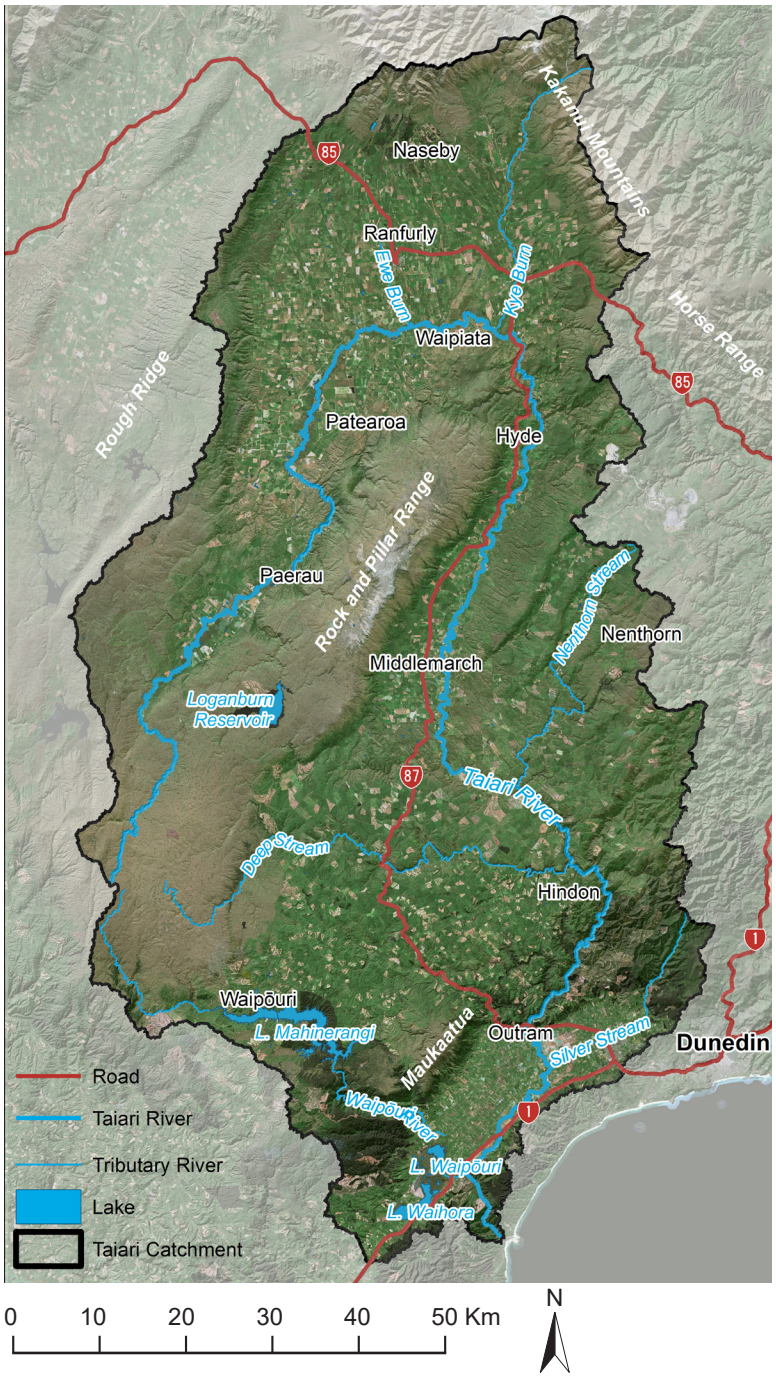
Climate change impacts and risks for the Taiari catchment



The Taiari catchment, showing the course of the Taiari River and its main tributaries. Wherever possible, the correct spelling for traditional Kāi Tahu names like Taiari and Māniatoto are used.

Introduction

DOC's Ngā Awa river restoration programme aims to restore the Taiari and 13 other New Zealand rivers in partnership with mana whenua. The information in this brochure summarises a 2023 report (prepared by GHC Consulting) which compiles current research on climate change impacts and risks to freshwater ecosystems of the Taiari. The original report can be accessed through the web links at the end of this brochure.

Work to better understand the risks to waterways in the Taiari catchment is ongoing, along with a range of projects to increase climate change resilience and protect biodiversity.

The Taiari catchment

The Taiari River is the second-largest river in Otago, flowing for more than 280 km. It drains the eastern Otago uplands and follows an almost circular path from its source, north towards Ranfurly, before turning south and passing through the Strath Taiari and Lower Taiari Plain on its way to the Pacific Ocean.

Waterways in the Taiari catchment

There are three distinct areas within the Taiari catchment, each with their own climate, and hydrological characteristics:

- The Māniatoto has a harsh dry climate and boasts some regionally significant wetlands. Irrigation plays a major part in sustaining agriculture. Major tributaries include the Kyeburn and the Loganburn.
- The Strath Taiari Plain is more confined between mountain ranges, and its climate also alternates between extreme summer heat and winter cold. Although rainfall is less than on the coast, irrigation helps to keep the valley reasonably green.
- The Lower Taiari Plain has a milder, maritime climate. The Taiari and its tributaries present a high flood risk at times, with human-engineered flood banks altering the natural characteristics of the river. A lake & wetland complex dominates the lower end of the plain. The Silver Stream enters the plain from the north near Mosgiel and the Waipōuri River joins the Taiari near Henley in the south.

Department of Conservation Te Papa Atawhai
GHC CONSULTING LTD
Ngā Awa river restoration

Climate change impacts

Predicted changes in climate and river flows across the Taiari catchment will have a significant impact on local ecosystems and communities. The likely impacts of climate change are summarised below, by upper, mid and lower catchment. The information presented here is summarised from a range of sources, including a report prepared by NIWA for the Otago Regional Council in 2019 (Climate Change Projections for the Otago Region).

Māniatoto basin

- Historical records show average air temperature increased by about 1.5°C since 1923. Average temperature is predicted to increase by 1 to 3°C by the 2090's.
- Between 6 and 30 additional 'extreme' hot days (>30°C) are predicted by the 2090's, and fewer frosts.
- Ranfurly rainfall records extend back to 1897. Average rainfall is 450mm/year, and no obvious trend is apparent.
- Average rainfall is predicted to increase by 5 to 10% by the 2090's, and rainfall intensity and seasonality is also predicted to increase.
- More dry days are likely around Ranfurly and upstream of Paerau.
- There will be less water in tributary streams during extended dry periods, particularly those draining from the Kakanui Mountains.
- High flow events may be larger and occur more frequently. Extreme and highly disruptive flood events may also occur more often.

The Māniatoto Basin wetlands, part of the Upper Taiari Wetlands Complex (GHC)

Lower Taiari Plain

- Records from Dunedin Airport show average temperature has increased by more than 1°C since 1960. Average temperature is predicted to increase by another 1.5 to 2.5°C by the 2090's.
- On the plain, 4 to 20 additional 'extreme' hot days are expected by the 2090's. Smaller increases are expected on the surrounding ranges.
- Average rainfall and rainfall intensity (storms) has increased since about 1950. Average rainfall is predicted to increase by 5-15% by the 2090's and storm events are likely to become more frequent and intense.
- High flows will continue to have an impact on the Lower Taieri Plain, both in the main stem and major tributaries such as the Silver Stream.

Examples of current land use on the lower Taiari Plain – intensive farming, wetlands and forestry (GHC)

Strath Taiari

- Average temperature is predicted to increase by 1 to 2.5°C by the 2090's.
- Between 4 and 20 additional 'extreme' hot days are expected by the 2090's, with 20 to 30 fewer frost days.
- Rainfall records from Middlemarch extend back to 1909. Average rainfall is about 500mm/year, with no obvious trends over this time.
- Average rainfall is predicted to increase by 5 to 10% by the 2090's, and rainfall intensity (storm events) is also predicted to increase.
- Fewer dry days are likely on the eastern side of the basin, with more dry days further west.
- There will generally be less water in the Taiari River and its tributaries during extended dry periods, but high flow and flood events may be larger.

The Taiari River winding through the Strath Taiari (GHC)

Climate change risks

Previous research has found that the highest risks to waterways in Otago will be those associated with increasing temperatures, and changes in rainfall, drought, and extreme weather events. The following tables show the key drivers of risk for waterways by the middle of this century (2040) and late century (2090). The four risk ratings used are Low, Medium, High and Extreme. The information presented here is summarised from a range of sources, including a report prepared by Tonkin & Taylor in 2021 (Otago Climate Change Risk Assessment).

	Risk rating		
Risk to alpine wetlands due to:	**Present**	**2040**	**2090**
▶ Higher temperature	M	H	E
▶ Drought and changes in rainfall	M	E	E
▶ Reduced snow and ice	H	E	E

Risk to river water quantity & quality due to:	**Present**	**2040**	**2090**
▶ Changes in rainfall, drought and higher temperature	L	H	E
▶ Inland flooding, reduced snow and ice	M	E	E

Risk to inland wetland ecosystems due to:	**Present**	**2040**	**2090**
▶ Higher temperature	L	M	E
▶ Drought	M	M	E
▶ Changes in rainfall	M	H	E

Risk to native ecosystems & species due to:	**Present**	**2040**	**2090**
▶ Changes in rainfall and drought	L	L	M
▶ Higher temperature	M	M	E
▶ Extreme weather events (floods)	M	H	E

Risk to coastal wetland ecosystems due to:	**Present**	**2040**	**2090**
▶ Drought	L	L	H
▶ Changes in rainfall	L	M	E
▶ Salinity stress and sea level rise	L	H	E

Taiari River at Tiroiti (GHC)

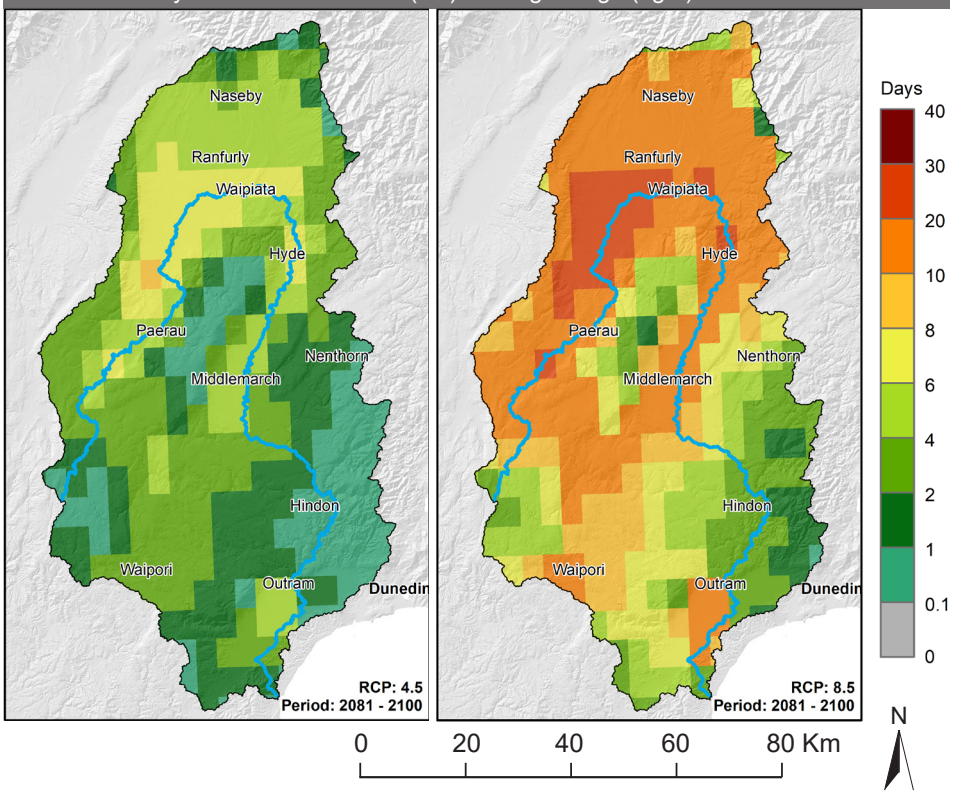
Case study: Heat, drought and low flow in the Māniatoto Basin

The number of extreme hot days (>30°C) in the Māniatoto Basin is predicted to increase by up to 30 days by 2090, depending on future greenhouse gas emissions. There is likely to be a seasonal trend, with most hot days occurring in summer when flows are at their lowest and demand for irrigation is at its peak. The number of dry days each year is also predicted to increase.

The risks associated with climate change may be extreme for waterways in the Māniatoto, which already experience hot dry conditions.

Drought: Lower flows are expected in the Taiari River and its tributaries due to extended/ warmer temperatures, and dry spells and drought. Water quality is closely linked to the amount of flow in the river, with low flows resulting in less frequent flushing of sediment and nutrient, with negative impacts on native ecosystems and species.

The maps show the predicted increase in the number of extreme hot days in the Taiari catchment by 2090 under low-mid (left) and high range (right) emission scenarios.



Flood flows: Extreme weather events (storms) and associated flooding and may lead to large injections of sediment and organic detritus into rivers and lake. This will increase the available nutrients for algal and macrophyte growth that may contribute to water quality deterioration.

Wetlands: The alpine and inland scroll plain wetlands in the Māniatoto are home to rare native fish and plants, and are unique both nationally and internationally. As shown on the previous page, alpine wetlands are at extreme risk due to changes in rainfall and temperature, and reduced snow and ice.

Wetlands offer a vast array of ecosystem services including flood mitigation and carbon storage. Wetland protection and restoration is therefore an excellent management response to increase resilience to climate change and contribute to mitigation of climate change.

Summary: Finding innovative ways to mitigate these types of risk should be a priority, to ensure that our waterways are resilient, and that they can continue to support important aquatic ecosystems and human activities.

More information can be accessed through the web links below.

Direct link to GHC report (TBC)

https://www.doc.govt.nz/our-work/freshwater-restoration/nga-awa/

https://www.lakestoriesnz.org/taiari