Climate-Related Resilience in an Alpine Tourism Destination: Aoraki/Mount Cook National Park

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Abstract: Alpine national parks are among the most climate-sensitive tourism landscapes, and Aoraki/Mount Cook National Park exemplifies how rapidly changing biophysical conditions are reshaping the foundations of destination management in Aotearoa New Zealand. Accelerated glacier retreat, unstable hydrological regimes, and increasingly variable weather patterns are altering access, damaging infrastructure, and challenging long-held assumptions about the stability of iconic alpine environments. While these shifts are well documented in scientific and hazard-management reports, far less is known about how such pressures are interpreted within the policy and planning documents that guide tourism and conservation decision-making. This paper addresses that gap through a qualitative document analysis of management plans, climate reports, visitor strategy materials and monitoring outputs drawn from institutional sources from 2005 onwards, offering a more contextualised understanding of how resilience is currently framed. The findings reveal a protected-area system in transition. Environmental change is clearly recognised across technical reports, yet its implications for tourism operations, visitor experience and long-term planning are not always addressed consistently across the document set. The term "resilience" appears in parts of the documents analysed, but it is applied in different ways, including in relation to hazard and visitor-safety management, infrastructure maintenance, and broader adaptation planning. An integrated framing that links climate projections to destination-level planning is not consistently evident, suggesting scope for clearer alignment between long-term risk information and day-to-day management decisions. At the same time, the document record highlights opportunities for reimagining visitor engagement, strengthening interpretation, and aligning future planning more closely with mana whenua values and cultural responsibilities. By situating Aoraki/Mount Cook National Park within broader scholarship on climate-related destination resilience, this study contributes a grounded analysis of how institutional narratives shape adaptation pathways in non-ski alpine tourism settings. It underscores the need for more coordinated, forward-looking and culturally grounded approaches capable of responding to ongoing environmental change in one of New Zealand's most iconic protected landscapes.

Keywords: Aoraki/Mount Cook National Park; Alpine Tourism; Climate Resilience; Glacier Retreat; Hydrological Change; Policy Framing

1. Introduction

Alpine protected areas are recognised as some of the most climate-sensitive tourism environments. Their biophysical systems respond quickly to warmer temperatures, altered precipitation and changing seasonal hydrology, making them visible indicators of wider environmental shifts. Across mountain regions, researchers describe rapid glacier retreat, unstable river systems, more variable snowfall and ecological transitions that reshape habitats and visitor landscapes. These shifts affect access and visitor safety.

Aotearoa New Zealand illustrates this challenge clearly. Alpine national parks form a core part of the country's tourism offering, and Aoraki/Mount Cook National Park is one of its most recognisable destinations. The park holds deep cultural significance within Te Ao Māori and supports a wide range of backcountry and adventure activities. As shown in Figure 1, Aoraki/Mount Cook National Park is located within the central Southern Alps of Aotearoa New Zealand. Its high elevation, extensive glaciated valleys and fast-changing weather systems also make it one of the country's most exposed places in a warming climate. The scientific assessments describe ongoing glacier change in the Southern Alps (Chinn et al., 2012; Willsman and Macara, 2020). National policy documents note that climate change is expected to increase the frequency and severity of some natural hazards, including flooding, which has implications for long-term planning in exposed environments (Ministry for the Environment, 2022). These shifts are likely to affect visitor access and raise questions about the longer-term continuity of tourism in the park.

International work shows that climate change does not affect mountain destinations in a uniform way. Early studies focused largely on ski tourism, yet many non-ski alpine settings now face equal or greater exposure. Reduced snow reliability, slope instability, infrastructure vulnerability and shifting visitor expectations are common themes across Europe, North America and Asia. However, these pressures appear differently in places like Aoraki/Mount Cook, where tourism depends on landscape aesthetics, glacier views and year-round mobility rather than winter sport economies. The distinctive conditions of the Southern Alps therefore produce their own management challenges.

Resilience has become a central concept for interpreting these pressures and is increasingly discussed in tourism research and protected-area management and governance (Holling, 1973; Walker et al., 2004; Lew, 2014; Espiner and Becken, 2014). In tourism and environmental planning, resilience refers to a destination's capacity to absorb disturbances, reorganise and continue functioning as conditions change. Across the documents analysed, the term is used with different emphases. Some texts focus on practical and operational concerns, such as maintaining tracks and managing visitor safety, while others refer more broadly to longer-term adaptation. In a national-park context, these framings are considered alongside statutory conservation obligations, mana whenua relationships and visitor expectations of meaningful but safe outdoor experiences.

Although climate resilience features prominently in national policy discussions (Ministry for the Environment, 2022), it is less clear how these priorities are carried through into tourism management in New Zealand's national parks. Much existing research reports climate impacts at national or regional scales, including evidence relevant to the Southern Alps (Chinn et al., 2012; Willsman and Macara, 2020), while fewer tourism-focused studies examine how individual parks translate climate risk information into visitor and infrastructure decisions. In New Zealand, tourism resilience research has been shaped by disruptive events and recovery processes (Orchiston and Higham, 2016), alongside a developing body of work on slower-onset landscape change such as glacier retreat (Strong et al., 2023). While adaptive governance and social-ecological resilience frameworks are well established conceptually (Holling, 1973; Walker et al., 2004), they are not always explicit in day-to-day planning and visitor-facing materials. Together, this points to the value of more place-based research on how parks such as Aoraki/Mount Cook identify vulnerabilities, prioritise responses and connect resilience principles to strategic and operational decisions.

This paper addresses these gaps through a qualitative analysis of available policy and environmental documents. The aim is to examine how resilience is framed across management plans, visitor strategies, scientific reports and monitoring materials, and to identify the climate-related pressures most relevant to the long-term sustainability of Aoraki/Mount Cook. By analysing how institutions describe ecological, operational and experiential aspects of resilience, the study contributes to discussions about how alpine tourism destinations adapt under accelerating environmental change.

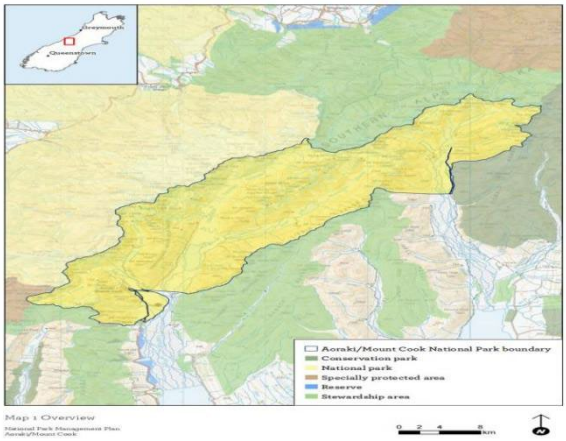

Figure 1. Location of Aoraki/Mount Cook National Park in the Southern Alps of New Zealand.

Source: Department of Conservation (DOC) overview map.

2. Literature Review

Climate change is now recognised as one of the most significant pressures shaping tourism destinations that depend on sensitive mountain landscapes. The tourism-climate change literature highlights glacier retreat, reduced snow reliability and increasing slope instability, all of which may affect access, infrastructure and visitor behaviour (Becken, 2013). Climate-related risks are widely discussed in relation to snow and ski-dependent tourism, and they also apply to nature-based alpine destinations where access and outdoor mobility shape visitor experiences (Scott, Hall and Gössling, 2012).

A core theme in this literature is the need to understand not only biophysical change but also the social and institutional systems through which tourism operates. Resilience provides a useful conceptual foundation for this work, referring to a system's capacity to absorb disturbance, adapt to change and continue functioning over

time (Holling, 1973; Walker et al., 2004). In tourism research, resilience thinking has been applied to questions of infrastructure vulnerability, risk governance and the adaptive capacity of organisations responsible for managing protected landscapes.

New Zealand has contributed substantially to this growing field. Some of the existing work focuses on short-term disruptions, such as earthquakes, which often act as catalysts for rethinking tourism practices (Orchiston and Higham, 2016). However, this emphasis on sudden shocks means that slower, cumulative changes in alpine environments have received comparatively less attention. Research in Glacier Country has applied the Tourism Adaptation Classification (TAC) framework to examine tourism adaptation responses associated with glacier change (Strong et al., 2023). These studies show that climate change affects not only physical landscapes but also the strategic decisions that shape tourism development.

Aoraki/Mount Cook National Park occupies a distinctive place. The park is characterised by rapid glacial change, unstable hydrological systems and highly variable weather conditions, yet published work is often oriented towards biophysical assessment, with tourism implications less consistently discussed. Although scientific work documents long-term glacier change in the Southern Alps, including shifts in ice volume and glacier-balance fluctuations (Chinn et al., 2012; Fitzharris, Chinn and Lamont, 1997), fewer studies examine how these dynamics intersect with visitor flows, infrastructure planning or destination management. This creates a gap in understanding how national parks interpret climate pressures and how these interpretations shape tourism strategy.

Institutional perspectives on resilience are important in protected-area tourism and management. Research on protected-area tourism has used resilience and vulnerability concepts to interpret destination pressures and responses (Espiner and Becken, 2014). In the documents analysed for this study, “resilience” is used in different ways, for example in relation to ecological protection, hazard and visitor-safety management, operational continuity and longer-term adaptation planning. These differences matter because they influence how risks are translated into action and how trade-offs are negotiated between conservation goals and tourism needs. Across the document set, some materials prioritise technical responses such as track reinforcement or realignment, whereas others highlight the need to build organisational capacity, strengthen decision-making processes or engage more closely with local communities and mana whenua (Robb, Harmsworth and Awatere, 2015).

Another relevant strand of literature considers visitor experience under environmental change. In climate-sensitive protected areas, shifting weather and hazard conditions can limit mobility, heighten safety concerns and alter the character of visits (Scott, Hall and Gössling, 2012). In Aoraki/Mount Cook, where glacier views and alpine terrain are central to the tourism offer, these dynamics can affect visitor experience. In the documents analysed for this study, the emphasis is largely on infrastructure and visitor safety, while experience-related considerations are discussed less explicitly.

Overall, existing scholarship demonstrates progress in understanding climate impacts on mountain tourism, but less attention is paid to how specific destinations articulate vulnerabilities and frame resilience within their institutional planning and management documents. This study contributes by examining how Aoraki/Mount Cook is represented across a suite of available plans, policy materials and scientific reports, offering a contextualised view of resilience in a changing alpine environment.

3. Methodology

This study uses a qualitative research design centred on document analysis. This method is suited to understanding long-term climate pressures in alpine environments, where statutory planning frameworks influence adaptation decisions. Rather than collecting primary data or conducting fieldwork, the analysis focuses on how institutions interpret climate-related risks through the policy and scientific documents that guide management in Aoraki/Mount Cook National Park. The aim is to understand how resilience is described and applied across the texts that shape destination planning.

Document analysis is widely used in tourism and environmental research, especially where governance arrangements play a major role in shaping adaptation pathways. This is particularly relevant for Aoraki/Mount Cook because the Department of Conservation oversees both conservation and visitor management. Its strategies, plans and technical guidance offer insight into how climate pressures are framed and which forms of resilience are prioritised. Scientific reports on glacier change and related environmental monitoring provide a complementary record of environmental trends that influence policy responses (Chinn et al., 2012; Willsman

and Macara, 2020). Considering these materials together enables a more grounded interpretation of how tourism, conservation and environmental risk intersect.

The document set includes management plans, climate guidance, visitor safety protocols, glacier monitoring reports, hydrological assessments and national adaptation frameworks produced from 2005 onwards. Documents are included when they remain foundational to current practice, particularly in relation to statutory obligations. The study also draws on selected environmental datasets, such as glacier volume estimates and seasonal weather summaries, to contextualise emerging themes. These datasets are not analysed quantitatively but help situate institutional narratives within the wider environmental trajectory of the Southern Alps.

Analysis followed an inductive thematic process. Each document was read multiple times to identify recurring ideas, assumptions and patterns in the language used to describe climate pressures and resilience. Manual coding supported close engagement with how documents interpret glacier retreat, hydrological change, slope instability and visitor risk. As themes stabilised, cross-document comparisons helped assess coherence and highlight gaps or inconsistencies. Particular attention was paid to how ecological, operational and experiential dimensions of resilience were framed and whether tourism considerations were integrated or treated separately.

Credibility was supported through repeated reading and comparison across publicly available documents, with themes refined as patterns emerged. Scientific summaries were consulted where relevant to provide contextual background. No ethics approval was required. As with all document-based research, the findings reflect institutional perspectives and constraints, which are acknowledged as part of the narratives shaping climate adaptation in Aoraki/Mount Cook.

4. Findings

The analysis shows that Aoraki/Mount Cook National Park is experiencing a set of climate pressures that appear consistently across policy, management and scientific documents. Although the texts vary in scope and purpose, they describe a landscape undergoing rapid physical change and a management system still adapting to these shifts. Four themes were most prominent: glacier retreat and the reshaping of landscape identity, hydrological and geomorphological change affecting access and infrastructure, increasing weather-related instability, and evolving but uneven institutional framings of resilience.

4.1 Glacier Retreat and Shifting Landscape Conditions

Scientific and monitoring reports document substantial glacier ice loss in the Southern Alps, including the Aoraki/Mount Cook region. Over recent decades, Southern Alps glaciers have shown sustained thinning and retreat, consistent with long-term ice-volume estimates and monitoring evidence (Chinn et al., 2012; Willsman and Macara, 2020). This pattern is presented as a continuing environmental pressure in alpine settings rather than a short-lived fluctuation. For a national park where glacier landscapes are a key component of visitor appeal, ongoing retreat has implications beyond biophysical change and is relevant to tourism and destination management. Changes in glacier extent, glacier termini and related proglacial features may influence where visitors can safely access and what can be viewed at key sites. Taken together, these documents frame glacier change as an ongoing process, suggesting that planning needs to account for continued landscape transformation alongside shorter-term hazard management (Chinn et al., 2012; Willsman and Macara, 2020).

4.2 Hydrological Change, Sediment Movement and Infrastructure Vulnerability

Hydrological and geomorphological pressures recur across the documents analysed. National policy documents indicate that climate change is expected to increase the frequency and severity of some extreme weather hazards, including flooding, with implications for long-term planning in exposed environments (Ministry for the Environment, 2022). The Waitaki catchment regional plan notes that river management and environmental flow decisions need to consider sediment transport, bank erosion, siltation and flood management. It also recognises that planning needs to balance these considerations with values such as accessibility and recreation (Waitaki Catchment Water Allocation Board, 2005). Within the Aoraki/Mount Cook material, DOC track information outlines the track network and provides practical information to support safe track selection and use, including track grades, indicative maps and safety guidance. In places, it also describes access features such as bridges and route options within the track network (Department of Conservation, 2022). Across the document set, responses focus mainly on practical access and risk management. However, the documents do not consistently link longer-

term climate-risk signals to operational guidance on infrastructure and access, suggesting scope to strengthen this connection.

4.3 Weather Variability, Access Disruption and Visitor Safety

A third theme relates to weather-related disruption and the implications for safe access. DOC visitor information for Aoraki/Mount Cook emphasises that alpine weather and track conditions can change quickly and highlights the importance of preparedness and safety when using the track network (Department of Conservation, 2022). Avalanche risk is also treated as a recurring constraint on safe access, with DOC safety guidance noting that some routes may be unsuitable or require temporary closure during higher-risk periods (Department of Conservation, 2010).

For visitors, these conditions may require flexibility in trip planning and day-to-day movement through the park. While safety procedures and hazard awareness are clearly communicated, the materials reviewed provide less explicit detail on how weather and hazard-related disruption may shift over time, or on how visitor management systems anticipate and manage interruptions.

4.4 Institutional Framings of Resilience

Research on protected-area tourism has used resilience and vulnerability concepts to interpret destination pressures and responses (Espiner and Becken, 2014). In the materials analysed for this study, the term "resilience" appears in parts of the document set and is used with different emphases, including ecological protection, operational management and longer-term adaptation planning. Some texts emphasise ecological resilience and the capacity of natural systems to accommodate change. Others foreground more operational concerns, particularly visitor safety, hazard management and the practical management of access in rapidly shifting alpine conditions (Department of Conservation, 2010; 2022). These differences highlight the difficulty of translating broad resilience ideas into day-to-day decision-making.

While infrastructure vulnerability is discussed in detail in parts of the document set, its implications for visitor experience and long-term product development are less consistently articulated. Similarly, although co-management and collaboration with mana whenua are acknowledged in the materials reviewed, the integration of cultural values into climate-related resilience framings is not always made explicit, pointing to opportunities for more holistic approaches.

5. Discussion

The findings show that Aoraki/Mount Cook National Park is already experiencing climate pressures that reshape both its landscapes and its management narratives. Read alongside wider work on climate change, destination resilience and alpine tourism, several implications emerge for how resilience is understood and applied in practice.

First, the link between environmental monitoring and tourism planning appears only partly developed. Scientific and monitoring sources document glacier retreat and related environmental change in considerable detail (Chinn et al., 2012; Willsman and Macara, 2020). National policy material also signals that climate change is altering hazard profiles, including flooding risk, with implications for long-term decision-making in exposed environments (Ministry for the Environment, 2022). Regional planning for the Waitaki catchment further highlights that river and flow management needs to take account of bedload and sediment transport processes, shoreline or bank erosion, and flood management, alongside values such as recreation opportunities and accessibility (Waitaki Catchment Water Allocation Board, 2005). However, these insights are not always translated into destination strategy. Related tourism–climate research also notes ongoing challenges in translating climate-risk information into tourism planning and infrastructure decisions (Scott, Hall and Gössling, 2012; Becken, 2013). At Aoraki/Mount Cook, management documents acknowledge climate impacts, but tourism consequences are often implied rather than clearly articulated. This constrains efforts to move from reactive maintenance toward anticipatory adaptation.

Second, the pace and character of change complicate institutional understandings of resilience. Glacier retreat and hydrological shifts are described as long-term trends, yet their implications are often communicated to visitors and managers through practical access information, including changing track conditions, occasional temporary closures and safety messaging. Resilience theory suggests that social and ecological systems need to absorb disturbance while retaining core functions and, where necessary, reorganise in response to new

conditions (Holling, 1973; Walker et al., 2004). The document record for Aoraki/Mount Cook indicates movement in this direction, but many responses still centre on repairing damage after events rather than using recurring disruptions to redesign access or reconsider infrastructure locations.

Third, resilience is not always translated into practice consistently across the document set. This draws on protected-area tourism scholarship that uses resilience to interpret destination pressures and responses, and that has proposed conceptual models to articulate how resilience can be considered alongside sustainability in tourism contexts (Espiner and Becken, 2014; Espiner, Orchiston and Higham, 2017). At Aoraki/Mount Cook, hazard-management materials are often more operationally detailed, while higher-level policy and strategy documents tend to describe climate pressures in broader terms. Without a shared framework that links these strands, resilience may remain a broad organising concept rather than a clear basis for destination governance.

The discussion also points to the importance of governance and cultural context. Across the statutory and planning materials reviewed, collaboration with mana whenua is acknowledged, but clear, document-level links between climate-related resilience priorities and Māori values, perspectives and collaborative planning priorities are not consistently set out. Work on adaptive governance highlights that durable resilience requires diverse knowledge systems and an ethic of long-term stewardship (Harmsworth, Awatere and Robb, 2016; Ministry for the Environment, 2022). Stronger connections between climate planning and Te Ao Māori perspectives would help ensure that adaptation pathways respect both environmental limits and cultural responsibilities.

Finally, the findings underline a tension between maintaining visitor access and acknowledging the limits imposed by a rapidly changing alpine environment. Aoraki/Mount Cook's appeal rests on glacier views, scenic valleys and relatively easy access to high mountain landscapes, yet these attributes are becoming less predictable. Research in Glacier Country suggests that similar destinations are beginning to reconsider what sustainable visitor experience means when iconic features are in flux (Strong et al., 2023). For Aoraki/Mount Cook, this points to the need for a more explicit, place-based resilience framework that links environmental monitoring, hazard management, tourism planning and mana whenua values. Such an approach would move beyond documenting change toward shaping a coherent, forward-looking response that matches the scale of the climate pressures now evident in the park.

6. Practical and Theoretical Implications

This paper highlights practical and conceptual implications for climate adaptation in alpine protected-area tourism destinations. Resilience planning for Aoraki/Mount Cook needs to account for interacting pressures, including glacier retreat, hydrological instability and increasing weather variability, which can affect access, infrastructure reliability and visitor safety. This points to the value of proactive monitoring and more anticipatory planning. Conceptually, the analysis shows that "resilience" is widely invoked but applied with different emphases across institutional documents, shaping which risks are prioritised and which responses are considered legitimate, while cultural values and visitor experience remain less explicitly integrated into climate-response planning.

7. Conclusion and Future Directions

Aoraki/Mount Cook National Park is already experiencing climate change rather than waiting for it. Glacier loss, hydrological and geomorphological pressures are changing the conditions under which visitors travel and managers plan. This study used qualitative document analysis to show how these pressures are currently framed and how ideas of resilience appear across policy, scientific and visitor-focused texts.

The findings point to clear awareness of environmental change but only partial integration of climate knowledge into tourism strategy. Resilience is used in many ways yet still lacks a coherent role within destination governance. At the same time, the documents suggest opportunities for more adaptive, culturally grounded approaches that work closely with mana whenua and give visitors a clearer sense of shared responsibility.

Future research could extend this work by incorporating stakeholder perspectives and by comparing Aoraki/Mount Cook with other alpine destinations, both within the Southern Alps and internationally.

Acknowledgements

The author thanks the ICTR reviewers for their constructive feedback. The author also acknowledges the Monash University teaching staff for insights gained through relevant coursework. Sincere thanks are extended to the

author's parents for their encouragement and financial support for conference participation, and to the author's partner and friends for their encouragement throughout the writing process.

Ethics Declaration

This study analysed publicly available documents. No human participants or primary data were involved, and no ethics approval was required.

AI Declaration

Generative AI tools were used in a limited and transparent manner to support the writing process. AI assistance was used for language refinement, improving clarity and proofreading. No AI system generated empirical material or conducted the document analysis. The research design, thematic approach, interpretation of the documents and final conclusions remain the author's own work. The final manuscript has been reviewed carefully to ensure accuracy and academic integrity.

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