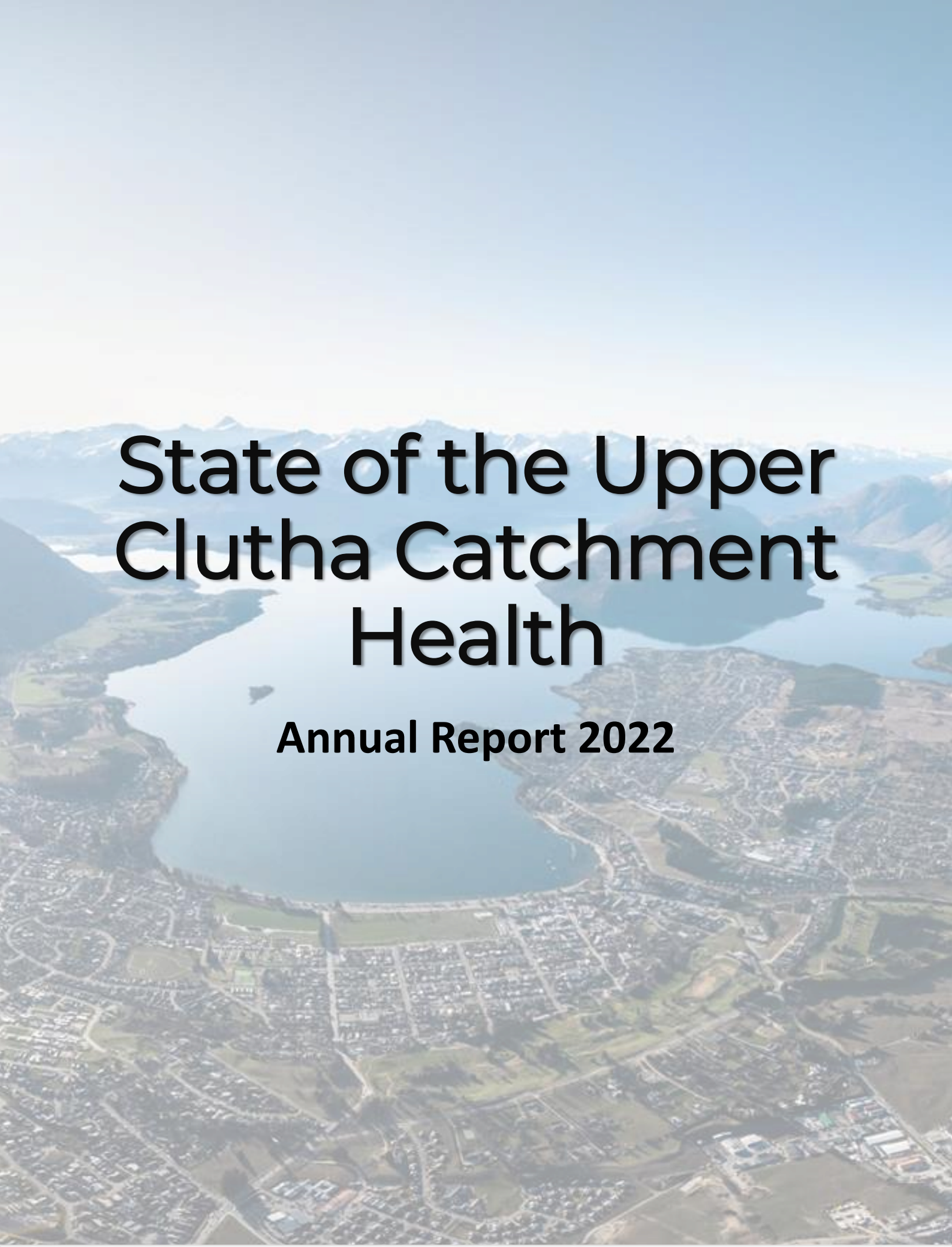

State of the Upper Clutha Catchment Health

Annual Report 2022

WĀNAKA WATER ACTION INITIATIVE

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Table of content

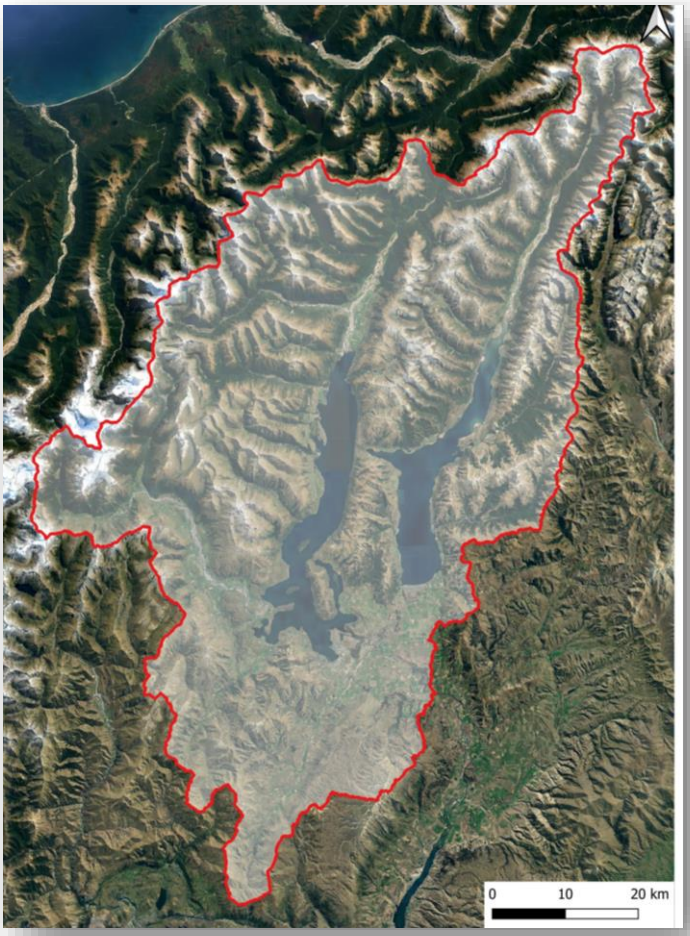
Introduction

This report presents an annual snapshot of the state of health of the Upper Clutha Catchment in 2022.

The aim of this report is to facilitate informed decision-making by stakeholders and the community about environmental management and investment in conservation efforts within the catchment.

The data presented in this report were obtained from the Upper Clutha Catchment Health Monitoring Framework. This framework uses a combination of quantitative and qualitative methods to assess the health of the catchment.

The findings are presented according to the following six indicators:



Upper Clutha Catchment, an area of approximately 4,600 km^2 with a population of over 13,000 residents.

- **Land Use Change:** Examines how the land within the catchment is being used and how it has changed over time. It includes an analysis of changes in land cover due to urbanisation, agriculture, and deforestation.
- **Climate Variables:** Presents temperature and rainfall observations as available from meteorological measurement sites in the catchment.
- **Water Quality:** Assesses the water quality of lakes and rivers.
- **Invasive Species :** Assesses the presence of invasive species; in particular, it considers the extent of pest control efforts and control of wilding pines.
- **Greenhouse Gas Emissions:** Presents the GHG emissions profile of the catchment, including emissions associated with the transport, energy, forestry and agricultural sectors.
- **Social Well-Being:** Assesses the well-being and quality of life of the people living in the catchment.

These indicators were chosen to provide insights on various key aspects of catchment health. However, the indicators are not static or exhaustive, and will evolve over time as the framework further develops. More information about the framework and data underpinning each indicator can be found in the technical report which is available from WAI Wānaka.

What do we mean by health?

The "health of the Upper Clutha Catchment" is seen here as a holistic concept that considers the interconnectedness of various environmental and social factors and how they collectively contribute to the well-being of the overall ecosystem and the communities that rely on it. Māori have always recognised the importance of the connection to the environment as vital to health and well-being. This Upper Clutha Catchment monitoring framework was developed to align with the Māori concept of te Taiao, a deep relationship of respect and reciprocity with the natural world. The health of the climate, land, water and living systems comes first. And when nature thrives, it positively impacts our families, communities and businesses[8].

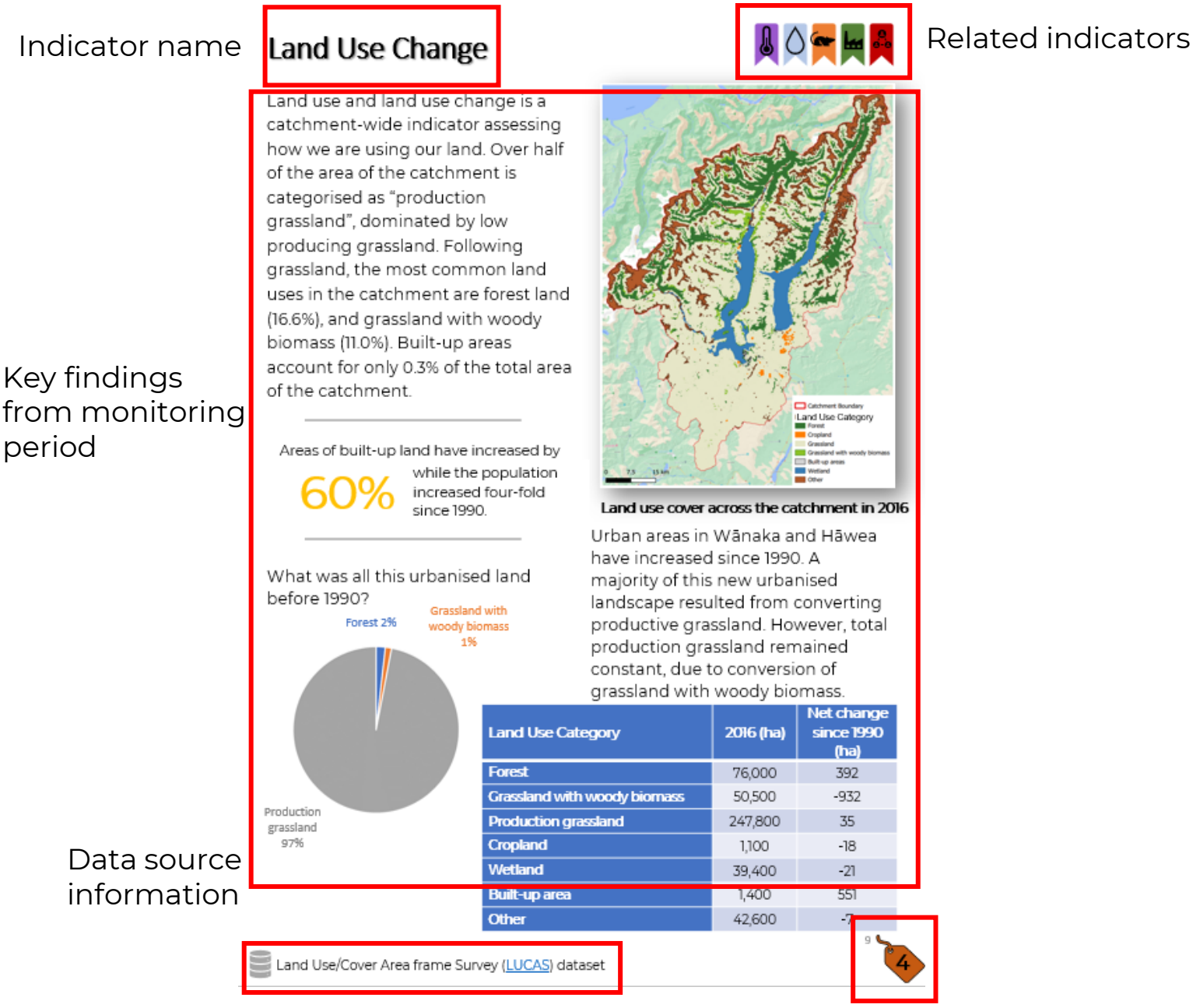
Health in the context of the Upper Clutha Catchment involves achieving a sustainable balance between human activities and the natural environment, recognising that a healthy catchment is one where the environment is treated with respect and care. The components of a healthy catchment and te Taiao are the climate, soil and land, water, and living systems which are interconnected and interdependent. This interaction is complex, preventing the overall health of the catchment being assessed with a simple ‘good’ or ‘bad’ rating.

This monitoring framework is designed to provide a snap-shot of the state of the catchment health, which is turn is indicative of its environmental well-being, encouraging us to strive for a future where humanity and the natural world sustain each other and to behave in ways that are more connected to te Taiao.

How to read this report

The State of the Upper Clutha Catchment Health annual report presents six indicators (listed in the table below) that provide insights into the overall health of land, water, biodiversity, and the community well-being within the catchment. Each indicator and its major results are described and presented as illustrated in the diagram below.

Details on data sources, data limitations and analysis can be found in the technical report which is available from WAI Wānaka.



How to read this report

While each indicator is described and presented individually, it is acknowledged that the individual components within the catchment are interconnected. To recognise this interconnection, “bookmarks” have been used to indicate which other indicator may be connected to or influenced by changes in a particular indicator. Each bookmark is coloured and assigned to a specific indicator.

Bookmarks for Indicators			
	Land Use Change		Invasive Species
	Climate Variables		Greenhouse Gas Emissions
	Water Quality		Social Well-Being

To recognise data constraints that need to be taken into account when considering the results of this report for decision-making, “tags” have been added to each indicator to maintain transparency. Each tag is coloured to a particular type of data limitation or assumption.

Assumptions and Limitation Tags*	
	**Incomplete data** tag is used as a general tag where raw data do not provide a complete data set for the catchment. This may either be due to data being only sparsely available, e.g., for only a sub-area of the whole catchment, or the temporal resolution of the data is poor.
	**Survey data** tag is used to describe raw data that were collected by surveys. Most importantly, survey data only provide information on a sample rather than an entire population. Therefore, this data may not provide a complete representation of the entire population of the catchment.
	**Scaled data** tag is used where data had to be scaled, either spatially or temporally, to match the geographic extent of the catchment or the temporal extent of the monitoring period.
	**Non-annual data** tag is used where historic data is presented, due to data from the current monitoring period not being available, nor possible to accurately extrapolate to the monitoring period.

* Refer to Section 3.3 in technical report for more details (report available from WAI Wānaka).

Land Use Change

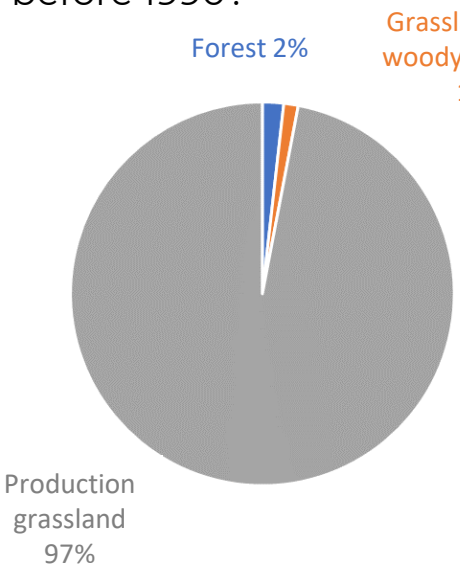
Land use and land use change is a catchment-wide indicator assessing how we are using our land. Over half of the area of the catchment is categorised as “production grassland”, dominated by low producing grassland. Following grassland, the most common land uses in the catchment are forest land (16.6%), and grassland with woody biomass (11.0%). Built-up areas account for only 0.3% of the total area of the catchment.

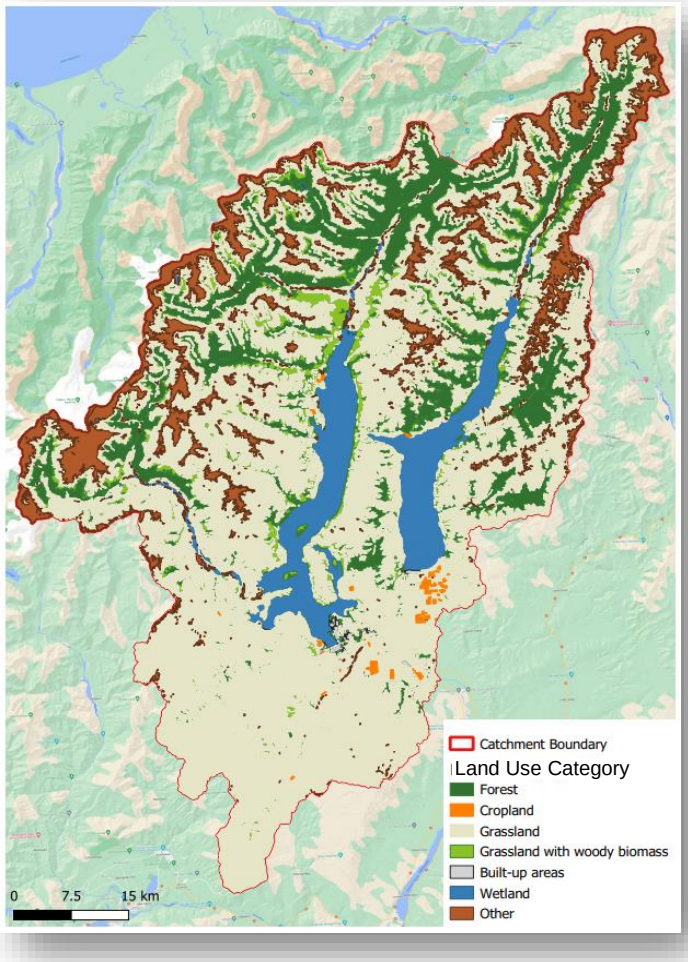
Areas of built-up land have increased by

60%

while the population increased four-fold since 1990.

What was all this urbanised land before 1990?





Land use cover across the catchment in 2016

Urban areas in Wānaka and Hāwea have increased since 1990. A majority of this new urbanised landscape resulted from converting productive grassland. However, total production grassland remained constant, due to conversion of grassland with woody biomass.

Land Use Category	2016 (ha)	Net change since 1990 (ha)
Forest	76,000	392
Grassland with woody biomass	50,500	-932
Production grassland	247,800	35
Cropland	1,100	-18
Wetland	39,400	-21
Built-up area	1,400	551
Other	42,600	-7

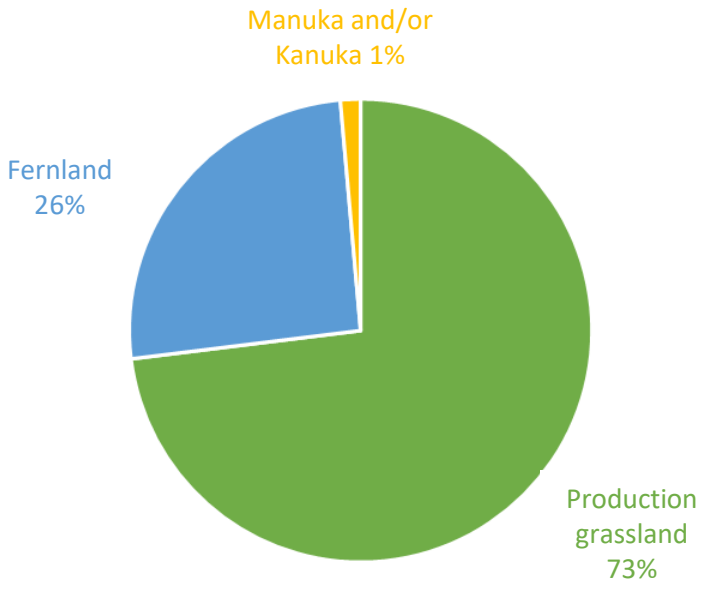
Land Use/Cover Area frame Survey (LUCAS) dataset

Land Use Change – Forest Cover

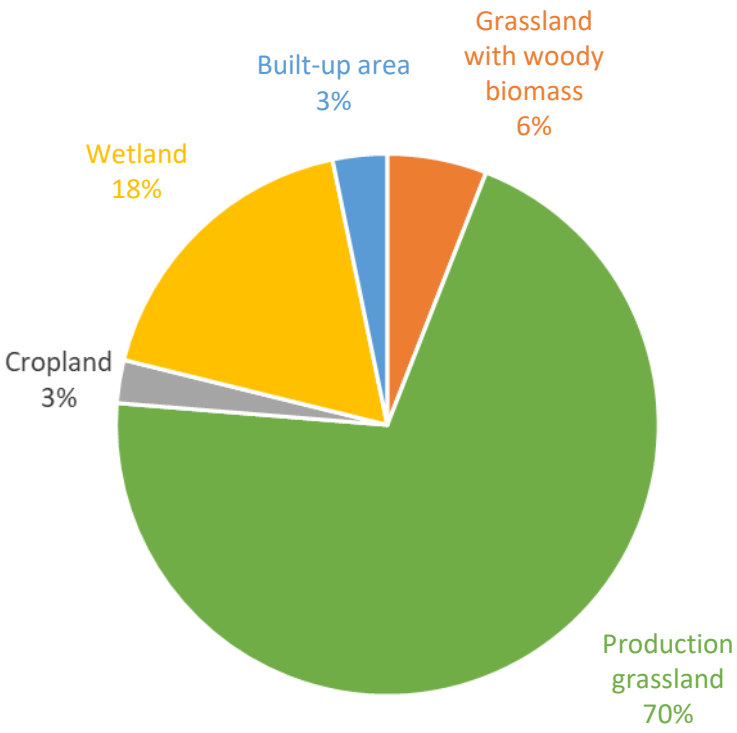
Since 1990, there has been a net increase of 300 ha of forestland across the catchment. However, most of this has been through the growth of new exotic forest, while the cover of natural, indigenous forest has seen a net decline.

To understand the current land use and land use change practices, a more recent dataset from 2008 to 2018 was analysed, showing a gross increase in exotic forest cover of 71 ha, which mainly is a result of the conversion of production grassland (52 ha). 52 ha account for 0.02% of the total production grassland available in the catchment.

A gross decrease in indigenous forest cover of 69 ha is observed between 2008 and 2018.



Land uses converted into exotic forest between 2008 and 2018.



Land uses converted from forestland since 1990.

Indigenous forest cover has decreased by

<0.2%

between 2008 and 2018.

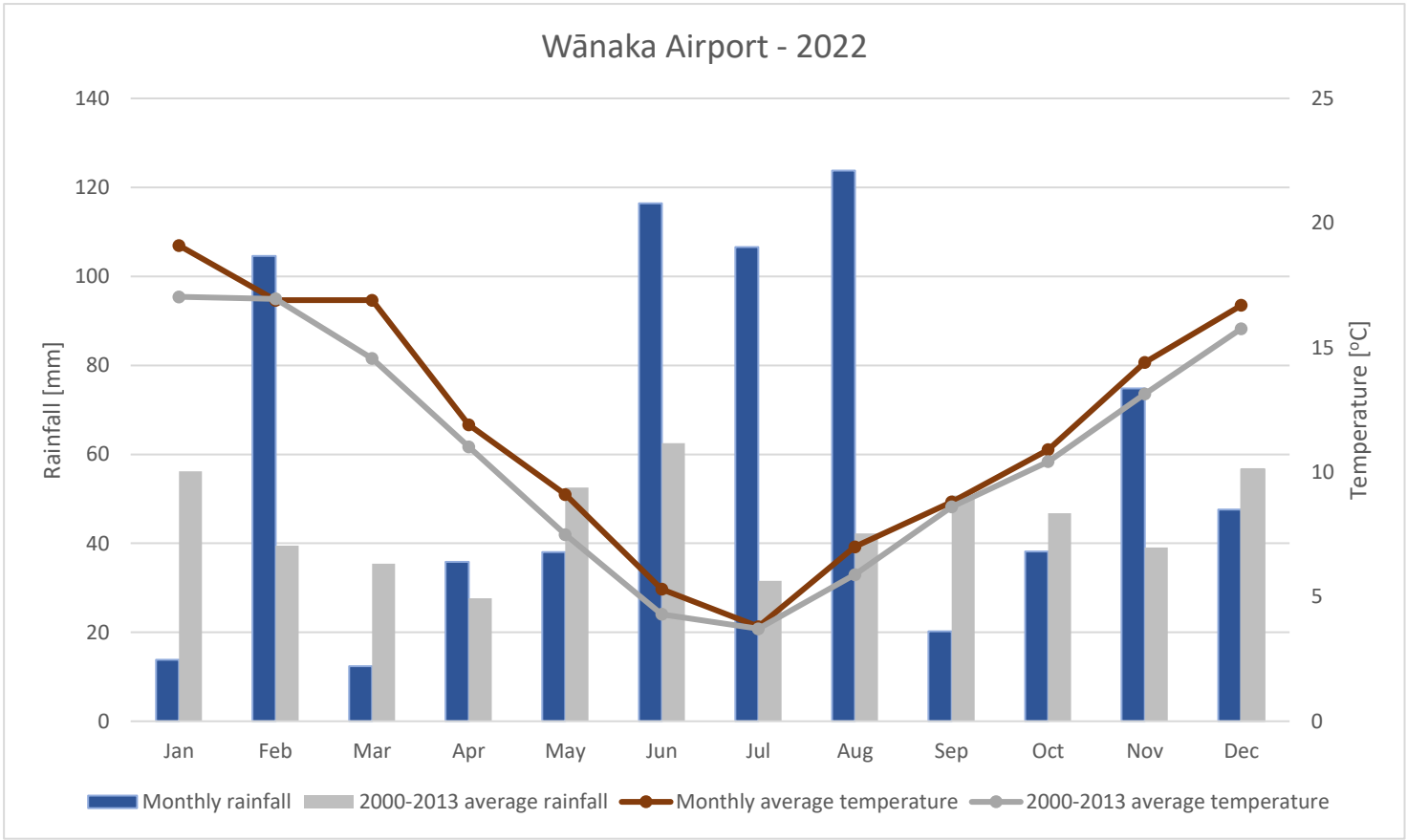
Most of the loss of indigenous forest that took place between 2008 and 2018 was the result of landslides in the high alpine[1], rather than a direct impact of anthropogenic activities. While indigenous forest is not under particular threat, other native vegetation classes, such as fernlands, have seen significant reductions in land cover: fernland decreased by 1,500 ha.

Land Use/Cover Area frame Survey (LUCAS) and Land Cover Database (LCDB) datasets.

Climate Variables

Climate variables are a key driver for many measures of catchment health due to their influence on the ecosystem as well as water quality and quantity. This indicator includes temperature and rainfall observations obtained from four, currently active, measurement sites. However, future expansion of the network of weather stations and parameters monitored would be extremely valuable to obtain a more robust representation of the climatic conditions of the catchment.

Active weather stations in the catchment.



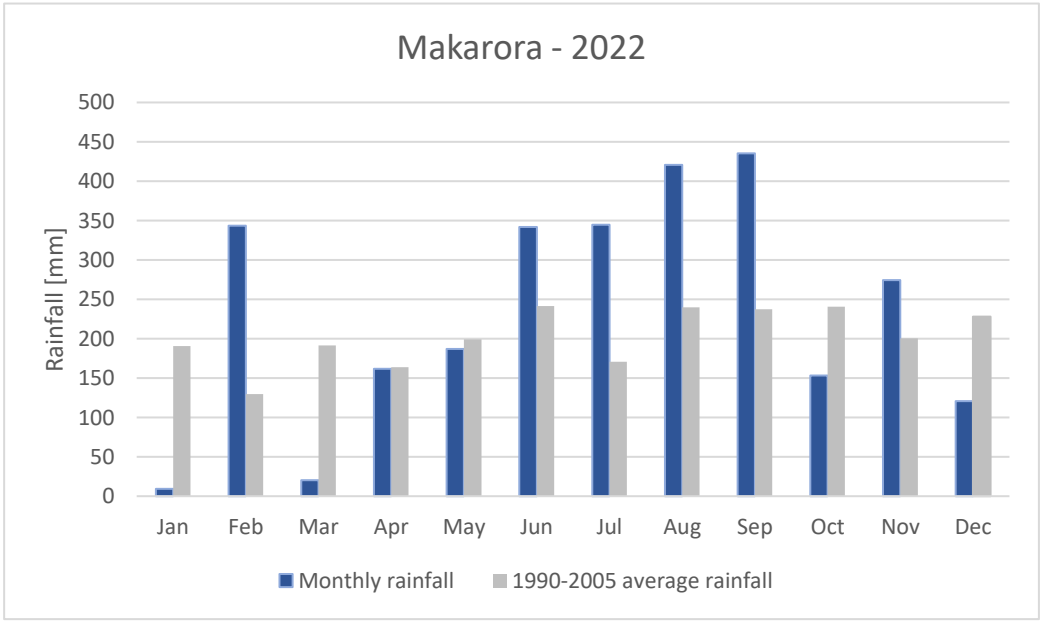
Monthly total rainfall and average monthly temperature as observed at Wānaka Airport.

The National Climate Database (CliFlo)

Climate Variables

The relationship between climate variables and other measures of catchment health are complex, but linked. Rainfall and temperature impact whether flora and fauna can flourish, may impede human recreation opportunities both in the summer and winter, as well as pose threats to the agricultural industry of the catchment.

Temperature data from 2022 show that our catchment continues to be slightly above the long-term average. The range of some invasive species may increase to include our catchment: for example, the sub-tropical bungalow palm, which currently only grows on the North Island, could spread to the South Island under a warming climate[2]. Furthermore, breeding seasons of invasive predators, such as rats, possums and mice, may also extend due to higher temperatures[2], which can also accelerate the reproductive cycle, leading to faster population growth, while rainfall influences the availability of food, water, and shelter for pests. Climate data presented here are thus important to consider when, for example, assessing the data presented as part of the invasive species indicator.



Monthly total rainfall as observed at Makaroa. No temperature data were available from the climate database.

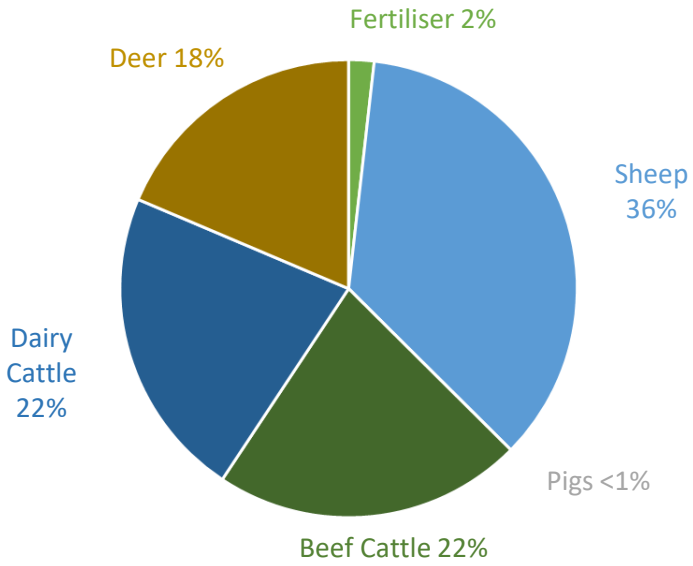
A dryer summer and wetter winter in 2022 were observed in Makarora compared to the long-term average from 1990 to 2005 – putting pressure on the water resources, especially in summer.

Furthermore, greater rainfall depths are expected to increase the likelihood of landslides and flooding.

The National Climate Database (CliFlo)

Greenhouse Gas Emissions

Climate change mitigation is an important target for the catchment, which has a strong focus on being a sustainable tourism destination[9,10]. The purpose of providing an emissions inventory as part of the monitoring framework is to determine significant sources of GHG emissions in the catchment, which, in turn, can help to prioritise mitigation efforts.



GHG emissions from the agriculture sector by industry.

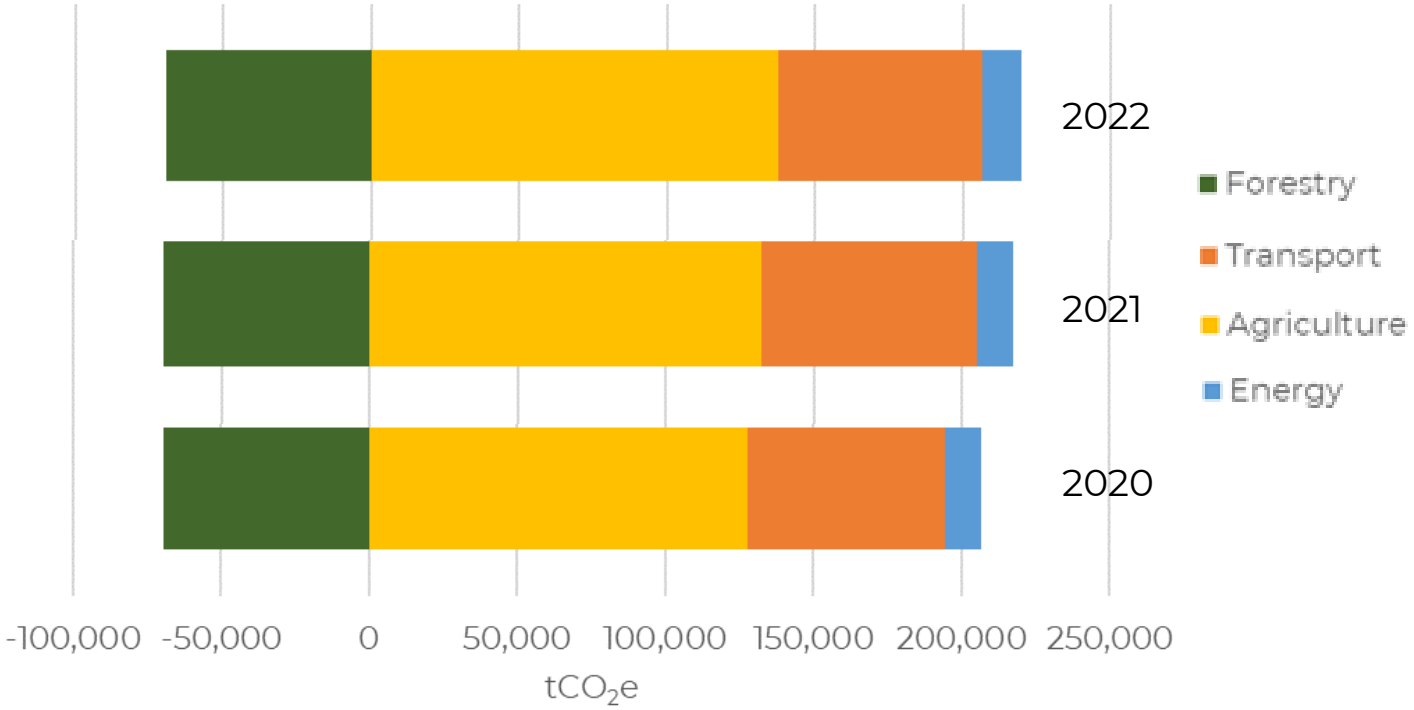
	Emissions (tCO_2e)	Change to previous year (%)
Transport	69,100	-4.7%
Energy	13,400	8.1%
Agriculture	137,000	3.6%
Forestry	-69,500	N/A
Net	150,000	1.6%

GHG emissions by sector in 2022 for the catchment. Forestry emissions are based on the most recent LUCAS data (from 2016).

Emissions within the catchment have increased since 2020.

The agriculture sector is the main contributor with 63% to the overall emissions of the catchment, followed by transport (31%).

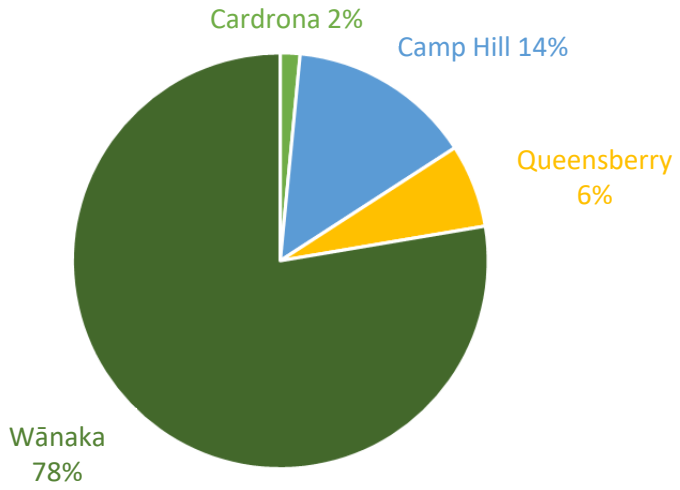
Agriculture emissions are dominated by the sheep, dairy, and beef industries. Data for this sector were obtained from StatsNZ census.



Agriculture – StatsNZ; Transport – Central Otago District Council
Energy – Aurora Energy, Forestry – LUCAS

Greenhouse Gas Emissions

Each sector can be analysed in more detail to understand where the largest contributing activities or sources exist.



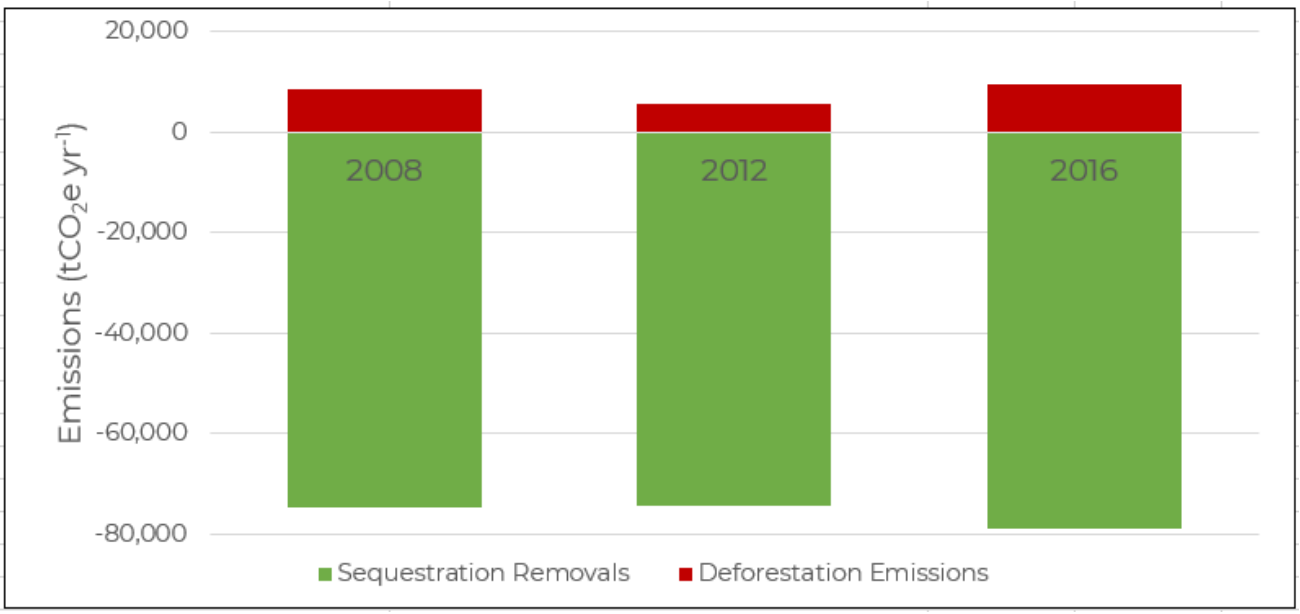
GHG emissions from the energy sector by location.

According to a survey conducted by the QLDC

80% of residents in the catchment stated that they were "concerned" or "very concerned" about the potential impacts of climate change.

To align with national climate change commitments and targets and to alleviate concern from residents increase in GHG emissions needs to be addressed across the sectors and catchment.

The forestry sector accounts for greenhouse gas removals in the catchment; as forests grow, they sequester carbon dioxide and act as a natural carbon sink. A small quantity of greenhouse gas emissions result from deforestation and harvesting of both natural and plantation forests: a loss of 10.3 ha of forestland in 2016 led to 9,500 tonnes of CO_2e emitted to the atmosphere.



GHG emissions and removals from the forestry sector.

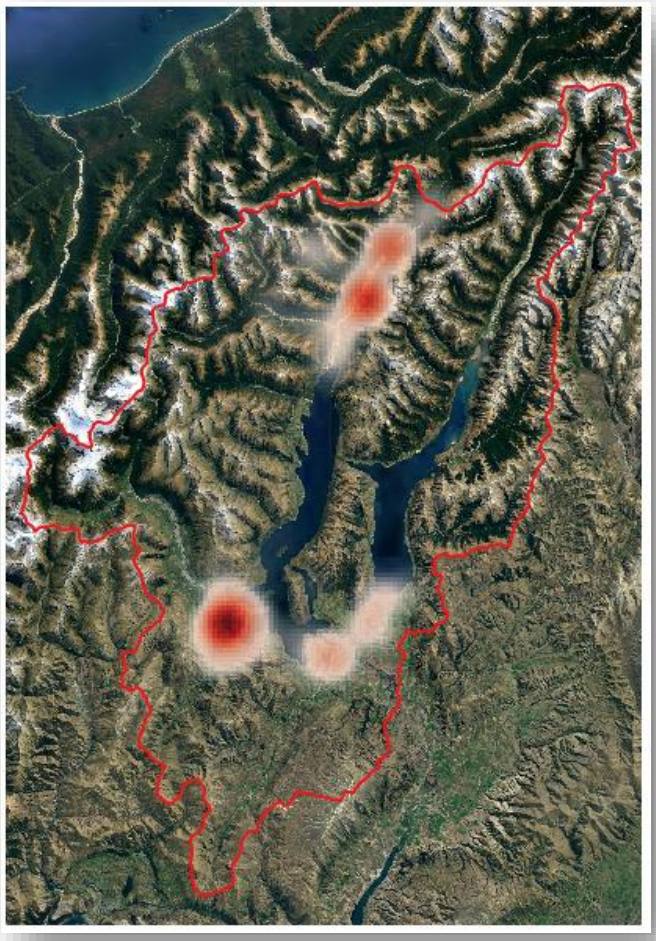
Agriculture – StatsNZ; Transport – Central Otago District Council
Energy – Aurora Energy, Forestry – LUCAS; QLDC Quality of Life survey

Invasive Species

New Zealand's biodiversity is unique: 100% of the country's frogs and reptiles, 90% of the insects, 80% of vascular plants, and 25% of bird species are only found in New Zealand[3].

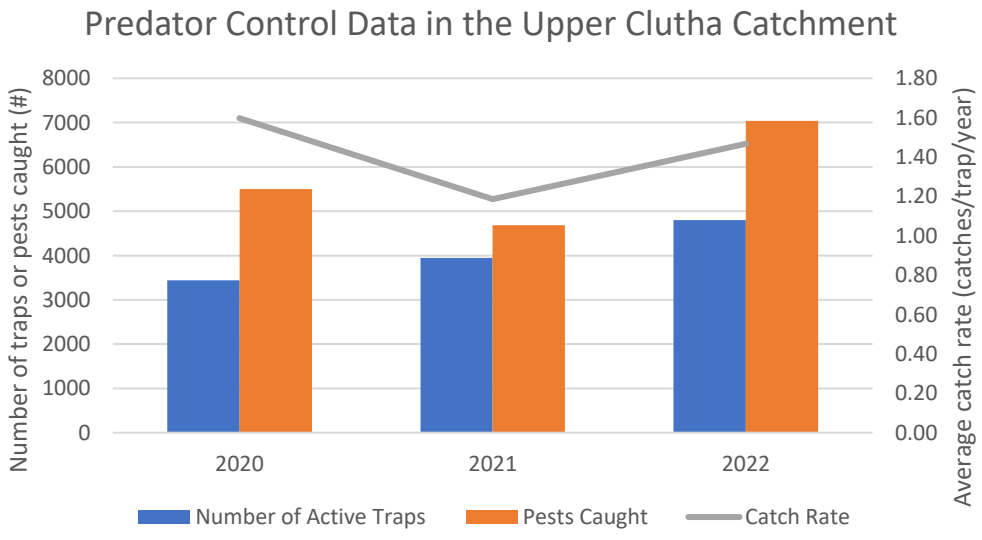
Invasive species are recognised as an important challenge in the catchment and greater region. The Otago Regional Council has classified 49 species[4] of plants and animals in the region as pests due to the threats they pose. With that we are home to a valuable ecosystem that needs protecting and restoring.

Monitoring the extent of invasive species can therefore provide an insight into the extent and control of threats to our ecosystems.



Pest control areas in the catchment.

Pest control efforts across the catchment have been on a steady increase the last three years, as the number of active traps (including automatic traps) across the catchment has been increasing.



Predator control data over the last three years.

The number of pests caught continues to increase as well, indicating that pest presence remains an issue.

Predator/pests – TrapNZ; Wilding conifers – WCIS

Invasive Species

The dominating pests caught in the catchment are rats (33%) followed by possums(17%).

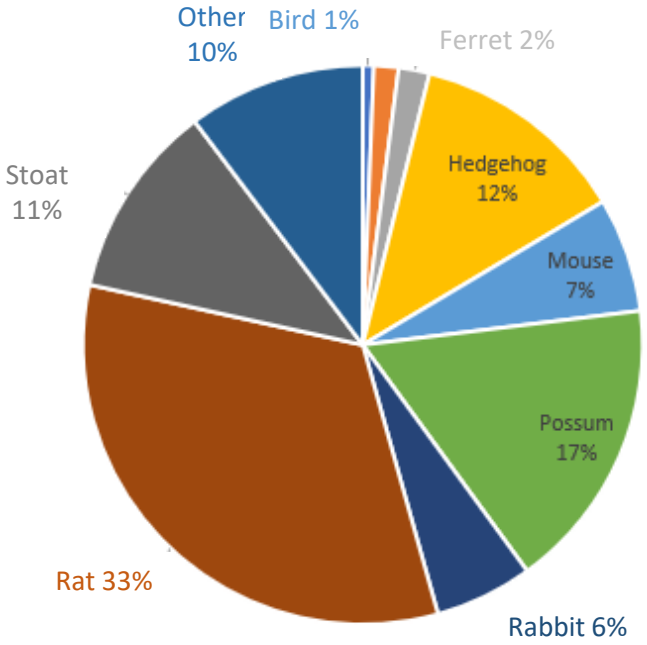
Continued efforts to control pests in the catchment is an important contribution to the national Predator Free 2050 goal, which is working towards an Aotearoa where our native species are safe from extinction and thrive alongside us.

503 Increase in the number of traps between 2020 and 2021

Wilding Conifers

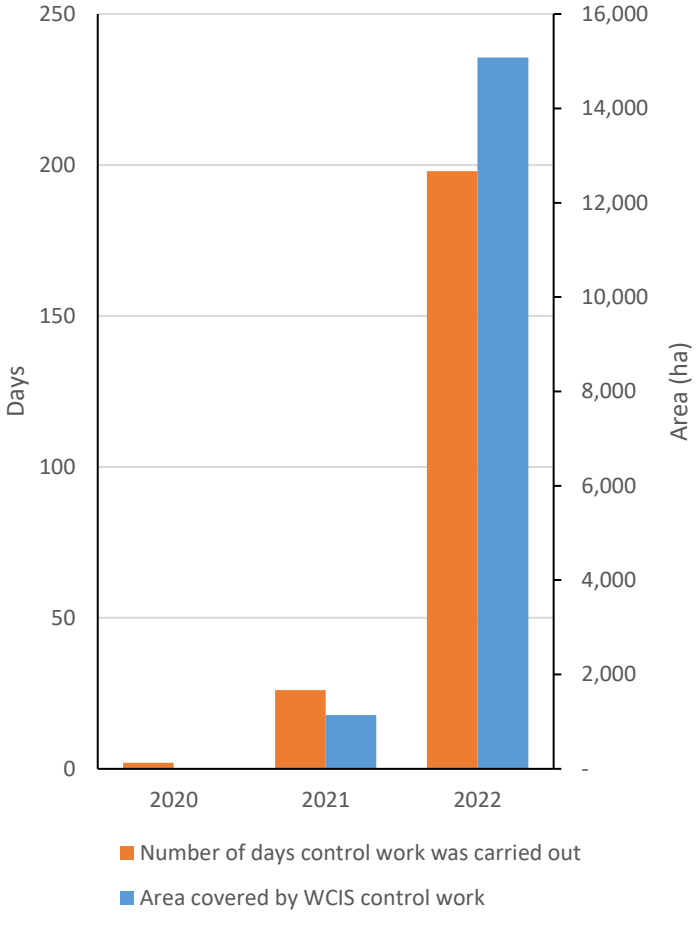
Wilding conifers are a threat to native plants and animals as they compete for sunlight and water. Particularly high-risk areas of wilding conifer invasion are the high country and tussock grasslands of the catchment which are further threatened by water demand and fire risk associated by the increase in wilding conifers. While WCIS, Whakatipu Wilding Conifer Control Group, and Central Otago Wilding Control Group continue their wilding pine management efforts, it is important to consider the increasing threat that spreading exotic forest cover may pose on the catchment.

The wilding data are currently only sourced from the WCIS, which only covers a fraction of the spatial extent of the catchment.



Type of pests being caught in traps across the catchment

855 Increase in the number of traps between 2021 and 2022.



Wilding pines control efforts by WCIS.

Predator/pests – TrapNZ; Wilding conifers – WCIS

Social Well-Being

Social well-being considers the social and economic aspects of catchment health, including:

- Community and Cultural Spirit
- Affordability
- Overall Quality of Life

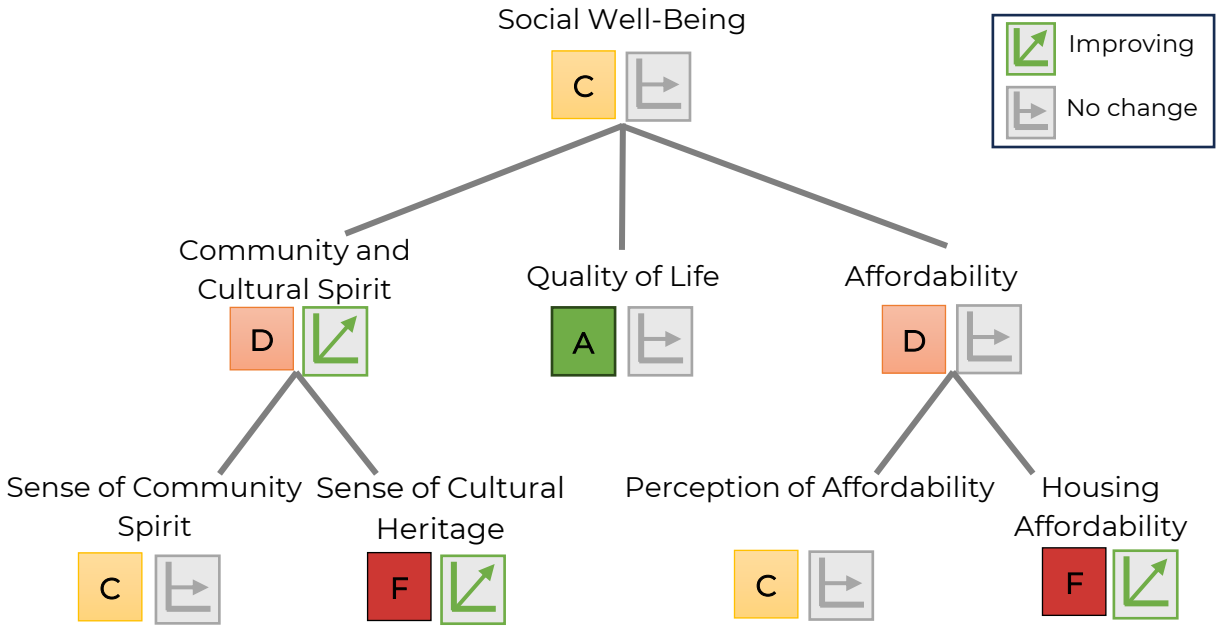
Monitoring social well-being is important, as social drivers have a key influence on other aspects of catchment health, including pest control, biodiversity, water quality and effective land use management.

The Queenstown Lake District Council conducts a 'Quality of Life Survey' annually to better understand what works well and what the challenges facing the residents in the district are. Data collected by this survey were used to derive social well-being rankings for the catchment.

C

Overall social well-being rank

Despite the low overall score, the sense of cultural heritage saw an improvement compared to the previous year, as more respondents reported being able to express their culture without feeling excluded from their community or neighbourhood. Nonetheless, just over one third of residents expressed satisfaction with the celebration of tangata whenua and Māori culture, which remains consistently low.



Rankings of the social well-being, including its different aspects.

QLDC Quality of Life survey

Social Well-Being

Various studies have been conducted to understand how the health of the environment we live in may impact the well-being of the people who live in it. Societies living in a flourishing, green environment may be more likely to thrive[5]. Wealthier societies may have more opportunities to invest in climate-aware lifestyle choices[6].

Māori health models, such as the concept of Te Whare Tapa Whā, illustrate the intimate link between the physical, spiritual and mental health of individuals with their communities and environment[7].

36% of survey respondents indicated that they had sufficient levels of disposable income after meeting all of their basic needs.

It is important to link social well-being to the other indicators presented in this report, to gain insights into how the health and happiness of the community may impact the catchment health.

82% of survey respondents stating their quality of life to be “good” or “extremely good”.

Spare income and spare time are vital requirements for residents of the catchment to be able to invest into caring for the environment; whether this is in the form of volunteer hours or financial donations to support ecological and environmental projects. Despite the high rank of the overall quality of life, the high cost of living and low affordability of housing pose significant threats for the future health of the catchment, as residents may simply be unable to afford to support improvements.

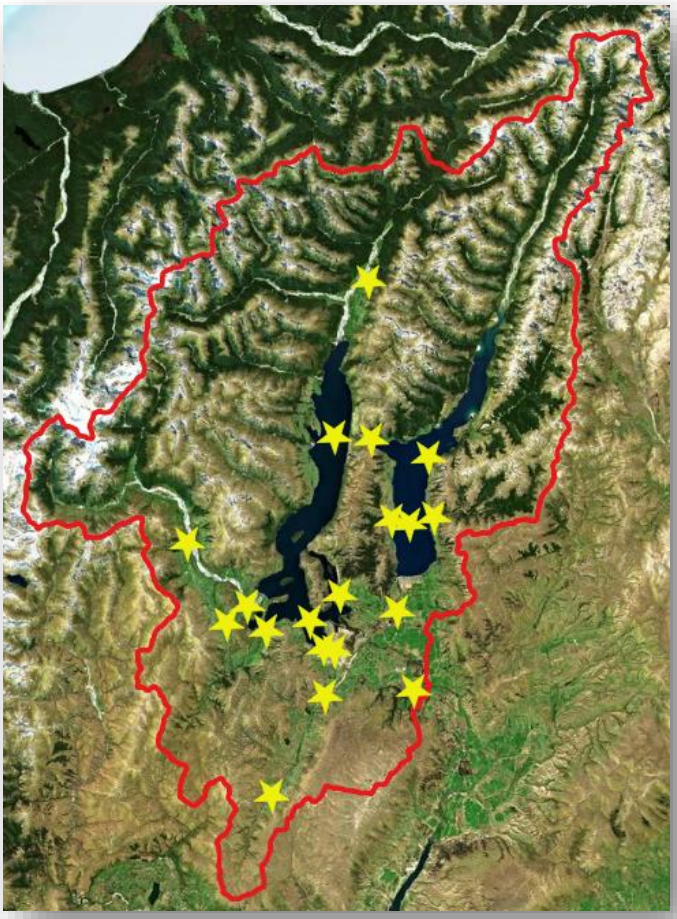
QLDC Quality of Life survey

Water Quality

Water quality rankings are provided for four parameters which were selected for their importance for ecosystem and human health:

- Total phosphorus
- Phytoplankton (chlorophyll-a)
- Escherichia coli
- Nitrate-nitrogen

Water quality was assessed in accordance with the guidelines provided by the National Policy Statement for Freshwater Management 2020 (NPS-FM), which ranks each parameter from A (good) to D or E (poor).



Water quality measurement sites .

While the parameters are being measured in both lake and rivers, NPS-FM provides guidelines that allow us to obtain quality ratings for total phosphorus and chlorophyll-a for lakes only, not rivers; rankings for nitrate can only be obtained for rivers not lakes.

		Definition
Phytoplankton (chlorophyll-a)	Ecosystem health	Chlorophyll-a is the green pigment in plants and algae that is used for photosynthesis and is a good indicator of the total amount of algae in a lake. Elevated chlorophyll-a concentrations can indicate nutrient enrichment (eutrophication), leading to algal blooms that disrupt the balance of aquatic life.
Total phosphorus		High levels of total phosphorus in water can come from either wastewater or run-off from agricultural land. Too much phosphorus can encourage the growth of nuisance plants such as algal blooms.
Nitrate-nitrogen		Nitrate-nitrogen is a very important plant nutrient but because it is highly water soluble, it leaches through soils and into groundwater very easily, particularly after heavy rainfall.
Escherichia coli	Human contact	E. coli (Escherichia coli) is an indicator of the faecal contamination and the presence of disease-causing organisms. Common sources of E. coli bacteria are human wastewater discharges, animal waste, bird droppings and stormwater run-off. E. coli is harmful to human health in high concentrations.

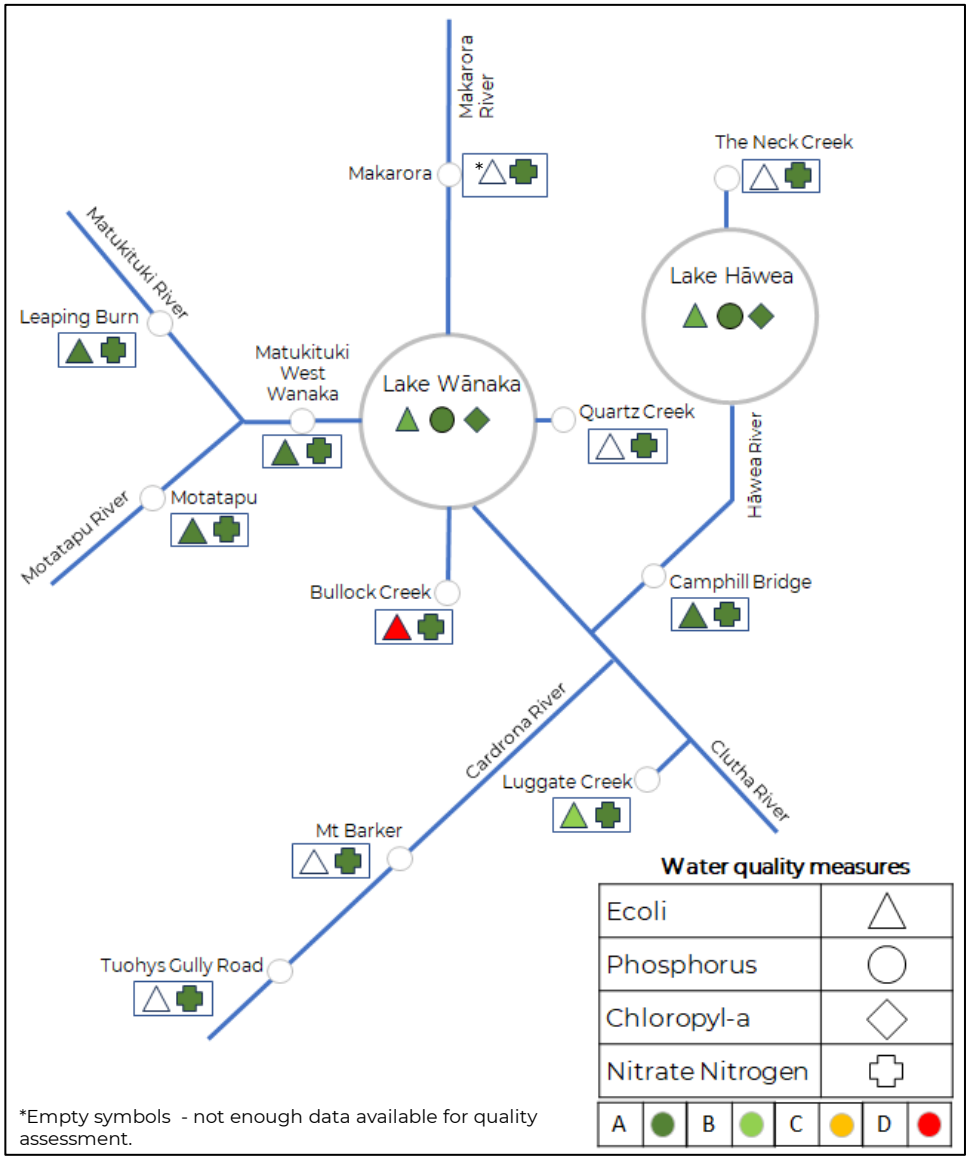
Water quality parameters included in this report.

ORC Environmental Portal; Land Air Water Aotearoa (LAWA)

Water Quality

Monitoring water quality parameters provides a comprehensive understanding of the health of aquatic systems, their impact on human well-being, and the need for sustainable environmental management practices.

- Monitoring nitrate levels helps manage agricultural practices to minimise pollution and protect water resources;
- Monitoring E.coli ensures that water sources are safe for recreational activities, drinking, and agricultural use;
- Monitoring chlorophyll-a levels provides insight into the overall health of aquatic ecosystems;
- Monitoring total phosphorus allows for early detection of potential threats to native species and habitats and it helps to identify and manage nutrient pollution, preventing detrimental effects, such as an ecological imbalance characterised by harmful algal blooms and oxygen depletion.



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[ORC Environmental Portal](); Land Air Water Aotearoa ([LAWA]())

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10. Queenstown Lakes Climate and Biodiversity Plan 2022-2025 – https://www.qldc.govt.nz/media/ie3jk5bb/qldc_climate-and-biodiversity-plan_jun22-web.pdf

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