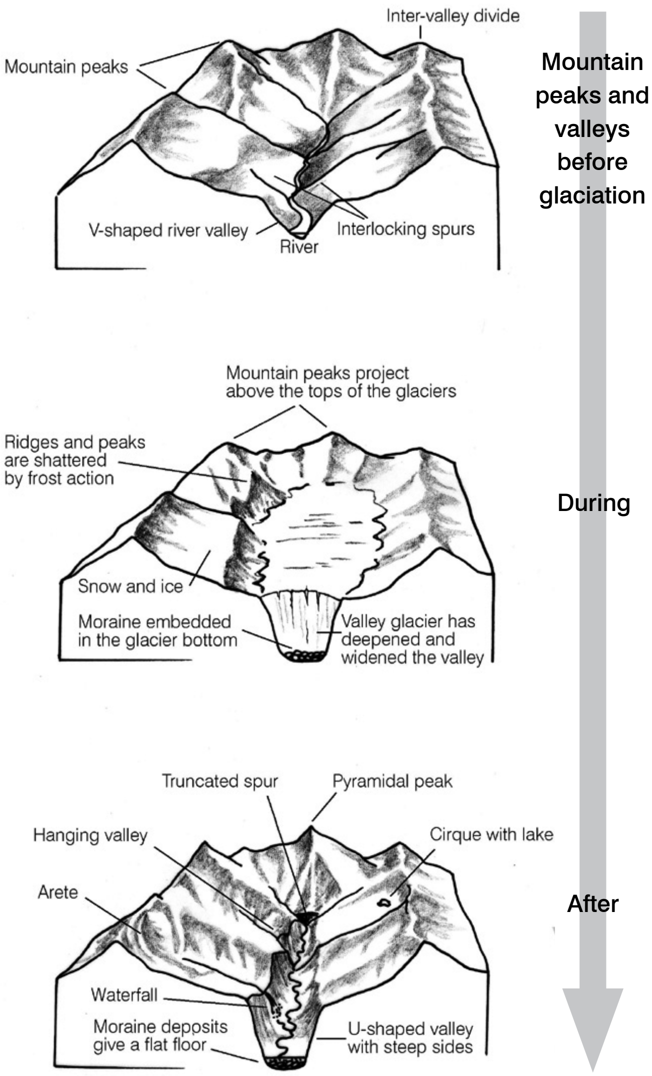


Photo: K J Davie

Erosion

"Glaciers are highly efficient agents of erosion and produce distinctive land forms." (Bishop and Forsyth[1]).

There are two main erosion processes – abrasion and plucking. Most landforms produced are a combination of both of these and fit into two categories – small-scale erosion landforms and large-scale erosion landforms. Of course, much of the work of the ancient glaciers can no longer be seen in the Aoraki/Mount Cook region, as other agents of erosion have been at work as well.



Source: R Burnett, *Physical Geography in Diagrams*

(i) Small-scale features

Striations: scratch marks on the bedrock surface caused by ice-embedded rocks being dragged across them. Marks are parallel to the direction of the movement.

Polished rock: rock is rounded or smoothed by finer rock material in ice.

Potholes: formed by vertical circulation of fast-flowing subglacial streams.

(ii) Large-scale landforms of glacial erosion

U-shaped valleys: these are left behind after the retreat of the glacier and are useful as they give an idea of the glacier's magnitude. The valley floor is often filled with gravels and moraine such as in the Tasman River Valley. Intruding spurs, which are a characteristic of V-shaped river valleys, become truncated in a U–shaped valley. An excellent example of a truncated spur is the lower shoulder of the Sebastopol on the early stages of the Red Tarns track (where the climb is initially very steep). The land completely flattens out at Red Tarns, indicating the height of the glacier that once came out of Black Birch Stream. Often U-Shaped valleys become dammed by terminal moraine loops and fill with water, creating lakes called finger lakes. Lake Pukaki is an example of a finger lake. Eventually finger lakes vanish, as the outwash plains at their heads advance down valley. One day Lakes Tekapo, Pukaki and Ohau will go, just as has happened with the Rakaia and Rangitata.

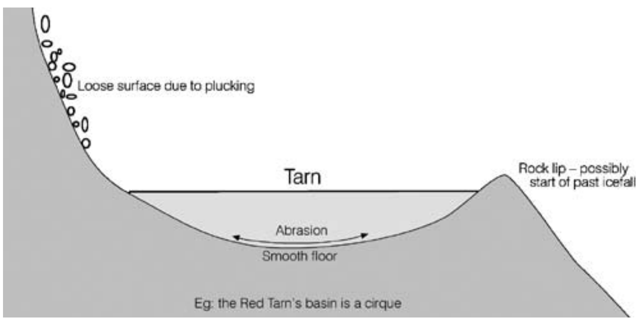
Cirque: (below left) this is a rounded basin that formerly housed the glacier's névé. The cirque often contains a small lake called a tarn.

Roche moutonée: (below right) a roche moutonée is a rock hill shaped by the passage of ice to give a smooth up-ice side and a rough, plucked and cliff-girt surface on the down-ice side. The upstream surface is often marked with striations. An example can be seen at Foliage Hill.

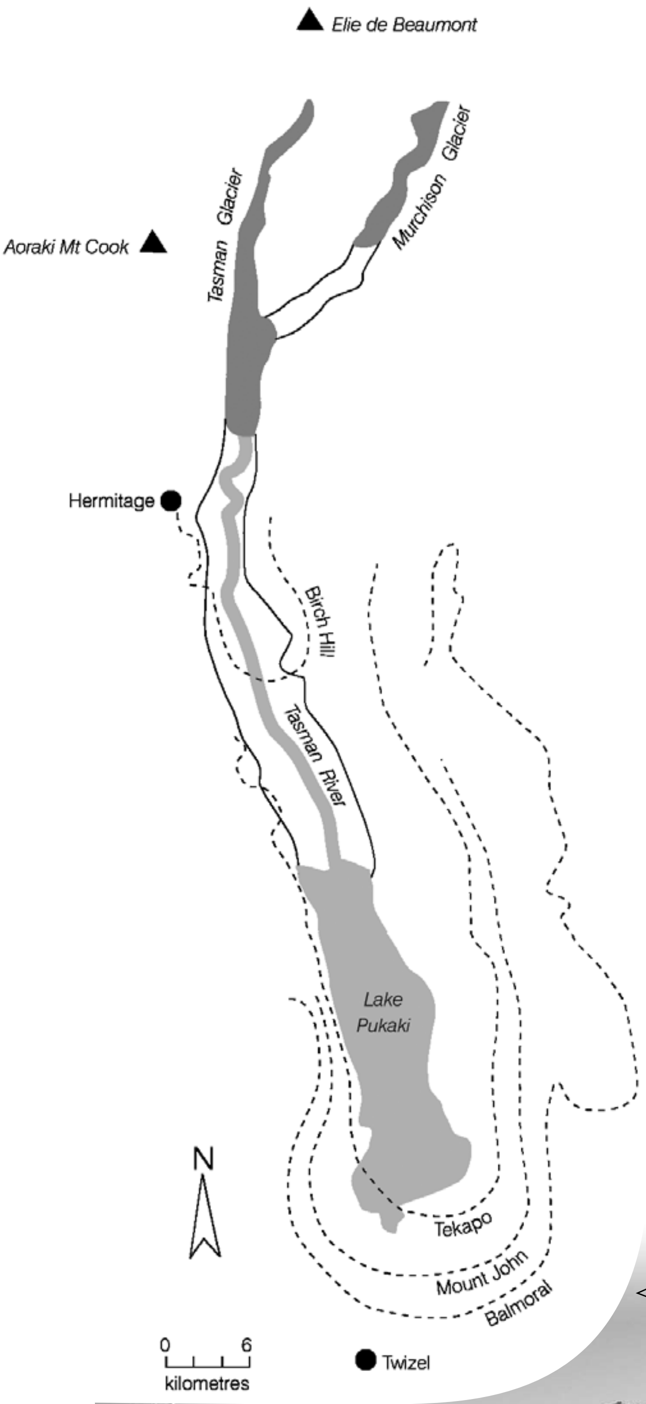
Hanging valleys: valleys of former tributary glaciers that do not cut their valleys as deeply as that of the glacier into which they flow. An example is south of Mt Sebastopol, where Sawyer Stream emerges from a hanging valley.

Arête: a ridge between two cirques. The best example of an arête that can be seen from Aoraki/Mount Cook village is the south ridge of Aoraki.

Col: a pass where two cirques converge. Tuckett Col separates the Tuckett Glacier from the Huddleston Glacier and can be seen from Aoraki/Mount Cook village.



[1]*Vanishing ice, an introduction to glaciers based on the Dart Glacier*, Bishop and Forsyth, 1988



Glacial transportation

A glacier carries material (**glacial drift)** in many different ways and in a range of sizes. Glaciers act as giant conveyors and most of the material they carry is hidden within the ice. The glacier's ability to transport depends on its magnitude. Material found far from the present snout of the Tasman Glacier indicates the magnitude of the glacier 14,000 years ago.

Glacial deposition

Glacial drift is classified according to whether it is stratified or non-stratified and where it is carried within the glacier, e.g. terminal, lateral, subglacial and **englacial moraine**.

Stratified: sorted in layers according to size with the largest at the bottom.

Non-stratified: not sorted in layers.

Melt-water lakes and water are always cloudy. When settled, the water is the most amazing turquoise. The lakes of the Mackenzie display this intense colour, which originates from rock flour.

Some examples of glacial deposition

- **Kame fields and kame terraces** – these are usually made up of moraine and are stratified. They are mostly fine sediment which is more likely to be found in the Fox and Franz Josef valleys.
- **Terminal moraine loops** – a good example is the Franz Josef loop moraine.
- **Lateral moraines** – the Mueller, Hooker and Tasman are good examples.
- **Recessional moraines** – these can be seen at Fox and Franz Josef glaciers.
- **Outwash plains** – these can be seen in the Tasman Valley; the braided river part from the terminal to Lake Pukaki.

Often landforms of past glacial deposition are subjected to further erosion by fluvioglacial systems. Mt Wakefield and screes opposite the Aoraki/Mount Cook village are good examples of the freeze-thaw process.

◁Past advances of Tasman Glacier

Photo: K J Davie

Human modification of the glaciation process

The diagram below outlines the glacial system. This is largely a naturally-occurring process and glaciers are not easily modified by humans. While we can use the natural features they produce, such as kame terraces (and modify this land), human impact on the glacial process itself is not so evident.

The glacier system

INPUTS	PROCESSES	OUTPUTS
climate	glacial	natural features/phenomenon:
orogenesis	erosion	U-shaped valleys
altitude	movement/transport	arêtes, roche moutonées
relief	deposition	fluvioglacial systems, kame terraces

FEEDBACK

Hydrological cycle

However, humans have impacted on the climate element in terms of global warming, which has a direct bearing on a glacier's **mass budget**, (accumulation/ablation), its magnitude and therefore its ability to erode, transport and deposit.

"Glaciers are dynamic, sensitive indicators of small changes in their environment, and there is much they can tell us about the climate, how it is changing, what it used to be and whether the greenhouse effect is real". (Bishop and Forsyth, p.10)

With warming climate change, melt occurs on the trunk (called downwasting) and less snow remains in the névé. When this occurs a glacier's mass budget is affected and ablation exceeds accumulation. The Tasman Glacier seems to be losing 0.5% of its volume per year. Downwasting is evident in the rapid dropping of surface levels at the trunk of the Tasman and also the Hooker and Mueller. Trimlines on the eastern side of Tasman Valley (Mount Cook and Braemar Stations) can be viewed clearly from State Highway 80, and give a good indication of the height of the glacier in the past.

Glacial historian A.P. Harper wrote in 1935, that prior to 1895, ice at the junction of the Ball and Tasman glaciers was up to the top of the lateral moraine at Ball Hut. However, since the turn of the twentieth century, the glacier has slumped at about one metre per year, so that now there is a drop of approximately 100 metres, from the top of the moraine down to the glacier.

Similar evidence is found on the Mueller Glacier. In 1913 the Mueller River flooded the first Hermitage, bursting through the lateral moraines of the Mueller. Evidence of the destruction this caused can be seen in the image opposite. Today, due to surface downwasting of about 100 metres, the melt-water rivers – even in flood – have no chance of breeching the lateral moraine.

The destruction of the first Hermitage, 1913

So while the Tasman's terminus is still pretty much where it was in 1862, it is now considerably lower than it was when explored by Haast. Other glaciers in the park, such as the Godley, Glassen, Mueller and the Stocking glaciers, have retreated up valley.

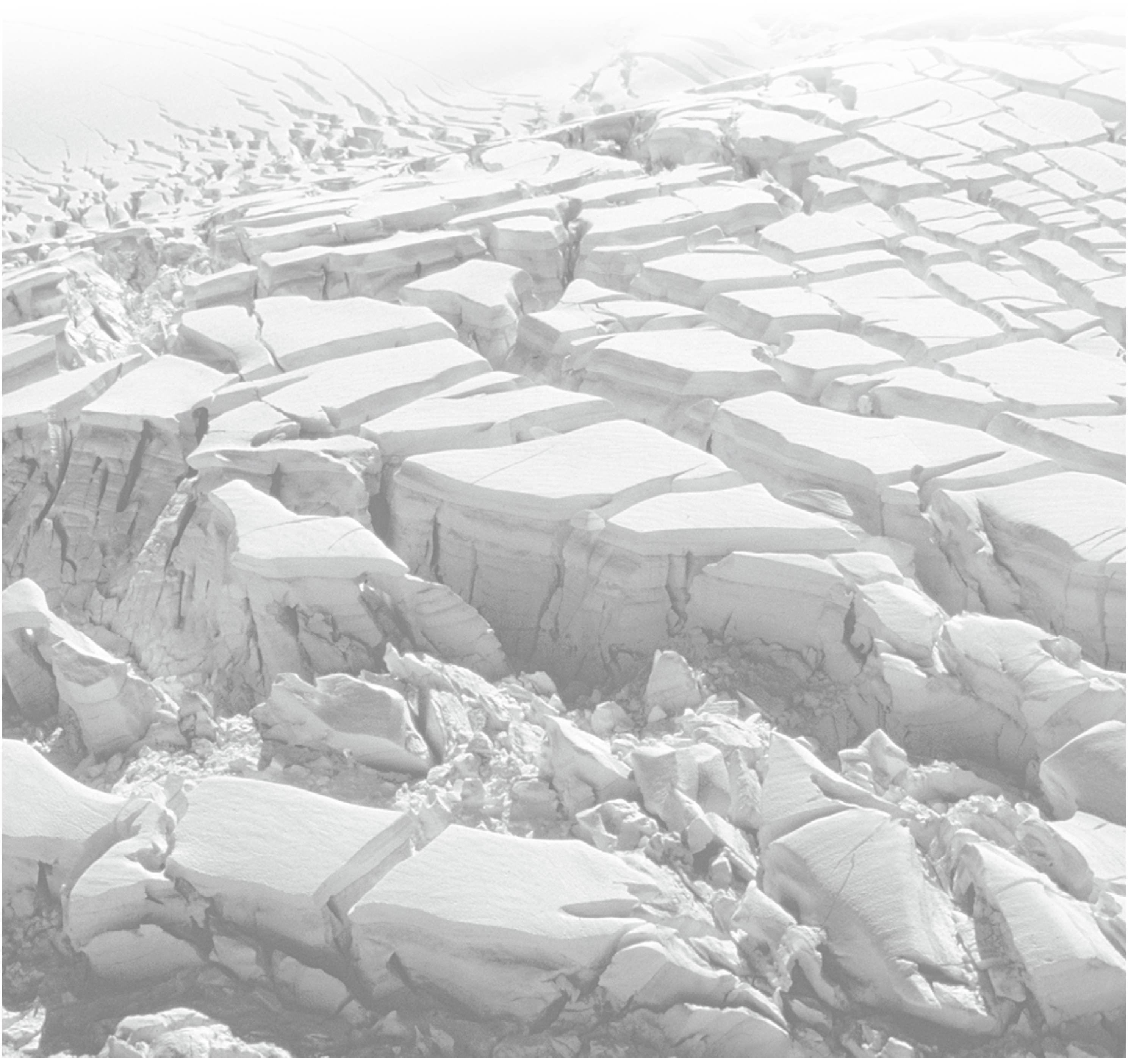
From this information, it would appear that climate change has had a part to play in glacial demise. Long-term climate statistics for the area are scarce, although some studies have suggested that by 2050, average temperatures will have risen by 1–2°C. Others suggest upper end predictions of a 4.5°C increase. There is already evidence that temperatures have risen 0.5°C since 1900 in New Zealand and that the earth is 4°–6°C warmer than during the Ice Ages.

In the 1980s and 1990s a minor advance occurred, particularly in the neighbouring Westland Tai Poutini National Park. After increased snowfalls on the Southern Alps/Kā Tiritiri o te Moana, the Fox and Franz Josef glaciers have advanced significantly, while the Tasman has only thickened slightly in the trunk. This is attributed to the increase in westerly weather-patterns, characterised by El Nino.

So how much do humans modify glaciation processes?

Humans modify the process minimally with the 'greenhouse effect'. But into this uncertain mixture, add El Nino, La Nina and the Southern Oscillation and we have a mass of uncertainty as to how much warming has actually occurred in the Aoraki/Mount Cook National Park. However, the evidence of long-term glacial downwasting is very much apparent.

For more information on climate change and global warming relating to New Zealand check out the NIWA website: www.niwa.cri.nz.



Section B – Climate and ecology

Weather

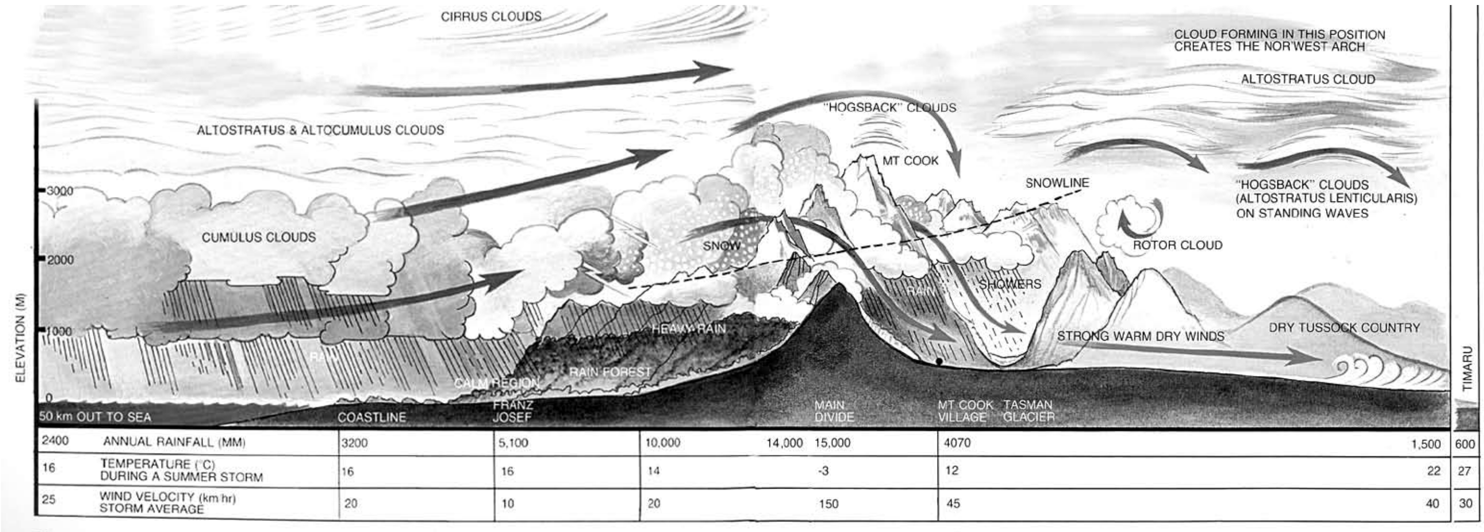
New Zealand borders the southern oceans, and the climate of Aoraki/Mount Cook National Park is dominated by the eastward movement of depressions and anticyclones from across these oceans. A recurring pattern is to have a period of settled weather, caused by an anticyclone, followed by a cold southerly. There are, however, seasonal variations to this pattern. Westerlies usually spread further north in spring and early summer and this is generally the windiest time in the mountains. Anticyclones can be found further south in winter, which causes more cold southerly flows but also settled periods.

In the Southern Hemisphere, winds flow clockwise around depressions and anticlockwise around anticyclones. On a weather map, the isobars are lines where the pressure is the same. In general, winds blow parallel to the isobars and the closer the isobars, the stronger the winds.

Although depressions and anticyclones determine the general conditions experienced over a wide area, the mountains themselves have a big influence on local weather. The Southern Alps/Kā Tiritiri o te Moana attain their greatest height in Aoraki/Mount Cook National Park – where the Main Divide averages about 3000 m – and are a major obstacle to the prevailing westerly flow.

As a depression or its associated cold front approaches from the Tasman Sea, a north-westerly airstream flows on to the South Island. This air is often moist, especially if it originates in the subtropics. As it rises over the Southern Alps/Kā Tiritiri o te Moana, the air expands and cools, causing the moisture to condense to form cloud and rain, with snow at higher levels. This rain or snow can start long before the front arrives. It is often heaviest around the 1200 m level on the western side of the Main Divide, with less rain or snow on the eastern side of the Alps. If a front becomes slow-moving, torrential rain can continue for several days about and west of the Main Divide.

Normally the winds behind a cold front turn to the south-west, and rain eases to showers near the Main Divide. If the flow turns to the south or south-east, cloud, rain or snow can become widespread on the eastern side of the Alps, bringing poor visibility and a rapid drop in the temperature.



Profile of a nor'wester

Westerly winds, moving across the southern oceans, become laden with moisture before encountering the barrier of the Southern Alps/Kā Tiritiri o te Moana. This barrier causes major disruption to the airflow, forcing it to rise. As the air rises it cools, forming clouds which produce rain and snow. Most of the rain falls to the west of the Main Divide, but falls of up to 537 mm have been recorded in 24 hours in Aoraki/Mount Cook village.

Signs of an approaching storm are increasing winds aloft and high cirrus clouds spreading across the sky from the west. Low cloud spills over the Main Divide like a waterfall, and hogsback clouds (smooth topped like a pig's back) appear over Aoraki/Mt Cook and the surrounding peaks. The winds spread to the lower levels, buffeting the eastern valleys, and rising dust plumes from the moraines and riverbeds.

Once the storm develops, hogsback clouds can be seen further to the east where they form within the waves of the nor'west airstream. At Aoraki/Mount Cook, hogsbacks over the highest peaks do not guarantee bad weather, but, if they form over the lower peaks, a storm is almost inevitable. From the first hogsback forming, it can take as little as two hours or as much as two days before the rain arrives.

By the time the air mass has passed over the mountain barrier, it has lost most of its moisture and descends on Canterbury as a hot, dry, blustery wind called the nor'wester. Similar winds are called the foehn in Europe and the chinook in Canada.

Plants

Life for plants could hardly be easy on a landscape as steep, high, glaciated, unstable, and storm-swept as New Zealand's central alps. But, even in this harsh environment, plants have adapted and thrive. More than four hundred species of 'higher plants' and many more 'lower plants' such as mosses and lichens, make up diverse and resilient native vegetation. These amazing plants have adapted to a constantly changing environment, including moving glaciers, flooding rivers and weather extremes. More than one hundred introduced plant species also exist in the area, with many now considered pest plants such as the colourful Russell lupin, the wild cherry and wilding pines.

In the mountains, climate and vegetation change with increased altitude. The higher you go, the lower the temperature because of increasing atmospheric pressure. Under normal circumstances in Aoraki/Mount Cook National Park, forest grows to about 1300 m, and snow tussock grassland between 1300 m and 1900 m. Above the snowline, rock, permanent snowfields, and glaciers dominate this remote world. But, even in this inhospitable environment, plants grow, with some 14 species of lichen found up on the highest rock of Aoraki/Mt Cook.

Because high mountains present a physical barrier to weather systems, vegetation of the wetter Main Divide is dramatically different from the drier ranges of the east.

Speargrass/taramea

Speargrass/taramea

Speargrasses, or Spaniards as they are often known, are very much part of the alpine environment. They are named speargrass because of the spiny leaf tips which can easily piece skin or clothing. The speargrasses are actually part of the carrot family and are unusual because they are long-lived and have separate male and female plants. They are easily able to colonise areas after fire and can grow quite densely.

Mt Cook lily

The Mt Cook lily (right) is also known as the mountain or giant buttercup. It is not a lily at all but part of the buttercup family and in fact is the world's largest one. Being a buttercup gives an indication of the kind of the environment it needs to survive . . . a wee bit damp. Because it grows near rocks which heat up during the day, it has stomates (these let water in and out of the leaves) on both sides of the leaves, not just the underneath like most other plants. This means the plant can control its temperature better and not dry out.

Mt Cook lily Photo: R Morris

Snow tussocks

Many species of snow tussock grow in the subalpine area, each adapted to different environmental conditions. The broad-leaved snow tussock and red tussock/haumata prefer wetter sites, whereas the narrow-leaved/wī kura and the slim-leaved snow tussocks prefer drier sites.

Broad-leaved snow tussock Photo: D Eason

Vegetable sheep

To withstand the high winds and harsh conditions, some plants have decided that growing low is the way to go. A vegetable sheep is a cushion plant and grows in a tight mat very close to the ground.

Vegetable sheep

Birds

Just like the plants that live permanently in Aoraki/Mount Cook National Park, there are some staunch wee birds that have adapted to the demanding alpine conditions and made this place home. Stormy weather, cold temperatures, and a short breeding season are some of the things they must contend with, but once adaptations have been made, species such as the rock wren/pīwauwau depend entirely on the alpine habitat to survive. Amazingly, there are about 35 different species which are either resident or regular visitors to the park. A further 15 or so put in the occasional appearance.

High on the mountain, the tiny rock wren is the only permanent resident although several other birds range up there to feed – pipits, keas, chukar (introduced Asiatic rock partridge), and surprisingly the black-backed gull/karoro. On the lower slopes, forest and scrub remnants are inhabited by the small insectivores (riflemen/tītitipounamu, fantails/pīwakawaka, tomtits/miromiro, grey warblers/riroriro, silvereyes/tauhou) along with small numbers of two larger forest birds, pigeons/kererū and moreporks/ruru. Introduced species (finches, sparrows, redpolls, blackbirds, thrushes, starlings, yellowhammers) live throughout the bush and the grasslands. In the valleys you will often find the scavenging harrier hawk/kāhu or perhaps see a falcon/kārearea swooping on prey from nearby bluffs. Out on the riverbeds and streams, in spring and summer, birds which are normally found in the coastal environment (gulls, pied oystercatchers/tōrea, terns/tarapirohe, pied stilts/poaka, banded dotterels/turiwhatu, wrybills/ngutu pare), come inland to the braided river systems to breed. In spring there is an abundance of aquatic insects which make the journey inland worthwhile. The breeding season is still fraught, with sand-blasting storms and floods which can cause nesting to fail. As an adaptation, most of the species breeding on the riverbeds will lay a second clutch. The majority of these birds are migratory and by autumn will have departed for warmer winter quarters near the sea.

Shorter visits are made by the shining cuckoo/pīpīwharauroa and the long-tailed cuckoo/koekoeā, after wintering in the Pacific around the Solomon Islands. Both species are more likely to be heard rather than seen, and like most cuckoos they do not raise their own young but will lay in the nest of another species. The grey warbler is a favourite with the shining cuckoo. Although the drawn-out screech of the long-tailed cuckoo is heard at times over summer, young have never been sighted and this could be because its preferred host birds do not live at Aoraki/Mount Cook.

Kea

In autumn the resident birds take advantage of the plentiful insect life and plant food (especially berries) to build fat reserves which help them survive the cold months. Winter at Aoraki/Mount Cook may bring snowfalls down into the valleys, burying already scarce supplies of food, and insects become less active in the cold and therefore harder to find.

The arrival of people impacted significantly on birdlife. Fires lit by Māori in the Mackenzie Basin began a process of habitat modification which European runholders continued at great speed, burning large areas of vegetation to create farmland. The introduction of mammalian predators (ferrets, stoats, cats), new diseases brought with introduced birds, and the collection of specimens for museums and zoos, hastened the departure of many native birds. When Julius van Haast explored Aoraki/Mount Cook in 1862, he reported seeing weka, kākā, blue duck/whio, scaup/black teal/ pāpango, and piopio (native thrush). Now all these birds are gone from the park, and the piopio is almost certainly extinct. The legacy of cats, ferrets, and stoats continues and there are predator control programmes in place aimed at reducing predator impacts on surviving bird species.

Rock wren/pīwauwau Photo: J Van Hal

Rock wren/pīwauwau

The rock wren (left) is a threatened species endemic to New Zealand. It inhabits the subalpine area, living and feeding in amongst rocks, scree and scattered alpine shrubs. It can fly quite strongly but usually only flies a few metres between rocks. The rock wren has totally adapted to this environment and lives here year round, surviving in winter under the snow in rock crevices and pockets under and between shrubs. It feeds on insects, spiders and the fruit of alpine plants.

Wrybill/ngutu pare

This endemic species is an oddity in the world . . . the only bird with a sideways-bending bill. This bill is an adaptation to searching under the stones in braided rivers to find aquatic invertebrates in spring and summer, and sifting through estuarine mudflats in the winter. For a nest, wrybills build a scrape in the shingle on river islands and banks, lining it with tiny stones. The eggs and nest are cryptic and camouflaged . . . very difficult to see and usually found by watching the nesting adults' behaviour as they try and lead intruders away from the nest site.

Wrybill /ngutu pare

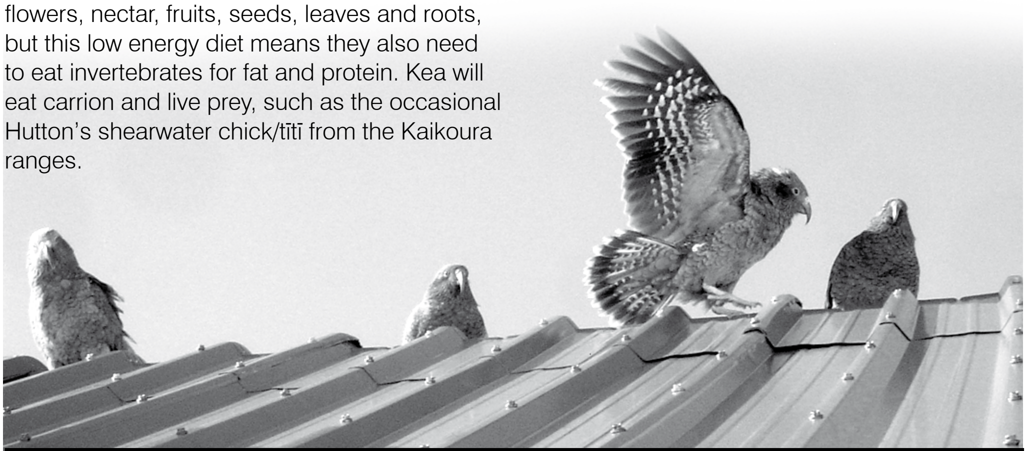
Falcon/kārearea Photo: K Lange

Falcon/kārearea

The falcon (left) is a threatened species and is endemic to New Zealand. It hunts birds and mice amongst open grassland and alpine scrub and herb-fields. Many of the small introduced finches have become part of the diet of the falcon. It lays its eggs in a scrape on a rock ledge or on the ground in a protected place. Falcons are territorial and fiercely defend their nest and young from intruders.

Kea

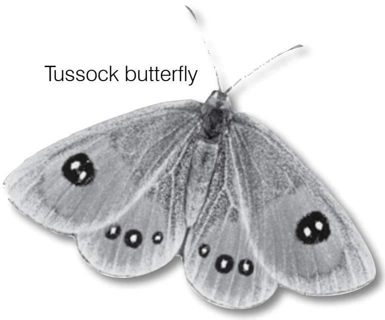
The kea (below) is an endemic parrot today found only in the Southern Alps/Kā Tiritiri o te Moana. Fossil remains show that at one time it was present in the North Island. Kea are recognised as one of the most intelligent birds in the world and it is this intelligence and their highly social behaviour that equips them for survival in the harsh mountain environment. Primarily a herbivore, kea eat flowers, nectar, fruits, seeds, leaves and roots, but this low energy diet means they also need to eat invertebrates for fat and protein. Kea will eat carrion and live prey, such as the occasional Hutton's shearwater chick/tītī from the Kaikoura ranges.



Insects and small animals

There is a teeming world of animal life in the park that is often overlooked . . . insects and small animals. They may be inconspicuous, but without these small creatures many birds would go hungry and plants would not be pollinated. Insect biodiversity is high within the park, with an array of spiders, moths and crickets including specially adapted species of wētā. There are also three lizard species and native fish including the upland bully and two Galaxiids.

Tussock butterfly



Of the three lizards, the grey-brown gecko is the most common. It is found under rocks or darting through grass in the summer, in the lower parts of the valleys. The smooth-skinned, stripy common skink/mokomoko is also common. Much less common is the very beautiful jewelled gecko/moko-kākāriki. None of the lizards live very high up the mountains, although other creatures do. Species of large black spiders are common on the barren surface moraines of the glaciers and are even found on rocks up to altitudes of more than 3000 m. Two species of black mountain butterfly, *Erebiola butleri* and *Percnodaimon pluto*, are true alpine dwellers and are often noticed fluttering over screes, moraines, rocks and even snowfields.

Like the birds and plants that spend all their lives in the mountain environment, insects that live here have also adapted to the extreme conditions. Most alpine insect species hibernate over winter, lying dormant and cold virtually to the point of freezing. Yet these over-wintering species are able to quickly recover and spring to life on warm winter days. One way they appear to have ensured they can catch as much warmth as possible, if the opportunity arises, is to be dark coloured. Many alpine insects have adopted this approach. The dark colour absorbs heat quickly when the sun appears and recharges the insects to allow them short bursts of intensive activity. Conversely, when temperatures drop, the dark pigment also assists in rapid heat loss, which lowers respiration and preserves energy. Insects that live at high altitudes have adapted by having reduced wings or none at all. This adaptation may allow them to crawl into tight crevices for shelter in an otherwise exposed environment.

Southern Alps gecko Photo: M Lettink

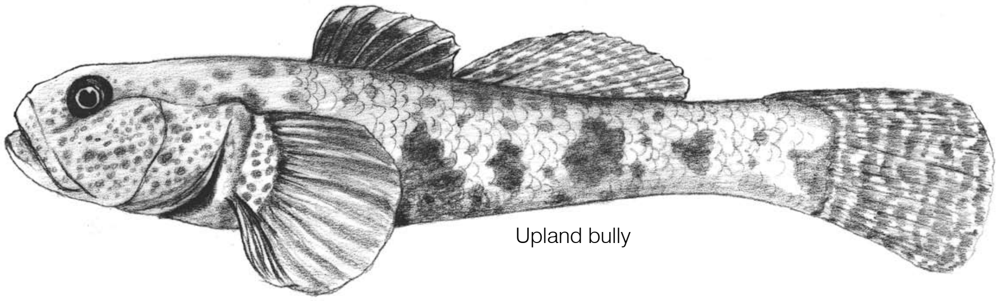
Members of the cricket and grasshopper family, which includes wētā, are some of the most conspicuous alpine insects. Snow wētā is an example of a wingless insect found between 1700 m and 3400 m and is associated with the highest flowering plants. On the tussock flats, a large, brown, striped, wingless wētā is commonly found when boulders are turned over. Species of wingless alpine grasshoppers are so abundant in places that when disturbed they sound like the patter of rain on the grass.

There have been 223 species of moths recorded from the park; many are beautiful, although certainly not flamboyant in size, colour or shape. Largest of all is *Aoraia aurimaculata* which may softly batter against your windows on an autumn night. Another large moth is the great grey mountain moth whose larvae feed on the wild Spaniard.

New Zealand is generally poorly represented by butterflies, but seven native species are present in the park. Their colour and daytime activity make them amongst the most noticeable insects. The small copper butterfly with its metallic purplish wing, the orange and black common copper butterfly, and the larger orange-spotted tussock butterfly can all occasionally be seen. If you look carefully on the riverbeds within the park you may spot the southern blue butterfly. The red admiral is quite common in summer.

Like insects generally, much remains unknown of the alpine species. Beetles and weevils are common and sometimes large numbers of green mānuka beetles may be found feeding on beeches or other trees. Tiger beetle larvae inhabit holes alongside some tracks. The characteristic green and white adults can be seen running and flying over bare ground on sunny days. Everywhere in summer, species of cicada, green or black, are more obvious to ear than eye. Two dark species are strangely abundant on the surface moraines of the larger glaciers.

The large and primitive dragonfly *Uropetala carovei*, with a 10–12 cm wingspan, can be seen hunting for the small insects on which it feeds, capturing them on the wing. The smaller blue and orange damselflies are commonest around tarns and still water and can be seen at the Red Tarns. In these pools aquatic insects such as water-boatmen and water-beetles abound.



Upland bully

Photo: M Rosen

Section C – Tourism in Aoraki/Mount Cook National Park

Aoraki/Mount Cook National Park was formally established in 1953 and received recognition as a World Heritage site in 1986 (one of only three in New Zealand).

Approximately 333,340 people visit each year, thirty per cent of whom are New Zealanders. Sixty six percent of all visitors are day trippers.

What do we mean by the term tourism?

Tourism is a cultural process – it involves people. It is a process because the activity involves modification and maintenance of the environment.

Photo: M Rosen

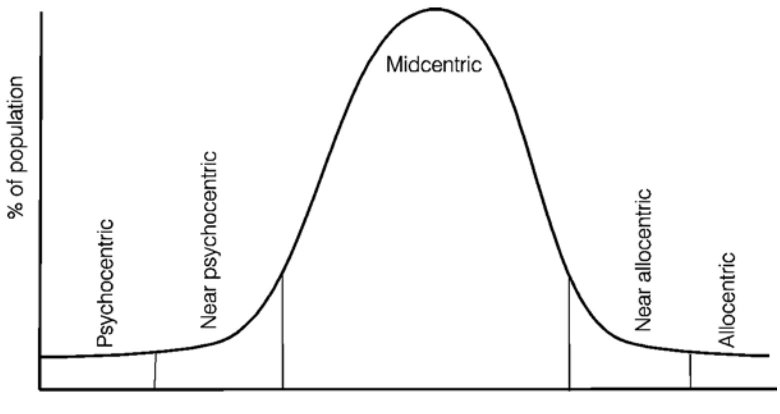
Tourism involves domestic and international visitors whose visit may be short or long-term (24 hours minimum and not permanent) for many different reasons – e.g. leisure/holiday, visiting friends and relatives or business.

Another way to categorise tourists is according to their 'psychological' type. Stanley C. Plog[2] devised a continuum that stretched from tourists who were 'psychocentric' to those that were 'allocentric' (see diagram below).

Psychocentric tourists preferred unadventurous mass-package holidays, whereas allocentric tourists preferred adventurous, different, and, at times, risky destinations. In between these were midcentric tourists, who make up the greatest percentage of the population and prefer a mixture of both.

The Department of Conservation Visitor Strategy recognises seven distinct visitor groups. They are:

1. Short-stop travellers
2. Day visitors
3. Overnighters
4. Back-country comfort seekers
5. Back-country adventurers
6. Remoteness seekers
7. Thrill seekers



Of the people who visit Aoraki/Mount Cook National Park each year, New Zealanders account for just 30%. Most of the remaining 70% of visitors are on organised tours and have limited time. Most will have lunch at the Hermitage and leave shortly afterwards. On average, this type of visitor will have only two hours in the park. These are the short-stop travellers. They may take a short walk, take photographs, and buy souvenirs. The sights will have been pointed out to them if they are part of a coach tour.

Aoraki/Mount Cook National Park, therefore, attracts allocentric, midcentric and psychocentric tourists. It caters for the package psychocentric tourist who requires low activity levels (i.e. has a look at the mountains from the comfort of the coach) to the high activity allocentric who might do a hike or climb a mountain.

Some further characteristics of psychographic types

Applying Plog's theory to Aoraki/Mount Cook as a tourist destination, we can see the national park caters for the needs of both types of tourist.

Specific tourism information on Aoraki/Mount Cook National Park

There is some evidence to suggest that prior to the arrival of Europeans in New Zealand, Māori also travelled like tourists. They left their villages and travelled on foot into the mountains. Māori had names for the highest mountains and their legends told how these came into existence. Technical terms were used to explain alpine phenomena such as huka pō for glaciers and hukahoro for avalanches. Burnt stones, moa bones, rock drawings, artefacts, shelters and stories all point to nomadic journeys 500 years ago that show Māori knew the Mackenzie Country well.

[2] *Why Destination Areas Rise and Fall in Popularity*, Stanley C. Plog, 1972

In modern tourist terms exploration is not a reason for making a journey. Exploration would probably fall into the leisure category considering that it is something that is done when you are not busy meeting basic needs. We could also argue that if Māori were searching for food sources, or raw materials such as greenstone/pounamu, then their journeys were business trips. For more information on Māori and the alpine region see p 56–57 in T*he Alpine World of Mount Cook National Park*, Andy Dennis and Craig Potton,1984.

Early European visitors to Aoraki/Mount Cook were probably runholders looking for grazing land, geologists and surveyors exploring the new country, and painters and poets who made much of the spectacular landscape. While these early visitors made their journeys on foot or by horse, today's visitors enjoy much less arduous travel.

Access

State Highway 80 to Aoraki/Mount Cook turns off State Highway 8 north of Twizel. The 55-kilometre sealed road is an all-weather road. Very occasionally heavy snowfalls force its closure for short periods. For the independent traveller the 351 kilometre journey from Christchurch takes approximately four hours. The 263-kilometre drive from Queenstown takes about three hours.

There are daily scheduled bus services to Aoraki/Mount Cook National Park. Many tour operators include the park in their itinerary. Some operators choose to stay overnight at Twizel and only make the journey into the national park if the weather is good and Aoraki/Mount Cook is visible. The end-of-road nature of Aoraki/Mount Cook village has a negative impact on tourism.

The airport is five kilometres from the village. There are charter flights to Aoraki/Mount Cook from Christchurch and Queenstown. Climbers wishing to gain access to the more remote high-altitude huts in Aoraki/Mount Cook National Park and Westland Tai Poutini National Park can charter these aircraft. Glentanner, a small airfield 15 minutes drive (20 kilometres) from Aoraki/Mount Cook village, operates aerial sightseeing services and offers helicopter access to many parts of the park.

Attractions

Attractions are those elements that attract the tourist to a particular region. The natural environment draws people to Aoraki/Mount Cook National Park. People come to admire the impressive natural scenery, the sounds of nature and the natural quiet, as well as to enjoy the clean green environment. Visitors also come to enjoy recreational activities. Recreation includes the opportunity to explore new places and try new challenges, have an adventure, or simply experience a different perspective in space and time.

During the summer visitors can:

- take photographs
- walk
- swim in the Blue Lakes or other tarns in the area
- climb mountains
- complete a guided ascent or take climbing instruction
- try rock climbing and bouldering
- hunt
- tramp the Copland Pass and the Ball Pass routes
- undertake overnight trips to Mueller Hut or to Ball Shelter
- play tennis
- go mountain biking
- go kayaking
- take a boat trip
- go paragliding
- take a scenic flight

Mueller Hut

During the winter there are not enough tourists visiting the village for some of these activities to remain viable, or the weather conditions are too severe for them to continue. Walking is limited by the weather and also the danger of avalanches. The 4WD Safari may be shortened because of avalanche danger. During winter, tourists can:

- ski the Tasman Glacier
- cross-country ski and ski tour
- heli-ski
- take scenic flights when the weather permits

Aoraki/Mount Cook offers some activities when the weather is bad. The Aoraki/Mount Cook National Park Visitor Centre offers an extensive range of interactive activities and the Sir Edmund Hillary Alpine Centre at the Hermitage provides a great audio-visual presentation, museum and planetarium.

Facilities and amenities

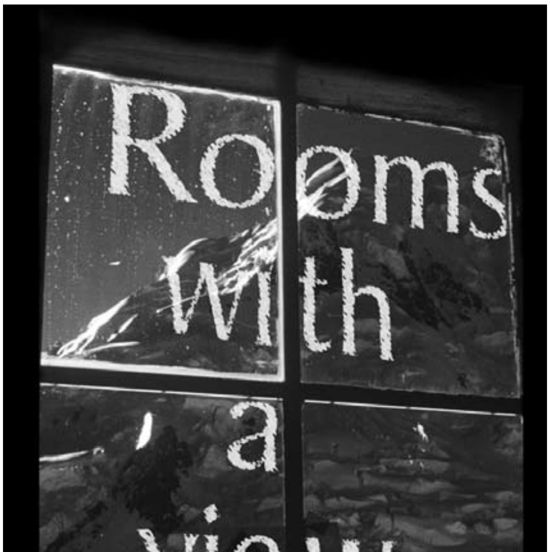
Amenities do not usually attract visitors to a particular region or destination but their quality and availability may be the cause of tourists avoiding a destination. Amenities include accommodation, shopping, catering, rental firms, and entertainment. Utilities are items such as roads, electricity, water, sewerage, waste disposal and communications. As tourism activity increases, so does the demand on existing infrastructural services and facilities.

Aoraki/Mount Cook village supports a permanent population of 120 people. During the peak summer season, as many as 3,000 people per day may use the amenities. At Aoraki/Mount Cook village the Department of Conservation acts as a local authority, assuming responsibility for rubbish collection, water supply, sewage and roading.

The accommodation available in the village ranges from park huts, a camping ground and youth hostel, to chalets, motels, lodges and a hotel with luxury suites. There are approximately 760 beds available to tourists. Some accommodation may be limited or closed during the winter from April to October.

The New Zealand Alpine Club owns Unwin Lodge, the Canterbury Mountaineering Club owns Wyn Irwin Lodge and the New Zealand Deerstalkers Association owns Thar Lodge. All three clubs may offer accommodation to non-members on a per-night basis.

Visitor numbers have increased over the past decade as have the variety of nationalities.
In the 12-month period between 1 July 1996 and 30 June 1997 a total of 1815 campers registered at the White Horse Hill camping ground. Of these, 36% were of Central European origin, 17% of Nordic or United Kingdom origin, 12% from North America, 10% from Australia, 2% from Japan and 18% were New Zealanders. Five per cent did not provide information about their origin. The heaviest use occurred during January, with the peak months being December to March.
Compare this with the current statistics when in the 12-month period between 1 July 2007 and 30 June 2008, a total of 10,188 campers registered at the White Horse Hill camping ground. Of these visitors, 53% were from central Europe, 7% from Canada and North America, 14% from Australia, 1% from Japan and Asia, 0.25% from Africa, 0.2% from the Pacific Islands, 0.25% from South America, 2.3% from the Middle East, and 20% from New Zealand. Only 2% did not provide any information about where they were from. The numbers have increased greatly over 11 years,



Hooker Hut

Ball Shelter

and visitors from countries not recorded in 1997 are now present in the data.

Aoraki/Mount Cook National Park has nine alpine huts, four standard huts and five basic huts/bivvies. Over the last 15 years an average of 7,434 people annually have stayed in the huts and bivvies. Figures obtained from daily radio schedules show Kelman receives the highest usage followed by Plateau and Tasman Saddle huts. Favourable publicity in the Lonely Planet 'Tramping in New Zealand' guide has resulted in a recent increase in the usage of Mueller Hut and over-crowding can be a problem during the summer period.

Opportunities to shop are limited, but some grocery items, a variety of clothes and outdoor equipment, and souvenirs are available. There are cafes in the village.

Local residents have to go further afield for groceries, furniture and other merchandise. Credit cards, EFTPOS cards or fuel cards operate the village petrol pumps but New Zealand pin numbers are required. This can and does cause problems for many motorists, especially for overseas visitors driving rental cars. All village businesses have EFTPOS and the Hermitage will change some money. The nearest banks are at Twizel and Timaru. Twizel, the closest town, has a small selection of shops while Timaru, a two and a half-hour-drive away, is the nearest city.

Preservation versus use

The Department of Conservation is responsible for the management of the Aoraki/Mount Cook National Park and Aoraki/Mount Cook village (including infrastructure such as water and sewage). With an estimated 300,000 visitors to Aoraki/Mount Cook National Park each year and 70,728 hectares of mountainous environment to protect and preserve, the Department of Conservation is busy . . . very busy! It employs 18 permanent staff and up to 15 seasonal staff over the summer period.

The Aoraki Area Office of the Department of Conservation operates on an annual budget of approximately $1.6 million – funded from government and its own revenue generated from concessions, hut fees and sales from the visitor centre. With these funds the department must strike the fine balance between protecting the environment as **kaitiaki** while ensuring New Zealand and international visitors can enjoy the magnificent environment. It is not always an easy balance to find, as demands can be competing and/or incompatible. The responsibility the department has is wide and includes:

- **Biodiversity and threatened species programmes** – There are plant and animal species which are special to the park and need to be protected to ensure they will continue to survive. Activities in the park that might affect these biodiversity values need to be carefully considered, i.e. placement of a walking track or granting of a concession. The Department of Conservation has a variety of fact-sheets highlighting the variety of species present which can be found on the Department of Conservation website or in the visitor centre. An astounding 30 indigenous bird species have been recorded within the park boundaries.
- **Visitor assets (tracks, huts, signage etc.)** – The construction of new, and the maintenance of existing tracks, and huts is on-going. The extreme weather conditions and harsh environment means constant change; rock and ice slips, flooded waterways, high winds and heavy snowfalls all contribute to track and hut site selection and maintenance. Biodiversity values also need to be considered when planning track and hut work.
- **Visitor centre** – The visitor centre is critical to the operation of the park. This is the first place most visitors go to when they reach Aoraki/Mount Cook village. All tourist and safety information is available at the centre. Intention books are kept, noting where people are going in the park, which tracks and huts they are using and when they expect to return. This is necessary for health and safety and for search and rescue, which is another service the department is responsible for in the park. Revenue from sales at the visitor centre is

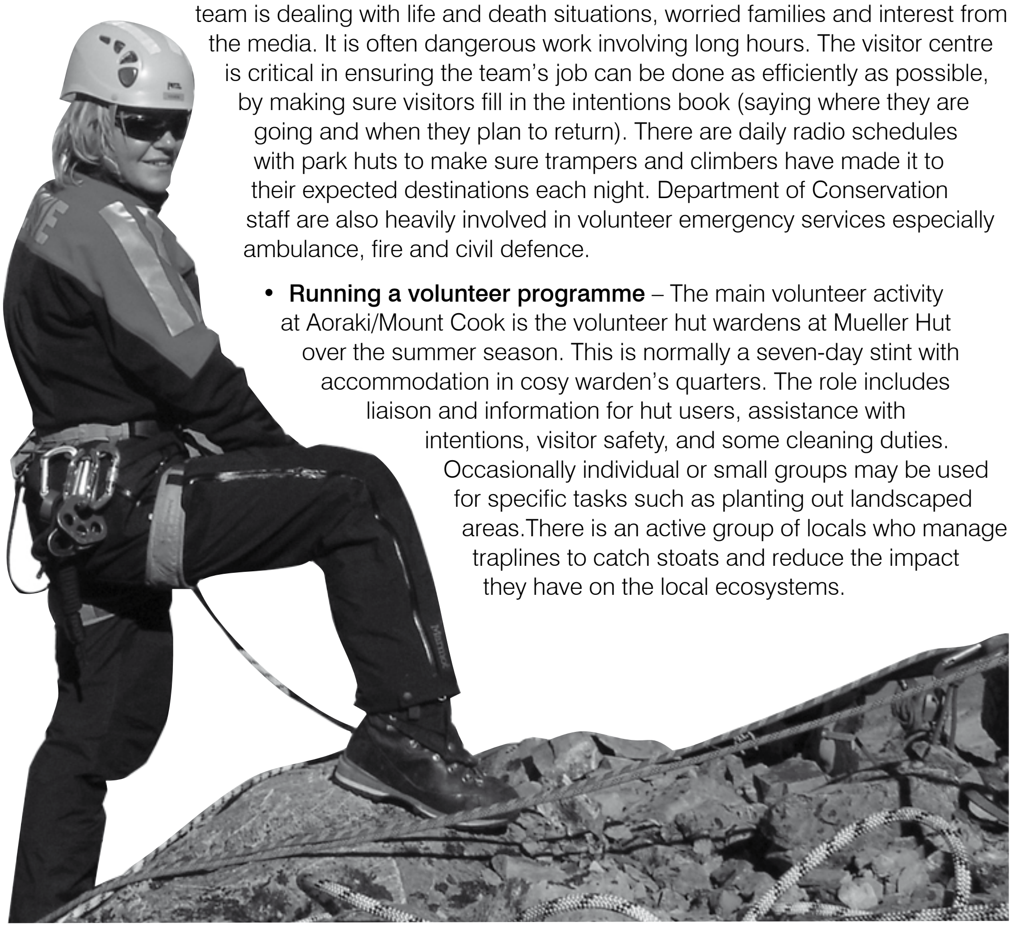
required to support the department's work, to ensure the park is adequately protected and visitors receive the service they expect.

- **Historic resources** – There is a long history of people visiting, passing through, working and living around Aoraki/Mt Cook and the current village site. Māori, early explorers, surveyors, mountain-climbers and artists have all been drawn to the awe-inspiring mountain environment. Historic sites are cared for by the Department of Conservation and range from dwellings and huts (the historic Empress Hut (left) is now beside the visitors centre), the Sawyer Stream hydro-power scheme, the alpine memorial and the pastoral run at Birch Hill. These historic sites and items are part of our heritage and are protected for everyone to enjoy.

- **Public awareness, education and interpretation** – Ensuring that the public knows about the department's role and, in particular, the park, is the job of Community Relations staff. The media plays a key role as a vehicle to get messages and information out to a wide audience. Search and Rescue is something that generates a lot of public and media interest. Staff need to be sensitive with how information is provided, for instance, when talking to the families of lost, injured or dead climbers. The area is a geography teacher's dream and many schools visit Aoraki/Mount Cook as part of their school year. The Department of Conservation provides education sessions and resources to support student learning.
- **Threats** – There are a number of introduced pest plants and animals resident in the park. Tahr, chamois, possum, rabbit and hare all have a detrimental affect upon the vegetation, especially in alpine and subalpine zones. Introduced plants such as the Russell lupin, gorse, broom, heather, and wild cherry alter habitats and compete with native plant species. Considerable funds must be spent each year to control pests. While eradication is often preferable, the reality is often that management is aimed at keeping pest numbers low enough that their impact is minimal.
- **Concessions** – All the land that the department manages, including Aoraki/Mt Cook, is public conservation land. It is land 'owned' by all New Zealanders. This means that if a person or a group of people wish to undertake activities on public conservation land for business purposes (i.e. to make money from public conservation land), they must get permission to do so and will need to pay a fee. This permission is called a concession. A concession ensures a level of fairness so that not just the few that run businesses benefit from conservation land. Only activities that are assessed as not impacting negatively on biodiversity or historic values, or the opportunity for all New Zealander's to recreate on public conservation land, are considered for a concession. Monies received through the concession process go to support conservation in the area the concession is operating.

Photo: M Hieatt

- **Search and rescue** – The Department of Conservation has joint responsibility with the Police Department for Search and Rescue operations within the park. A highly skilled team is always on standby but is especially busy throughout the summer months. This is a huge role as the team is dealing with life and death situations, worried families and interest from the media. It is often dangerous work involving long hours. The visitor centre is critical in ensuring the team's job can be done as efficiently as possible, by making sure visitors fill in the intentions book (saying where they are going and when they plan to return). There are daily radio schedules with park huts to make sure trampers and climbers have made it to their expected destinations each night. Department of Conservation staff are also heavily involved in volunteer emergency services especially ambulance, fire and civil defence.
- **Running a volunteer programme** – The main volunteer activity at Aoraki/Mount Cook is the volunteer hut wardens at Mueller Hut over the summer season. This is normally a seven-day stint with accommodation in cosy warden's quarters. The role includes liaison and information for hut users, assistance with intentions, visitor safety, and some cleaning duties. Occasionally individual or small groups may be used for specific tasks such as planting out landscaped areas.There is an active group of locals who manage traplines to catch stoats and reduce the impact they have on the local ecosystems.



Member of Aoraki/Mt Cook Alpine Rescue Team Photo: D Bogie

The environmental care code

Toitu te whenua – to leave the land undisturbed – is the right and respectful thing to do. We should visit and enjoy a place without causing harm. But how do we make sure people respect the environment they visit? How do we make sure that everyone who visits behaves appropriately?

In a place such as Aoraki/Mount Cook where there are large numbers of visitors, and people tramping and climbing into the mountains where amenities are basic, managing how people behave is challenging . . . particularly when they are out of sight up in the mountains. The Department of Conservation has a care code which outlines expected behaviours (see below) but do people really follow it? Issues arising from toilet waste in the mountains is a fact, and Mueller Hut a good example. Burying toilet waste in the snow only lasts as long as the snow does! The Department of Conservation Aoraki Area developed the 'poo pot' to encourage people to, quite literally, carry out what they carry in!

Alpine care code:

- plan ahead
- pack it in, pack it out – take all your rubbish with you
- dispose of your toilet waste appropriately – use poo pots
- respect our Māori heritage
- look after our native species
- be considerate of others
- keep to the track
- camp carefully
- leave no trace

It is important for everyone to respect the Ngāi Tahu tapu and Tōpuni status of Aoraki. The first section of this resource outlines the reasons behind the tapu status of many places and land features.

Recreation and human use is an important element of national parks such as Aoraki/Mount Cook, but how do we ensure that national parks are also areas for preservation?

Aoraki/Mount Cook National Park is continuously changing and natural processes are responsible for many of these changes. But humans, since they first arrived, have also contributed to change in the park. Some people consider the human-induced changes such as vegetation removal by fire and axe, grazing of livestock and the introduction of pest species (tahr and chamois) has greatly accelerated the process of erosion. It is difficult to measure the amount of erosion we can attribute to humans, but erosion seen on Glentanner Station may not have occurred if the original vegetation cover had remained.

The environmental impact of tourism in Aoraki/Mount Cook National Park has changed over time. In the early days of European mountaineering and visits to the park, no-one could perhaps imagine the number of people that would live in the village and visit some 120 years later. In 1890, managing water and waste for so few inhabitants and visitors probably had little environmental impact . . . but that is no longer the case and much thought and consideration must now go into managing air, water, noise and visual pollution.

Ensuring that water supplies are not contaminated by sewage and waste is as important for the alpine environment and waterways as it is for humans living and visiting the park. Air travel allows many of us who are not mountaineers to experience the high alpine environment . . . but aircraft and helicopters are noisy and for many people the very peace of the mountains is what they wish to experience. There are also the cultural values of Aoraki and the park to consider and pollution of any sort is hard to marry with the tapu and Tōpuni status of Aoraki and the park.

So, with so much to consider when making decisions about tourism in the park, it begs the question – is there is still room for greater tourism development at Aoraki/Mount Cook National Park or has tourism in the park reached a stage of maturity? There are many views, with some people sure that a level of saturation has been reached and that any increase would put so much pressure on the environment that it would no longer be possible to retain a balance between tourism and the natural ecology of this special place.

The challenge for the Department of Conservation, as the caretakers of this iconic national park, is to both safeguard precious natural and cultural heritage, while making the park more accessible and more meaningful to a wider spectrum of visitors.

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