Tourism Sector Climate Change Scenarios

Ko te kaupapa waka ki te moana hoe ai ko te kahui atua ki te ranga rere ai
While the fleet of canoes over the ocean are paddled the flocks of gods are above in the heavens flying

The Aotearoa Circle

Mihi

Tukua te wairua, māna e whakahaumanu, e whakaroa te rerehua o Aotearoa mō ngā uri whakaheke.

Hei arataki i ā mātou mahi me tā mātou whāinga matua kia hono ai te ira tangata ki te taiao.

Tōia mai rā te kaha me te ngākau pono kia hatutū tahi ai tātou ki ngā āwhā arahi kia ora aka te ao tukupū.

Kia poipoia mō āke tonu atu.

Whakamaua kia tina, Hui e! Tāiki e!

Greeting

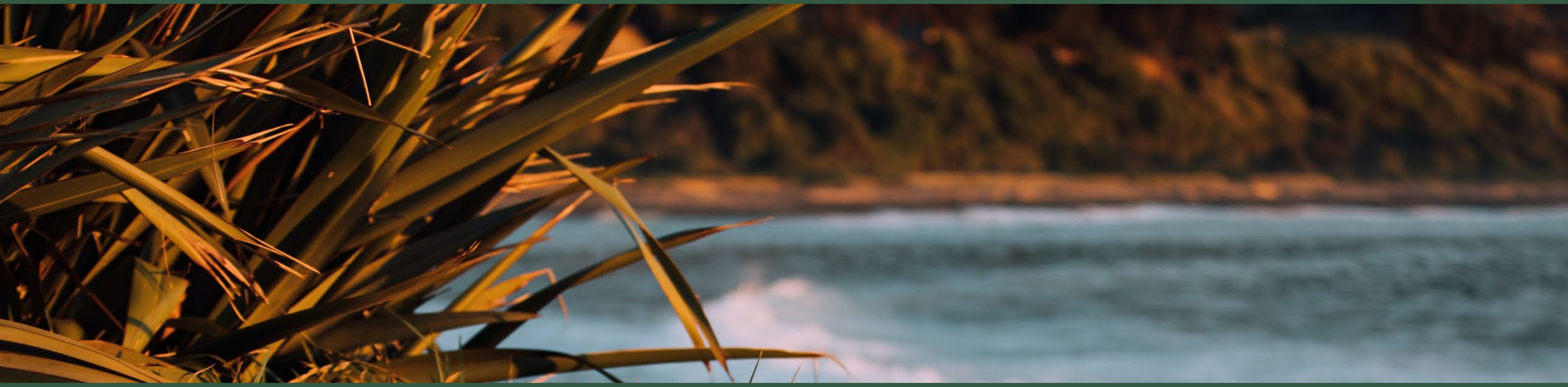
Release the spirit, to restore Aotearoa's beauty for future generations.

To guide our work and purpose in connecting people with the environment.

Let us draw in strength and integrity to meet the headwinds of today and lead for a better planet.

Ensuring it is nurtured forever.

United we affirm!



Introduction

Co-chairs letter

Climate change is happening now. The tragic impacts of Cyclone Gabrielle have brought this into starkly devastating focus. This plan now has a greater sense of urgency. Many of our regions and communities have been deeply affected in 2023 already. In the last two and half years the movement of people across borders, even within regions, was all but eliminated. The tourism sector has been nearly driven to extinction, like the Huia and other species of the past. But many of us also heard more birds in our neighbourhoods and we found healing from connecting with nature.

There are many learnings for Aotearoa New Zealand. Taking stock of what is truly important to us as individuals, whānau, and as a community. How we are part of nature and nature is everyone's business. The gift of connecting with people across distance and discovering new destinations. We can better see the web of relationships and connections that sustains our Mauri.

As we take flight again, Aotearoa New Zealand can follow regenerative pathways to safeguard our tourism brand promise and reputation, while ensuring we adapt to the impacts of climate change. A tourism sector that gives back to communities, gives back to Te Taiao, values the role mana whenua have as kaitiaki of people and place, and contributes to our prosperity and that of future generations. To achieve this will be no small feat. It requires a societal shift in mindset. It is not enough that all partners and stakeholders have a seat at the table, but they will need to be the driving forces that hold firm to this future.

At the heart of this change needs to be a recognition from everyone that climate change action must be accelerated. Through this work, we have explored a number of possible future scenarios. They all unequivocally demonstrate that a changing climate will make things harder – the question for us is by how much. The scale of the challenges we face in the future will be determined by us, in how quickly and proactively we respond now. We need to commit to rapidly following regenerative pathways (see page 51) or we will see a catastrophic decline in our natural environment.

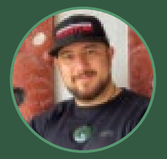
The reality that changes we make in our corner of the world will have little impact on the global environment is not lost on us. But we also know that we can either sit on our hands and leave our future to others, or we can give it our all and be an example of what can be achieved when everyone paddles the waka together.

Aotearoa New Zealand is unique – both its people and its places. Nothing is insurmountable when we know what we stand to lose. When we decide to move forward together, we move in leaps and bounds. We also lean on the knowledge of those who have walked before us. We have adopted Māori values to frame the actions we commit too in our journey ahead.

The business owners and managers, scientific and economic experts, policy and strategy specialists, professionals in the environment and mātauranga Māori, and the secretariat cannot be thanked enough for their contribution to developing the Tourism Sector Scenario Analysis and Adaptation Roadmap. This cross-section of people validates the content and provides confidence in the ability to bring the roadmap to life on the ground.

Mauri Ora.

Laurissa Cooney
Air New Zealand,
The Aotearoa Circle,
Tourism Bay of Plenty



Tak Mutu
MDA Experiences

Penny Nelson
DOC

Project governance

The working group for this project consisted of a tiered governance structure which reflected the diversity of the tourism sector.

The co-chairs provided governance and oversight of the project and its outputs. The co-chairs' responsibilities included providing final sign off on members of the leadership group and technical expert group, final sign off of outputs and acting as the spokespeople for the project to ministers, the media and other key stakeholders.

The Leadership Group (LG) set the ambition for the project and guided and reviewed the work of the Technical Expert Group. They are leaders in their field and brought mana to the project. The group met on a regular basis to provide input and feedback to the TEG and agree on key decisions throughout the project.

The Technical Expert Group (TEG) included technical experts across climate science, the tourism sector, policy and sustainable finance. The TEG has undertaken key research, stakeholder engagement and development of the Adaptation Roadmap, and ensured co-design with te ao Māori.

The Aotearoa Circle contracted PwC New Zealand to support the development of climate scenarios and an Adaptation Roadmap for the tourism sector. **PwC acted as secretariat**; offering climate change expertise, workshop facilitation, report writing, and assisting the development of the adaptation strategy.

The Aotearoa Circle, and other stakeholders, including Sir Jonathon Porritt (Aotearoa Circle Guardian), Rob McGowan (Pa Ropata) Joe Harawira (Department of Conservation), and Tame Malcolm (Department of Conservation) were also involved in oversight of aspects of the final report.

Project funding

This project has been partly funded by Government through the Aotearoa Circle. It is closely aligned to the Environment phase of the Tourism Industry Transformation Plan (ITP), including through some shared Leadership Group members.

The scope of the Environment phase of the ITP is underpinned by three pillars:

1. **Climate change adaptation** – understanding the impact that climate change will have on the tourism industry and taking action to ensure the industry can adapt to climate events
2. **Climate change mitigation** – transforming the New Zealand tourism industry into a low carbon emissions industry
3. **Fostering positive ecological outcomes**, such as biodiversity and ecosystem restoration.

A draft Action Plan for the Environment ITP is expected to be available for public consultation in mid-2023.

The Leadership Group

This kaupapa is lead by a collaboration of industry professionals

Claire Walker
Sky Entertainment Group

Grant Webster
Tourism Holdings Ltd.

Heather Kirkham
MBIE

Jo Allison
Ngāi Tahu Holdings

Rebecca Ingram
TIA

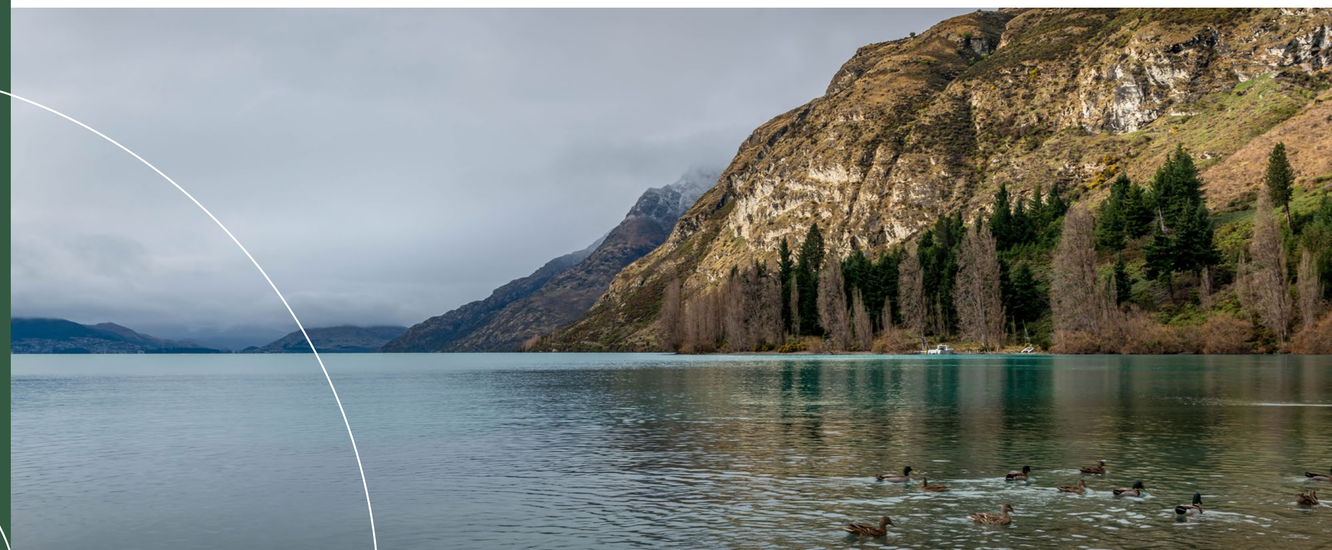
Les Morgan
Sudima Hotels/
Hind Management

John Morgan
NIWA

Kiri Goulter
Regional Tourism NZ

René De Monchy
Tourism New Zealand

Stephen England-Hall
RealNZ



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Values and Concepts

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Huia
Extinct and endemic bird of Aotearoa New Zealand. Regarded as a wise navigator that led humans to our home.

Kaitiakitanga
Guardianship and protection of our natural, built and cultural resources for the benefit of current and future generations.

Kaupapa
Important point of discussion or engagement of a project/scheme/initiative.

Manaakitanga
Showing respect, hospitality, generosity and care for others.

Manu
Birds, protected by atua, god Tāne Mahuta.

Mātauranga
Knowledge, wisdom, and understanding, often referred to as an educator.

Mauri
Life principle, life force, vital essence, special nature, a material symbol of a life principle, source of emotions – the essential quality and vitality of a being or entity.

Pīwakawaka
Bird, commonly referred to as a fantail; an endemic bird to Aotearoa New Zealand. Often regarded as a symbol of hope.

Rangatiratanga
Upholding the mana of the people in all we do, empowering ourselves and those around us and leading by example.

Regenerative tourism
An emerging notion that places a high value on the landscape and communities which are hosts to visitors and ensures that visitors leave the environment better than they found it.[1]

Roopu
Group of contributors.

Taiao
The living world, earth, nature, biodiversity and forests.

Tāne Mahuta
Māori atua, god of the forest, son of Ranginui and Papatūānuku. Our protector of te taiao, nature and manu, birds.

Te ao Māori
The Māori world view and interconnectedness of living and non-living entities.

Tiaki
To care, conserve, and protect.

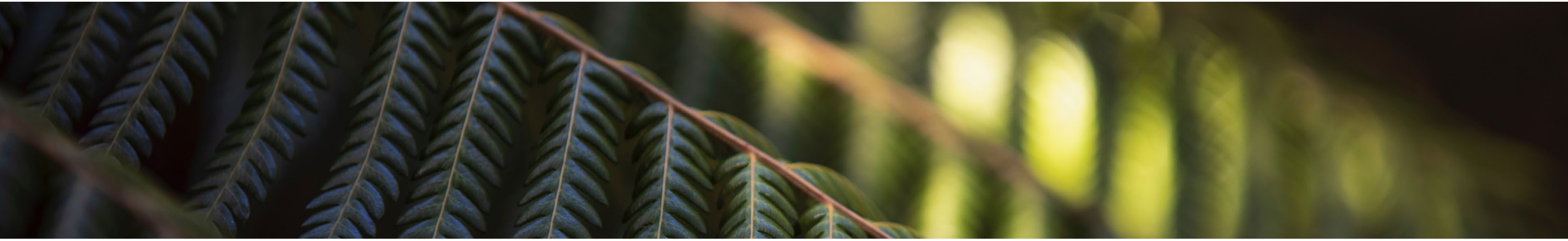
Tikanga
Upholding our customs, values, cultural practices and doing what is right.

Tohungatanga
Supporting and growing our whānau to enable them to be their best.

Wairua
Spiritual essence, vibrational frequency between all things

Whanaungatanga
A sense of family and belonging: relationships built on shared experiences and working together.

Whakatauki
Māori proverb or formulaic saying. Whakatauki creates meaning in our story.



1 Matunga, H., Matunga, H.P., & Urlich, S. (2020). From exploitative to regenerative tourism: Tino rangatiratanga and tourism in Aotearoa New Zealand.

Context and Objectives

Context and Objectives

Our visitors will remain at the core of the Aotearoa New Zealand experience, whether they have travelled from the neighbouring town or halfway around the world – arriving into our communities as visitors and leaving as whānau. In this future, our visitors will be enriched through their experience, yet they will also contribute value back to Aotearoa New Zealand and to our communities: a reciprocal relationship between visitor and community. This is the picture of a healthy, regenerative tourism sector that we can be proud to leave to those who come after us.

"Mauri tū, Mauri rere, Mauri oho"

The Mauri is uplifted, it flies and it is awakened

The challenge

Growing global concerns regarding climate change and environmental degradation represent a threat to our tourism sector. Aotearoa New Zealand's tourism is built around and reliant on its natural landscapes and cultural assets. While it was never intended to be an environmental statement, the 100% pure New Zealand brand has inevitably been interpreted as such and is a major draw for visitors.

But, environmental degradation is already affecting our landscape and our reputation as a 'clean, green' destination. The natural environments that have supported Aotearoa New Zealand's tourism industry, and the infrastructure that allows us to access and enjoy them are at increasing risk from climate change hazards. Significant weather events (e.g. floods, droughts), increasing temperatures (e.g. shortened snow seasons), sea level rise (e.g. coastal erosion), biodiversity loss (e.g. kauri dieback), and glacier melt all pose risks to an industry that is already struggling to recover from the COVID-19 pandemic. Combined with large numbers of visitors in some of our most outstanding National Parks and reserves, this is starting to have a negative environmental impact. In addition, there is growing interest in carbon emissions and how this translates in terms of an 'environmental travel footprint'.

All this amounts to a sector that is facing serious challenges to its collective business model.

At the same time, the tourism sector is projected to recover and expand over the next five years. Global restrictions on movement are starting to ease post COVID-19, and we will again become an attractive destination for overseas travel. Also, not to be underestimated are the benefits and burdens that domestic travellers create across New Zealand. But without significant changes being made across the sector, investment and insurance will become increasingly harder to access.

The opportunity

As the tourism sector begins to recover from the impacts of the COVID-19 pandemic, there is a rare opportunity to refocus the sector's long term strategy. The Tourism Sector Climate Change Scenarios and Adaptation Roadmap leverages the industry's real desire to change direction. It is essential that the sector takes action to understand the risks, challenges and opportunities it could face in the future. With this firm grounding, the sector can explore how it could change to ensure it is an adaptive, regenerative, values-driven industry that can prosper in an uncertain and rapidly changing world. This work also provides useful reference for organisations captured by the mandatory Climate-related Disclosures (CRD) regime passed into law in 2021, which requires large listed companies to disclose their climate-related financial risks.

In order to enable the CRD disclosures, the External Reporting Board (XRB) has developed standards and guidance for climate reporting entities (CREs). To fulfil the requirements of the disclosure regime, CREs must undertake scenario analysis. As a key first step, the XRB has encouraged sectors to collaborate to develop shared climate scenarios. This collaborative approach supports the development of robust scenarios that are decision-relevant for the tourism sector, and will enable a level of consistency and comparability across individual sector participants' climate risk, opportunity and impact disclosure. It also provides a platform to bring the sector together to think about the future, how to embed sustainability and build regenerative pathways, while building resilience to climate change.

Objectives

The Tourism Sector Climate Change Scenarios and Adaptation Roadmap has two objectives.

The first objective is to develop a set of climate change scenarios that can be used by industry participants to understand the physical and transition climate-related risks they face and identify opportunities. Identification of sector level risks and opportunities is a valuable input for organisations as they seek to undertake further detailed analysis to identify climate change risks and opportunities specific to their organisations.

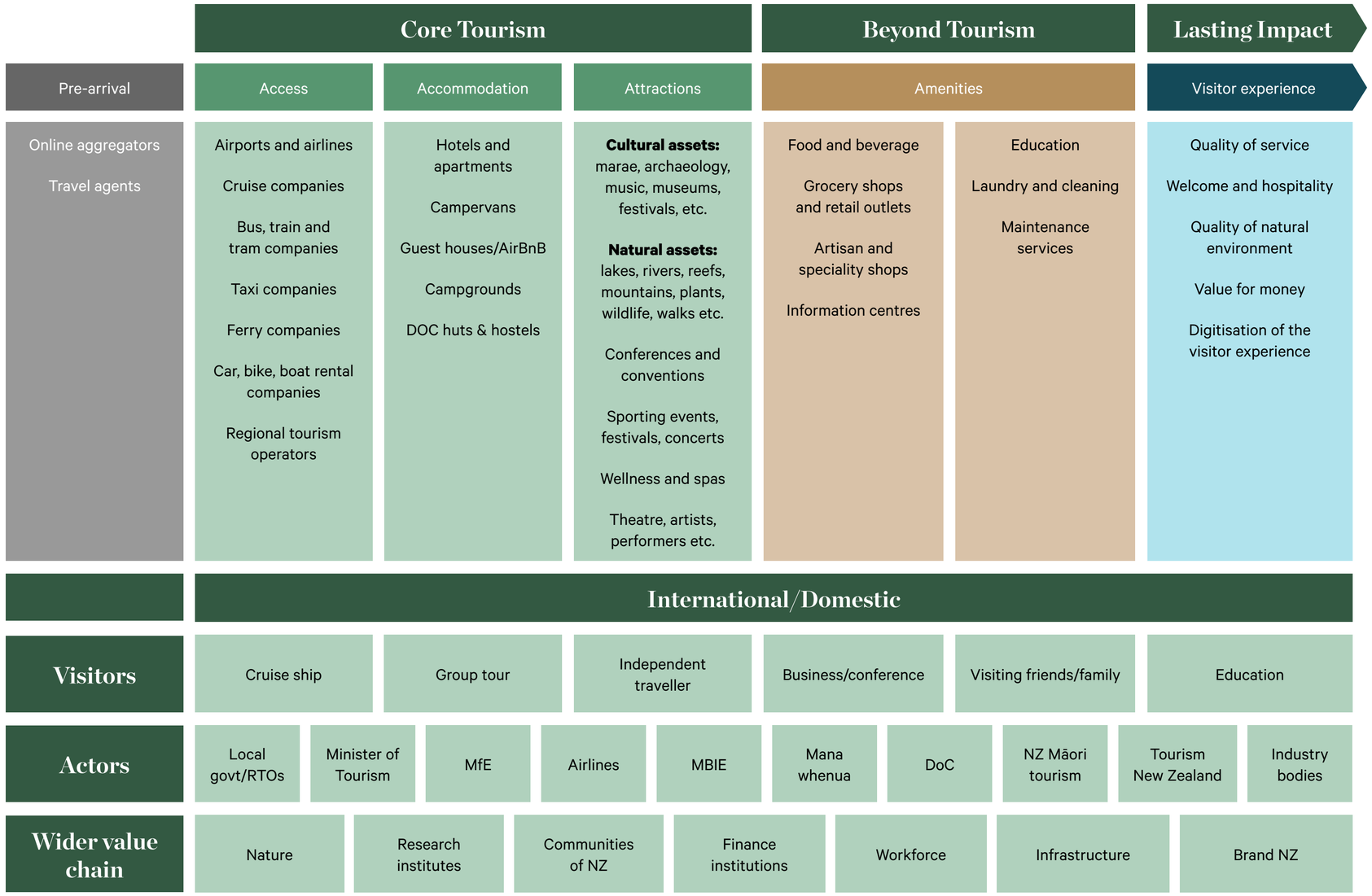
The second objective is to develop an Adaptation Roadmap with clear objectives and tangible actions that participants in the tourism sector can implement between now and 2030. This roadmap will emphasise regenerative pathways to enhancing the resilience and sustainability of the tourism sector. It can act as a critical lever to future proof the industry by supporting the protection, restoration and regeneration of a healthy, resilient and biodiverse landscape for the enjoyment of domestic and international visitors; building the resilience of industry participants; and enhancing adaptive capacity across the value chain.

Defining the tourism sector

Tourism sector participants provide tourism services for local and international travellers on trips of less than one year. This includes people travelling for work, leisure, education or other reasons. The sector's services are broad, encompassing transport, accommodation, hospitality, recreation and retail services. Total tourism expenditure was $26.5 billion in the year ending March 2022 and generated a direct contribution of $10 billion to GDP. Prior to COVID-19, tourism expenditure was $42 billion and it it projected to grow and surpass this level. Tourism employs around 145,000 people in New Zealand[2].

Because of the complexity, it was necessary to define the Aotearoa New Zealand tourism sector to ensure this work was relevant to as many industry players as possible. We built on work undertaken by Tourism New Zealand (2021), the New Zealand Government Tourism Strategy (2019), and the Tourism Task Force Interim Report (2021). The tourism sector value chain is captured in Figure 1.

Figure 1: Tourism sector value chain



2 Stats NZ. (2022). Tourism satellite account: Year ended March 2022.

Te ao Māori Framework

Kia kotahi mai ki te ao nei
Kia kotahi mai ki te whenua nei
Kia kotahi mai ki te wairere nei
Kia kotahi mai ki te hauora
Kia kotahi mai nga iwi katoa
Patuki tahi nga Manawa e

Be as one with the universe
Be as one with Mother Earth
Flow as one with the sacred waters
Breathe as one with the winds
Let us be as one in conservation
Let our hearts beat as one in unison with Mother Earth

– Hirini Melbourne

Framing a path with Taiao in mind

Under the lush canopy of Te Māra a Tāne (Zealandia) with the rain gently drumming our senses to life, drop by drop, we as a roopu began to frame up this work.

Standing in the ngahere (forest) we noticed the soft soil under our feet, the fresh air we breathed into our lungs, the smell of Taiao, appreciated the shelter offered by the trees, and we heard manu (birds) call.

Starting the work by taking a moment to rest in nature shifted us as a roopu. The experience planted a seed that grew our sense of an ecosystem that connects us to our surroundings, as a roopu and to the whenua. There was a heartbeat of the whenua. The Mauri of people and place became one through the wairua (spiritual essence, vibrational frequency between all things). It gave us a place where knowledge of ancestors blended with new ways of thinking. It became clear that the task ahead needs to be seen across time – we are part of a connected whole.

In short, it is time to do things differently. This message is central to what we mean by regenerative in this roadmap – it is about progressing social change that honours Mauri.

Regenerative is the goal we strive for but also what we need to achieve with every single touch point we have on the ground. To adapt to climate change we must alter the way we plan and carry out our daily operations.

In this section we provide some principles to support a journey with Taiao in mind, every step of the way.

Learning from our surroundings

Tāne Mahuta

Standing in Te Māra a Tāne we were reminded of Tane Mahuta. To cover and nourish his Mother, Papatūānuku, and to fill the world with life Tane Mahuta created the ngahere. He brought manu to life. Later, he created humans. Tane's actions reminded us of the importance of restoring and being regenerative in what we do. A whakatauki of Te Awa Tupua (Whanganui) Iwi brings this learning to life at place: 'Ko au te Awa, ko te Awa ko au – I am the the River and the River is me. A kaumatua explained this whakatauki further that we do not have to say anything – all we have to do is to get to know the trees, plants and they will tell us everything we need to know.

Manu

Based on how Tane created new life forms, manu are our tuakana (elder sibling). As taina (younger sibling), we must live in ways that acknowledge the rightful place of manu as our tuakana. We must treat manu with respect and listen to their guidance, and we have used learnings from them in this roadmap.

Manu are symbolic of the visitor economy, whether visitors journey over the land, across the seas, or take to the sky to discover and explore destinations. Manu have long called people to Aotearoa. Migratory manu, like the Kuaka (bar-tailed godwit), helped show Māori the way to Aotearoa. When Māori arrived in Aotearoa, manu taught them how to make this new land their home. Manu taught them to eat. Their feathers cloaked and kept them warm. They taught them how to keep safe and how to keep their whanau safe. For example, the Huia was usually found on the edge of forests. If Māori got lost in a forest, they knew that if they followed the Huia, they would find a way out.

Manu also taught them how to speak. We see this in the names of our manu as they are often based on the sounds that the manu makes, for example the Kea and Tieke (saddleback). Our language is further enriched by the whakatauki that come about from observing their movements and behaviours.

The Huia showed that everyone has a unique role to play. The Huia was known for the males and females having different beaks. It meant they did not compete for food but had their own role in ensuring the survival of the species. Through over-hunting the Huia became extinct. History taught us that we must be stewards and it is a lens for the tourism sector to take on.

Taking steps with Taiao in mind

Observing how the larger trees can provide protection for the smaller trees, plants, and Papatūānuku is symbolic of the role that corporations can play in the path ahead. If we frame our path with nature in mind, each visitor that spend time in nature will leave both the person and nature with their Mauri enhanced, not depleted. We will achieve an abundant regenerative tourism sector that ensures people, planet, and prosperity are balanced.

The concept of Mauri signify the connection and commitment we see in this roadmap to nature. The Tiwaiwaka framework by Rob McGowan (Pa Ropata) captures this in six principles, which we have adopted and used throughout this roadmap. We recommend the Tiwaiwaka principles are adopted by every tourism operator to support their planning for a future that requires adjustments to a changing climate.

Tiwaiwaka Principles

Principle 1:

Caring for the whenua is the first priority. Everything else must be measured against this.

Principle 2:

We are not the centre of the Universe, but we are part of it.

Principle 3:

The Mauri is the web of connections that sustains life.

Principle 4:

Te Tangata, people, are not the masters of the Mauri; we are part of the Mauri and embraced by it.

Principle 5:

No individual person is more important than any other. Each must contribute what they have to offer, and receive what they need to be well.

Principle 6:

We give special care to the tiniest living creatures.

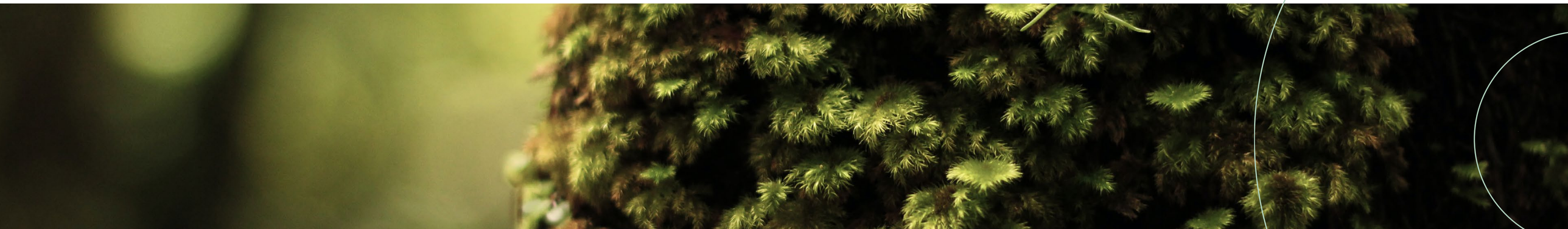
When the roadmap is followed, both the visitor that spends time in nature and nature itself will have their Mauri enhanced, not depleted. The Tiwaiwaka principles remind us that the answers we need for our future are already to be found in our surroundings. All we have to do is learn to listen, listen to hear, and hear to take action. Like the Piwakawaka, the principles are a symbol of hope. They offer a way to look to possible futures and imagine what they may mean for our collective Mauri.

Special thanks

This framework and adaptation work carries the Mauri of the many people and their organisations who contributed, setting a very strong foundation for the roadmap. Like nature, this work will evolve and its strength is from the collective contribution.

Ehara taku toa i te toa takitahi, he toa takitini (my strength is not as an individual but as a collective). Connecting to a Te Ao perspective enables us to grow through lived experience.

We want to acknowledge the support of people that walked alongside us on our journey to frame a path with nature in mind. We are grateful for the generous assistance of Kaumatua Joe Harawira (Pouwhakahaere, Te Papa Atawhai) and Otene Hopa (PwC), who were alongside the roopu at Te Māra a Tāne. They connected the roopu to Taiao through karakia, waiata, and kōrero. Tame Malcolm (Deputy Director-General, Te Papa Atawhai) for mātauranga that widened and deepened learnings from ancestors. Rob McGowan (Pa Ropata) for generous support to engage with Tiwaiwaka.



Tourism Sector Scenarios

Nau te rourou, Naku te rourou, Ka ora ai te Taiao, ka Ora I te Tangata

With your basket and my basket (contribution, wisdom), Nature will thrive and the people will be well

Guide to using climate scenarios

Giving structure to an uncertain future: why we do climate scenario analysis

Scenario analysis allows us to build resilience to the challenges the future will bring through an exploration of how that future could look. Using scenarios, we can interrogate the decisions we make today by exploring the range of plausible pathways the future could take.

The future is inherently uncertain, especially in the context of climate change. Climate scenarios allow us to give structure to this uncertain future. They do not aim to predict the future, instead they paint broad pictures of how the future could look, and in doing so create a rich dataset for testing the resilience of the sector to climate change and the challenges it brings. According to the Task Force on Climate-Related Financial Disclosures (TCFD), "in a world of uncertainty, scenarios are intended to explore alternatives that may significantly alter the basis for "business-as-usual" assumptions".[3]

Scenarios are becoming more common in corporate climate strategy. Under the Climate Standards CS1-3 released by the XRB in December 2022, Climate Related Entities (CREs) are required to perform scenario analysis to better understand climate-related risks and opportunities for their organisation. To ease the burden on individual organisations, the XRB has recommended that sectors come together to develop shared scenarios that CREs within the sector can use. The intention of the shared sectorwide scenarios is to ensure consistency and comparability in disclosures across each sector. Sectoral collaboration will also "provide greater comparability and lead to higher quality scenarios, while imposing fewer resource demands for CREs".[4]

The XRB has stipulated that CREs use at least three scenarios: a scenario in which global warming is limited to 1.5°C, a scenario in which warming exceeds (or is on track to exceed) 3°C and one other of the sector or organisation's choosing. This range ensures that organisations are testing their resilience to both the physical and transition risks it could face in the future, and incorporating irreducible elements of uncertainty into their financial planning.

What scenarios look like

Scenarios should enable us to think critically about how the sector currently operates and how it can improve its resilience to the challenges of climate change the future will bring. The TCFD cites five characteristics of high quality scenarios:[5]

- **Plausibility** – scenarios should be credible, possible and believable
- **Distinctiveness** – each scenario should include a different combination of key factors and provide differentiated messages
- **Consistency** – scenarios should have strong internal logic, where interactions between factors, actions and reactions are consistent across scenarios and able to be logically explained
- **Relevance** – scenarios must be decision relevant. They should provide insights that enable dynamic risk management and strategic planning
- **Challenge** – scenarios should challenge conventional wisdom and simplistic forward thinking. They should aim to incorporate alternative pathways that challenge current assumptions.

Strengths and weaknesses of scenarios

The tourism sector is a complex economy with dynamic interactions across sectors, societies, ecosystems and human structures. Understanding complexity requires 'systems thinking', which examines how the elements of the system interrelate, evolve through time and fit within broader systems. Scenario analysis is a systems thinking tool that captures this complexity. The scenarios outlined in this report explore the dynamic interrelations within the sector and how it could be impacted by, and feed into, the broader economic and cultural landscape.

Scenarios are not predictions of the future. None of the scenarios in this report reflects an expectation of what will happen; they are plausible descriptions of what could happen. They reinforce the need for dynamism in the sector and deepen our understanding of the future implications of the choices we make today.

3 Task Force on Climate Related Disclosures (2017). The use of scenario analysis in disclosure of climate-related risks and opportunities.
4 External Reporting Board. (2022). Aotearoa New Zealand Climate Standards.
5 Ibid #4

Using scenario analysis to inform dynamic risk management

A robust strategy is more than a specific company's emissions target or pathway; it is an approach that recognises uncertainty, provides flexibility, and can respond appropriately to the future as it unfolds.[6]

Key steps to implementing scenario analysis informed by the TCFD guidance:

a. Introduce the concept of scenario analysis to board members and senior management

If scenario analysis, or climate risk broadly, is not already a core part of the organisation, some time should be spent educating senior management and board members on the basics of climate change and how scenario analysis can improve organisational strategy. This may require experts from outside the organisation coming to speak or provide other educational material.

b. Establish the governance and work structures, and the scenario team

Bring together a 'scenario team' that spans the organisation's operating model and includes sufficient representation from the executive team to ensure buy-in for the project. Determine who will be ultimately responsible for the work and who will be accountable for implementing any actions that emerge through the process.

Ideally, the leader should be a senior staff member from the strategy or sustainability team. Facilitation and administration are important roles throughout the process, as they stimulate an open and challenging environment, maintain internal communications and ensure progress is made within time and budget constraints.

Determine if external assistance is required to fill any capability or resource gaps within the organisation.

c. Mobilise

Begin the scenario analysis process by identifying the focal question for the analysis. For most organisations, a simple and broad question such as 'how could climate change plausibly affect our organisation?' is an ideal place to start. It's critical to link in with the risk and opportunity function to ensure they are included in the scenario analysis process.

The early parts of the scenario analysis process are centred around understanding how the business operates, what its strategic goals are, its key operating markets and environments, and how decisions get made. Identify key gaps in the available information that need to be filled.

d. Explore the impacts on the business

Using the scenario narratives in this report, develop targeted narratives that explore how your organisation fits into the picture. Do not assume any adaptations are taken at your organisation, but instead aim to understand how the changed world impacts on the organisation's ability to operate.

You may wish to include some detailed quantitative modelling at this stage. However, be conscious that, as the TCFD wrote, "excessive focus on quantification permeating stakeholder discussions or scenario team deliberations can impair strategic thinking." Be sure to incorporate uncertainties that cover the wide range of plausible future outcomes.

In particular, identify and assess impacts on the business' operations, strategy and financial planning. Explore how these impacts create risks and opportunities for the organisation, and what are the key drivers behind them. The TCFD recommends asking the question" How would our company's existing (or proposed) strategy likely perform under each scenario if it were true?"

e. Identify options and strategy

Conduct thought experiments that explore how existing or proposed strategies, decisions or actions would perform under each scenario. This is an important and challenging step, as it requires organisations to place their own internal visions for the future in the context of the wide range of plausible future outcomes. It's critical to think broadly here and challenge existing assumptions and processes.

Develop options that address the implications of different actions and strategies in the scenarios. Think about the timeframe for each option, its likelihood of success and the materiality of the impact it addresses. Articulate the strategic focus of each option, the scope of its implications and how it could be initiated.

Evaluate strategic options using a set of criteria that accounts for alignment with the organisation's overall vision, its risk appetite, the value generated by the option and the organisation's ability to execute the option. Recognise the uncertainty illuminated in the scenarios by building flexibility and dynamism into strategic options.

f. Implement a review and repeat proces

The scenario analysis process should not be a one-off project. Integrate this process into the organisation's operations by reviewing the analysis for information gaps, biases or blind spots at its conclusion, and developing structures for ongoing analysis. These structures could include in-house capability building or modelling, risk management processes and disclosure.

Scenario development process

The scenarios detailed in this report were developed across three workshops with the Technical Expert Group. Each workshop built on the previous one and allowed us to build up decision-relevant scenario narratives over time.

Figure 2: The scenario development process

6 Task Force on Climate-Related Financial Disclosures. (2020). Guidance on scenario analysis for non-financial companies.

Climate-related risk assessment and identification

Definition of physical and transition risk

Physical risks arise from chronic changes to the climate such as rising sea levels and warming, and acute extreme weather events such as droughts and intense rainfall.

Transition risks arise from the process of adjusting to a low carbon economy or adapting to the impacts of climate change.

Risk and materiality assessment

As an initial step for developing the climate scenarios, the most significant risks were identified through a workshop with the TEG, and confirmed in discussions with the LG and co-chairs. The top risks are outlined in the table below.

Table 1: The most significant risks to the sector

Physical risks
Inability to maintain Aotearoa New Zealand as an attractive destination
Loss of species/biodiversity
Inability to access attractions and locations
Reduction in operating days/opportunities

Transition risks
Reduction in positive customer sentiment for Aotearoa New Zealand
Increase in climate change regulation drives increased costs pressure on visitors
Inability for the tourism sector to keep up with the rate of change
Inability for operators to effectively conduct financially viable businesses

Drivers of change

Drivers of change (sometimes referred to as driving forces) are critical trends or influencers that affect how the tourism sector operates. They are usually large-scale, exogenous factors that impact how climate risks and opportunities cascade through the tourism sector. Drivers of change are a key input into climate scenarios. According to the XRB, "understanding which driving forces will have the greatest influence in shaping outcomes for the sector is an essential step in creating climate-related scenarios."[7] By exploring how the drivers of change could evolve and interact in the scenarios, we can build up a picture of how the future could look, and how climate risks and opportunities could flow through the sector.

Through the workshop process, stakeholders identified a number of drivers of change that will affect the tourism sector in the future. Through the workshops, the TEG and LG acknowledged there were a number of significant drivers of change that have the potential to drive more change and impact in the future.

These drivers of change can be grouped into five broad categories:

1. Environmental
2. Markets
3. Policy
4. Social
5. Technology

Table 2: The top drivers of change

Drivers of change	Category
Severe acute weather events	Environment
Biodiversity/habitat loss	Environment
Cost increases due to infrastructure needs/energy availability	Markets
Challenges accessing capital	Markets
Government priorities	Policy
Decarbonisation of air travel	Policy
Social pressure to reduce travel	Social
Global displacement/geopolitical tension	Social
Speed/access/cost of emerging tech	Technology
Pace of technology advances	Technology

7 External Reporting Board. (2022). Scenario analysis: Getting started at the sector level.

1. Environmental

Physical climate change

The New Zealand tourism sector is intimately connected to the country's natural assets. Visitors come from all over the world to experience the natural beauty of New Zealand's fjords, glaciers, mountains, lakes and coastlines.

As the climate changes, so too do these natural assets. Warming is melting our glaciers and reducing snowfall, intense rainfall is causing damage to our National Parks and Great Walks, biodiversity is declining and floods are devastating rural communities, while storm surges and sea level rise are ruining our beaches. Safe, thriving and popular attractions today may be damaged, costly and inaccessible in the future.

The tourism sector needs to think deeply about what the future could look like for key attractions – how do we protect our natural assets and at what cost?

2. Markets

Cost of travel and operations

For visitors, the cost of travel is a key criterion in determining where to visit and what to do there. It is impossible to predict how the cost of travel will evolve in the future. New Zealand is a long way from most of the world, and airlines may be forced to pay for their emissions, making flying very expensive.

Energy-intensive attractions might also be forced to pass on high emissions costs. Similarly, investment in technology to enable emissions reductions may be expensive or cost-saving for operators. So how many visitors will come to New Zealand in 30 years time?

3. Policy

Government priorities

The way government bodies respond to climate change has consequences for the tourism sector. Does the Government prioritise meeting our climate change goals in a way that also protects biodiversity? If so, does this mean cutting some areas off from tourism or helping to build a regenerative and participatory tourism sector? The answers to these questions and others will determine how the tourism landscape will be defined in the coming decades. The level of policy integration between the sector, local governments and regional tourism operators, and the funding provided for destination management, will reveal the extent to which Central Government prioritises tourism, and shapes the sector's future.

COVID-19 has also shown that the structures created around the tourism industry have become important for other economic and business activities, like logistics, transporting freight and moving people around the world. For example, some key labour couldn't be accessed as airlines cancelled flights due to lack of visitors. Recovering from COVID-19 and as borders reopen, the tourism sector (especially airlines) are still struggling to bounce back to pre-covid operating levels; bringing a different appreciation for the role that the tourism sector plays in enabling other economic and business activities.

4. Social

Shifting perceptions

People are calling for large-scale action on climate change more than ever. Tourism is a discretionary activity that without question contributes to climate change and biodiversity decline. Widespread social calls to reduce highly-emitting activities could well lead to social pressure to reduce travel, including long haul flights.

Concepts such as 'flygskam' – flight shaming – have the potential to significantly impact demand for travel and the tourism industry's social licence. However, research shows that people tend to leave their values at home when they go on holiday. How this social pressure evolves will impact the sector's ability to continue to operate into the future.

5. Technology

The future of travel

Tourism, like all industries, is seeing the rapid impact of digital and technological evolution. From flight and hotel aggregators to virtual reality and amphibious vehicles, all aspects of the industry have the potential to be touched by emerging technology. But, will technology enable sustainable tourism opportunities, provide virtual alternatives, price small businesses out of the market or something else entirely? The pace and accessibility of technological advances could stimulate or suppress demand for travel. It could empower regenerative tourism or create high barriers to entry into the market. There is no doubt that technology is key to the next few decades, but how its role plays out is uncertain.

Impact pathways

To bring the two concepts of climate risk assessment and drivers of change together, we have developed impact pathways that give us a snapshot of the complex relationship between the parts of the tourism sector value chain and how they could be impacted by exogenous changes. Exploring these relationships allows organisations to better understand the complexity and cascading impacts climate-related drivers could have on their business. Importantly, exploring these pathways can enable an organisation to place itself within the complex tourism ecosystem and recognise how direct impacts on one part of the supply chain can flow on to affect the whole sector.

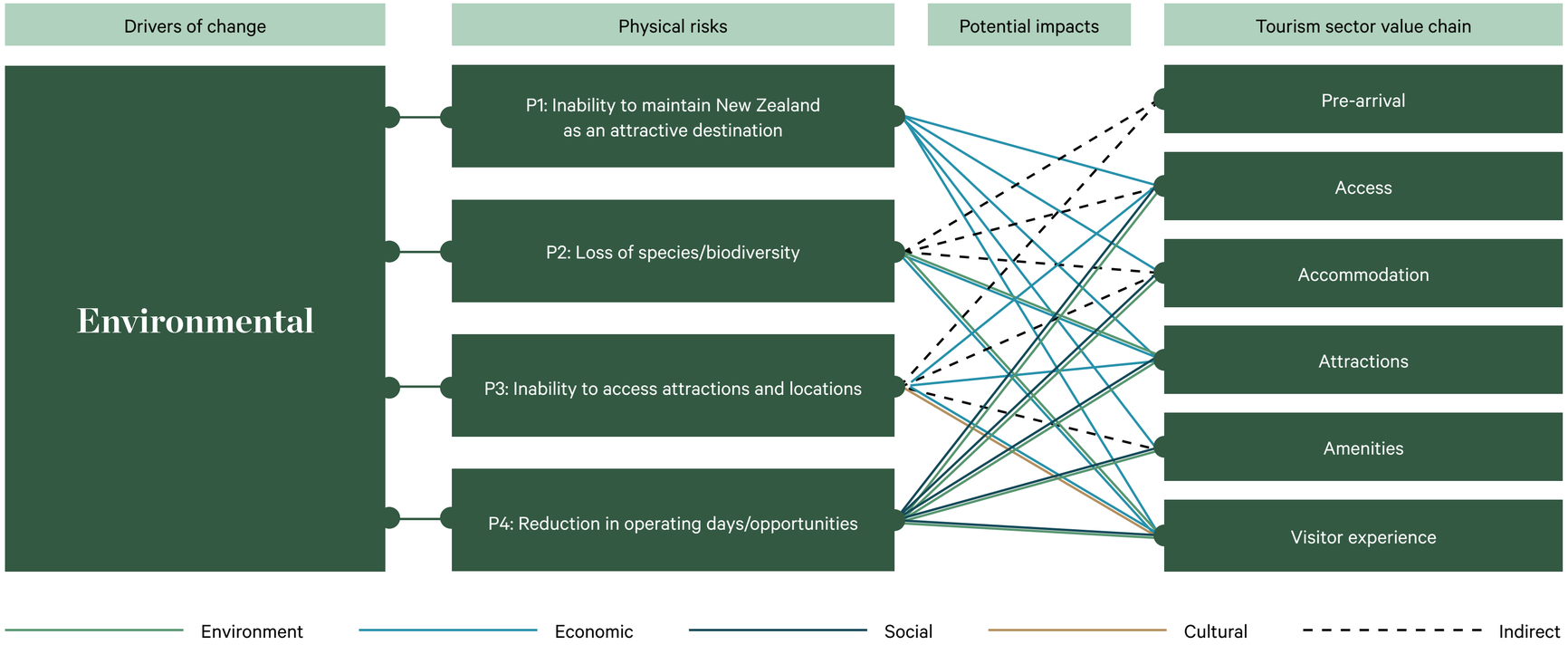
The pathways demonstrate how the most significant risks could impact parts of the supply chain. They illustrate that all areas of the tourism sector supply chain could be impacted if the most significant risks eventuated either directly or indirectly.

Physical impact pathways

Physical impact pathways reveal the parts of the value chain that could plausibly be impacted by risks associated with physical climate change under the environmental driver of change. In the example illustrated in Figure 3, we have explored the potential impacts that the top physical risks could have on the tourism sector supply chain.

To note: these pathways are not comprehensive and risks can have other impacts not captured in this diagram.

Figure 3: Physical impact pathways

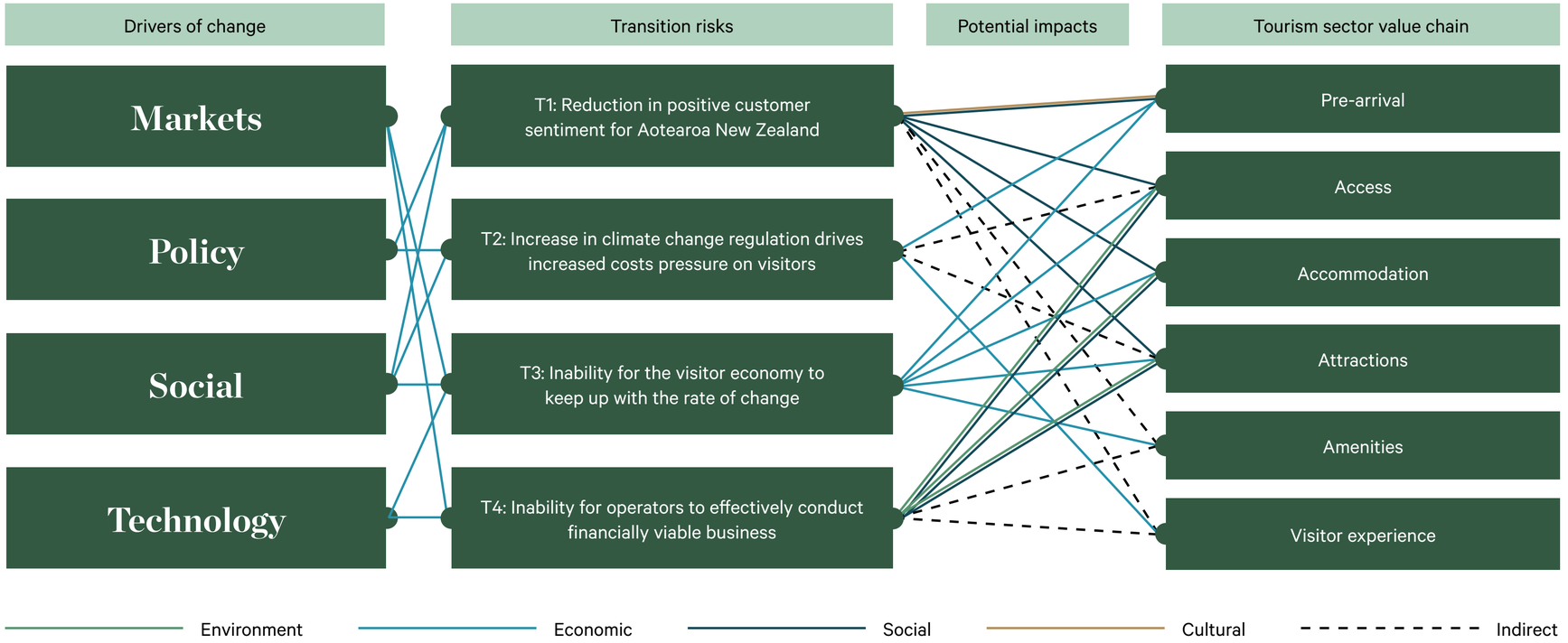


Transition impact pathways

Transition impact pathways reveal the parts of the value chain that could plausibly be impacted by risks associated with transition to a low carbon economy. Because the tourism sector is complex and deeply interwoven with other parts of the economy, transition risks can lead to complex impacts on the sector.

These pathways are captured under the markets, policy, social and technology drivers of change and do not attempt to capture all possible paths through which transition risks can cascade, but rather illustrate the systems thinking approach that underpins scenario analysis.

Figure 4: Transition impact pathways



Tourism Sector Scenarios

Orderly – Hiahia Scenario

Hiahia represents a smooth transition to global net zero CO_2 by 2050. It limits global warming to 1.5°C by the end of the century through stringent climate policies and innovation. The orderly scenario assumes climate policies are introduced immediately and become gradually more stringent as the target date looms. Physical risks are relatively subdued but transition risks are high . Getting to net zero by 2050 is an ambitious scenario.

Net zero 2050

The global situation

In Hiahia, strong and immediate action is implemented in the mid 2020s to tackle the critical environmental and socioeconomic issues facing the world. The UN Sustainable Development Goals (SDGs) become a global priority and a number of them are achieved. There is large-scale transition away from fossil fuel energy sources, moderate deployment of carbon dioxide removal and rapid advances in technology to reach the net zero goal.

Aotearoa New Zealand situation

By 2050 progress in reducing emissions, reversing biodiversity loss and improving social outcomes earns global respect. By acknowledging the concept of Mauri in decision-making, New Zealand shows how society can change its relationship with the natural world and embed kaitiakitanga into private sector decision-making. Aotearoa New Zealand is a place of hope, where climate change and biodiversity policy are irrevocably linked to create a haven of 'balance' between nature, technology and the economy. Emissions of CO_2 reach net zero by 2037, making us a key part of the global effort to limit climate change to 1.5°C.

The tourism sector is thriving. Visitors choose New Zealand for the unique experience, the full immersion in nature and regenerative thinking. Their visit is about their relationship with nature as a result of seeing the world through a Te Ao lens.

Economy

A concerted re-prioritisation of economic goals has occurred so that focus has shifted from financial outcomes to broader human and planetary wellbeing. Measures of national and global success now include social, environmental and cultural indicators that better reflect quality of life.

Technology

Focus has shifted towards innovation and technology that reduces our material footprint. Successful technology must be long-lasting, circular and highly efficient.

Social

The increase in focus on the UN SDGs leads to widespread progressive social investment, resulting in reduced inequities across the world.

Incomes

The focus on equity means that income growth slows in the global north but accelerates in the global south, and access to basic needs has increased globally.

Aviation, Cruise and Transport

International bodies such as ICAO and IMO were strengthened and pursued more ambitious targets in the mid 2020s following proactive action in the sector. All transport, aviation and cruise lines are now mostly decarbonised through the uptake of sustainable fuels.

(SSP1: Sustainability, RCP2.6)

Policy

The COVID-19 recovery was centred around meeting the targets set out in the Climate Change Response Act and the new Biodiversity Protection Act enacted in 2025. Climate policies are inclusive, incorporate biodiversity protection and ensure equitable transition. Local adaptation projects are supported by partnerships through community, local and Central Government and the private sector.

Ecosystems

Reversing ecosystem decline has been a core government objective since 2030. Although policy has been as inclusive as possible, government bodies have had to make trade-offs when allocating conservation funding. A new system for allocating funding has emerged based on vulnerability and adaptive capacity.

Mauri

Indigenous systems thinking is incorporated into business and government thinking. Kaitiakitanga is a core intention of every successful organisation and Mauri is high.

Physical climate change

Severe weather events including rainfall worsen but less than in other scenarios and severe impacts are mitigated. The South Island experiences higher levels of rainfall. The West Coast is impacted severely, leading to more frequent closures of natural assets and attractions and some have to be closed permanently. Glacier retreat at iconic mountain landscapes such as Fox Glacier and Franz Josef Glacier continues at a slower rate. Coastal assets are increasingly exposed to storm surge and sea level rise. The North Island experiences less precipitation, but greater levels of severe weather around the coast in the North and East. Some beaches in the Bay of Plenty and Hawke's Bay are lost and coastal roads require large investment to protect them from storm surge. Communities are impacted, leaving some cut-off in severe storms and there is migration away from exposed areas. Snowfall declines globally, but at a slower rate here.

(SPANZ F, CCC Tailwinds)

Key indicators

Hiahia in 2050 (unless otherwise stated)

1.6°C
increase in global temp
(relative to pre-industrial levels)

NZ Extreme rainfall
+15%
For 2040 relative to 1990

0.8Mha
NZ native forestry

0.2m
Sea level rise NZ
(for 2050 relative to 2005)

NZ Snowfall
-10 days
For 2040 relative to 1990

$277
Per tonne NZD carbon price

6Mt
NZ emissions (CO_2-e)

NZ Glacier retreat
-32%
For 2050 relative to 2005

7%
Global population increase
(relative to 2022)

26Gt
Global emissions (CO_2-e)

NZ Extreme heat
+15 days
For 2040 relative to 1990

$629tn
Global GDP (NZD)

16%
NZ population increase
(relative to 2020)

$43NZD
Global per barrel oil price

Key outcomes

- The tourism sector is recognised as a critical contributor to the New Zealand economy and a complex system that interacts with a range of other sectors and government agencies. The success of all sectors is measured by the four areas of Mauri wellbeing and outcomes aligned to the UN SDGs.
- The tourism sector has become a world-leader for championing regenerative tourism with a low environmental footprint. The concept of Mauri is embedded into visitor experiences and business practices.
- Climate data is easily accessible and comprehensive so physical risk assessments are an established part of business practice – even for small businesses.
- Domestic travel makes up a larger part of visitor expenditure than historically, but international visitors still come, mostly from short and medium-haul markets.
- New Zealand has met the emissions reduction targets in the Climate Change Response Act as part of a global push to meet the goals of the Paris Agreement.
- Aviation has been largely decarbonised but still has climate impacts due to radiative forcing effects. The residual emissions are credibly removed through permanent carbon sinks.
- Successive National Adaptation Plans have laid the groundwork for effective adaptation, including retreat from some highly exposed areas.
- Effective conservation has meant that populations of some iconic species, such as yellow eyed penguins in Southland and kiwi in Northland, are rebuilding.

Key info 2050

98%
Renewable electricity

98%
EV light passenger vehicle kilometres travelled

94%
EV bus vehicle kilometres travelled

-70%
Change in domestic aviation fossil fuel use relative to 2019 levels

Changes across the five drivers of change show how Aotearoa New Zealand has evolved over 30 years in the orderly scenario

Environmental

Biodiversity protection has been interwoven with climate change policy, resulting in effective management of ecosystems. Mana whenua, the tourism sector and local communities play an active role in preserving biodiversity and regenerating the landscape. Predator Free 2050 is achieved. Renewed focus on reversing ecosystem decline has led to new protected areas and reserves.

Tourism operators transition to provide ecosystem service offerings. Providing visitors with the opportunity to immerse themselves in nature and contribute to regenerating native ecosystems. Mauri benefits as biodiversity and rural communities thrive as they welcome visitors. Significant investment in infrastructure in regions of outstanding beauty, such as central Otago, Fjordland and Nelson/Tasman allows them to become circular environments to improve water use efficiency, minimise waste disposal and ensure a balance between people, place and profit.

Difficult decisions were made around retreating from attractions impacted by climate change, especially in Northland, and Coromandel, along the West Coast of the South Island and around the Bay of Plenty. Scenario analysis and the adoption of dynamic adaptive approaches is commonplace to help make difficult decisions for large scale investment in natural and cultural assets.

Markets

The sector gains confidence in making long term decisions. The decision in the mid-2020s to embed Mauri as a wellbeing measure has enhanced our attractiveness as a destination. Visitors arrive from the Asia Pacific region opportunities to participate in nature based activities. Technology is used by visitors as they travel to measure Mauri: immediately seeing how they have helped regenerate nature, strengthened their connection to community, and contributed to a thriving nature-based economy.

The finance sector and international investment market increasingly seek to invest in regenerative forms of tourism. Operators that can illustrate they are contributing to ecosystem restoration, emissions reductions, and increasing Mauri are attractive to investors. Similarly, government funding is available for innovative experience providers and organisations that build regenerative pathways. Organisations with high emissions struggle to remain viable.

The sector has pivoted its thinking from a conventional economic model and established itself as a global leader in indigenous systems thinking: applying the MauriOmeter to ensure a just transition to net zero with nature and humans co-existing in a regenerative system, while still being economically viable.

Policy

Government is agile, responsive and systems thinking, and has placed Mauri at the centre of decision making. Tourism is recognised as a complex system with human, geographical and institutional relationships. Successive emissions budgets have been met and National Adaptation Plans implemented. Local governments implement adaptation strategies. The destination management approach is well-funded and has an expanded mandate to drive adaptation across the regions, and to equip tourism operators to adopt regenerative models. A tourism levy exists for biodiversity protection to support new protected areas and reserves.

Kaitiakitanga is integral to government policy and metrics have been developed to measure Mauri for communities, Taiao and visitors.

Safety in areas exposed to extreme weather is also a key concern. Some areas are designated permanently off-limits. Experience providers in many regions are required and empowered to implement proactive monitoring and protective measures to ensure visitors' safety.

Social

The tourism sector has worked with education providers and the government to build a talent base in regenerative tourism. Iwi/Māori have carved out a significant space in the tourism sector by developing new experiences that benefit people and the planet. They play a leading role in driving regenerative tourism practices in the regions. Te ao Māori principles have been widely adopted and contributed to the attractiveness of New Zealand as a destination of choice for climate conscious visitors.

The tourism sector's contribution to biodiversity protection is really clear and this is a driving factor in the promotion of experiences by destination management offices and industry operators. The championing of Mauri as core to the tourism sector has created a culture of inclusion and regeneration within the sector. Visitors, environments and organisations are all enriched through their experiences. Mana is strong amongst New Zealanders from the strong leadership role the tourism sector has taken. Partnerships have emerged across central and local governments, communities and regional economies.

Technology

Investment in innovation and technology is significant in the rush to fund the transition. Tourism is a winner in this regard as operators are constantly wanting to improve the visitor experience, enhance their Mauri and wellbeing while lowering cost and carbon footprint. The uptake of artificial intelligence is high to provide services to people who no longer want to fly great distances, and allow visitors to still experience permanently closed-off areas. The sector develops depth and breadth in the metaverse experience economy that complements its physical tourism product and establishes the first rules of compassionate and respectful indigeneity online. Not all tourism operators can afford the costs of new technology and investment can be risky.

Public sector organisations are able to invest in upgrades to building methods, materials and monitoring systems to ensure new or rebuilt assets are more resilient to the physical impacts of climate change. Real-time climate data is publicly available and has transformed how small businesses operate; managing health and safety risks and enabling forecasting for non-operating days. Investment in artificial snow technology ensures adequate skiing conditions so we become a more desirable skiing destination.

Strong climate action drives the transition to a net zero world where tourism thrives

Climate risk assessment and reporting is 'business as usual' for tourism operators and kaitiakitanga and manaakitanga underpin many corporate strategies. The most resilient organisations incorporate climate change into financial planning and their balance sheets report carbon exposure. Mauri tends to be highest for these tourism operators. Businesses that have failed to incorporate climate change into their planning have become unviable as the global economy has changed. Strong private and public sector investment has helped strengthen crucial infrastructure, including airports and water storage facilities.

Domestic tourism is popular. It makes up a greater proportion of tourism expenditure than historical levels because the costs of long haul travel increased with the introduction of sustainable aviation fuels (SAFs) in the 2030s. Operators are assisted to reduce their environmental footprint and rewarded for doing so. International and domestic visitors are keen to explore areas beyond the typical 'hotspots', giving an opportunity for small communities and businesses to benefit from regenerative tourism. Finance, subject to green conditions, is available for climate innovation in the sector. We become a key destination for visitors wanting to experience the rich biodiversity.

Disorderly – Pokanoa Scenario

Pokanoa represents a disorderly transition with little policy action until 2030 after which strong, rapid action is needed to limit warming to 2°C. This scenario assumes countries or territories recover from COVID-19 using fossil-fuel heavy policies so emissions increase and carbon budgets are not met. It is only after 2030 that new climate change policies are introduced, but not all countries take equal action. Physical and transition risks are also higher as a consequence. This is a costly and disruptive transition to net zero emissions. Global net zero is reached around 2060.

Delayed transition

The global situation

In Pokanoa, policy lethargy continues until 2032 when countries have to report on achievement of their first nationally determined contribution (NDC1) targets. China and the USA front a global geopolitical shift towards limiting global warming as much as possible. Richer nations are able to adapt better than those less wealthy and the divide between rich and poor widens. Other societal goals, such as biodiversity protection and reducing inequality, are deprioritised. Discussion on the role of forestry in mitigating climate change takes centre stage in the United Nations climate change negotiations.

Aotearoa New Zealand situation

Around 2030, a sequence of compound weather events sweeps across New Zealand, causing significant damage to people and property. The most vulnerable parts of the country suffer the greatest losses, leading to political tension and loss of faith in government. Coupled with the costly offshore mitigation to meet NDC1, political parties join forces to tackle climate change, depoliticising the issue. The delay in effective policy implementation results in a transition that is expensive and inequitable, it takes a toll on Iwi/Māori and business. Large-scale forestry a significant contributor to abatement. Our emissions of CO_2 reach net zero around 2040.

The tourism sector is struggling. Long-haul travel has become very expensive, so only a small number of wealthy people visit from overseas. Domestic travel has increased, though it is also costly.

Economy

Trade is strong and globalisation has accelerated. Strong leadership in China and the USA has created general stability. Countries that chose not to reduce emissions faced penalties and higher costs in global markets.

Technology

Technology advancements are slow until 2030 then very fast since. Technology innovation is aimed at enabling emissions reductions, especially in energy, construction and transport. But a 'technology divide' emerges as wealthy groups adopt new technology while lower socio-economic groups are unable to do so.

Social

Development and income growth continues to proceed unevenly and progress towards the SDGs is piecemeal. Policy that fails to account for impacts on social outcomes such as equity and poverty eradication have increased inequalities. Urban populations expand as smart cities are developed and become attractive places to live.

Incomes

Asia sees strong economic growth as it embraces the shift to a low emissions world, but much of the developed world sees weak or no growth. Income inequality persists across most of the world and challenges to reducing vulnerability of lower income groups remain high.

Aviation, Cruise and Transport

Aviation has proven hard to decarbonise. Low emissions fuels are available, but costs are high and aviation still contributes to climate change. Cruise lines adopted sustainable fuels as hydrogen became more widely available, but costs remained high and some cruise lines were unable to convert. Other modes of transport rapidly decarbonised.

(SSP2: Middle of the road, RCP4.5, IEA Sustainable development)

Policy

Policy remains similar to pre-COVID-19 times throughout the 2020s, with little focus on emissions reductions or biodiversity protection. After paying the high cost of meeting the NDC1 target through offshore mitigation in the EU and the USA, reducing domestic emissions becomes a priority above almost all other issues. Disruptive policy with a strong reliance on exotic forestry to offset carbon is the norm.

Ecosystems

The combination of large forestry plantations and climate action leads to mixed impacts on ecosystems. Most ecosystems have benefitted from the slowing of the rate of warming, but some were lost as land was appropriated for forestry and energy supply. This has caused a lot of tension around which ecosystems should be protected and what can be sacrificed.

Mauri

New Zealand was late to the party on climate action and has suffered as a result. A number of rural communities have lost identity and unemployment has risen. For some, overdue climate action has improved wellbeing, but for others, Mauri is depleted.

Physical climate change

The risks associated with severe weather events are worse than in the hiahia scenario, and the lack of concerted action to build resilience before 2030 makes us unprepared for the impacts climate change inevitably brings. The sequence of events that sweeps across the country in 2030 causes significant damage and exposes the lack of adaptation planning. Large amounts of infrastructure have to be rebuilt as roads, bridges, energy infrastructure and homes are devastated by intense rainfall and floods, which could have been lessened by effective adaptation in the 2020s.

As in hiahia, glacier retreat continues and sea level rise puts low-lying coastal attractions and assets at risk. Fire risk also increases in many parts of the country, including the central and northern South Island, and the eastern North Island. Sea level rise is having very real impacts on coastal communities and low-lying airports.

(SPANZ B, CCC Headwinds)

Key indicators

Pokanoa in 2050 (unless otherwise stated)

2.0°C

increase in global temp
(relative to pre-industrial levels)

NZ Extreme rainfall

+18%

For 2040 relative to 1990

0.5Mha

NZ native forestry

0.22m

Sea level rise NZ
(for 2050 relative to 2005)

24Mt

NZ emissions (CO_2-e)

57Gt

Global emissions (CO_2-e)

22%

NZ population increase
(relative to 2020)

NZ Snowfall

-15 days

For 2040 relative to 1990

NZ Glacier retreat

-37%

For 2050 relative to 2005

NZ Extreme heat

+20 days

For 2040 relative to 1990

$89NZD

Global per barrel oil price

$369

per tonne NZD carbon price

16%

Global population increase
(relative to 2022)

$543tn

Global GDP (NZD)

Key outcomes

- Operating costs increase due to regulation-related rises in the prices of energy, fuel, transport and rent. Emissions-intensive businesses quickly face insurmountable challenges.
- The focus on climate change leads to biodiversity protection being deprioritised. Only localised biodiversity projects that have climate co-benefits are funded.
- Access to climate data has improved after being piecemeal until the mid-2030s. It remains expensive for businesses to assess their climate risks and transparency is poor.
- New Zealand fails to meet the first three emissions budgets set by the Government, but introduces and meets stringent budgets following those failures.
- Aviation has become very expensive and lost considerable popularity. Alternative transport methods are not sufficiently fast or cheap to replace lost long-haul travel, but are growing.
- The physical impacts of climate change have caused significant damage across the country, but by the 2040s National Adaptation Plans (reframed as National Resilience Plans) have significantly strengthened the resilience of the country.

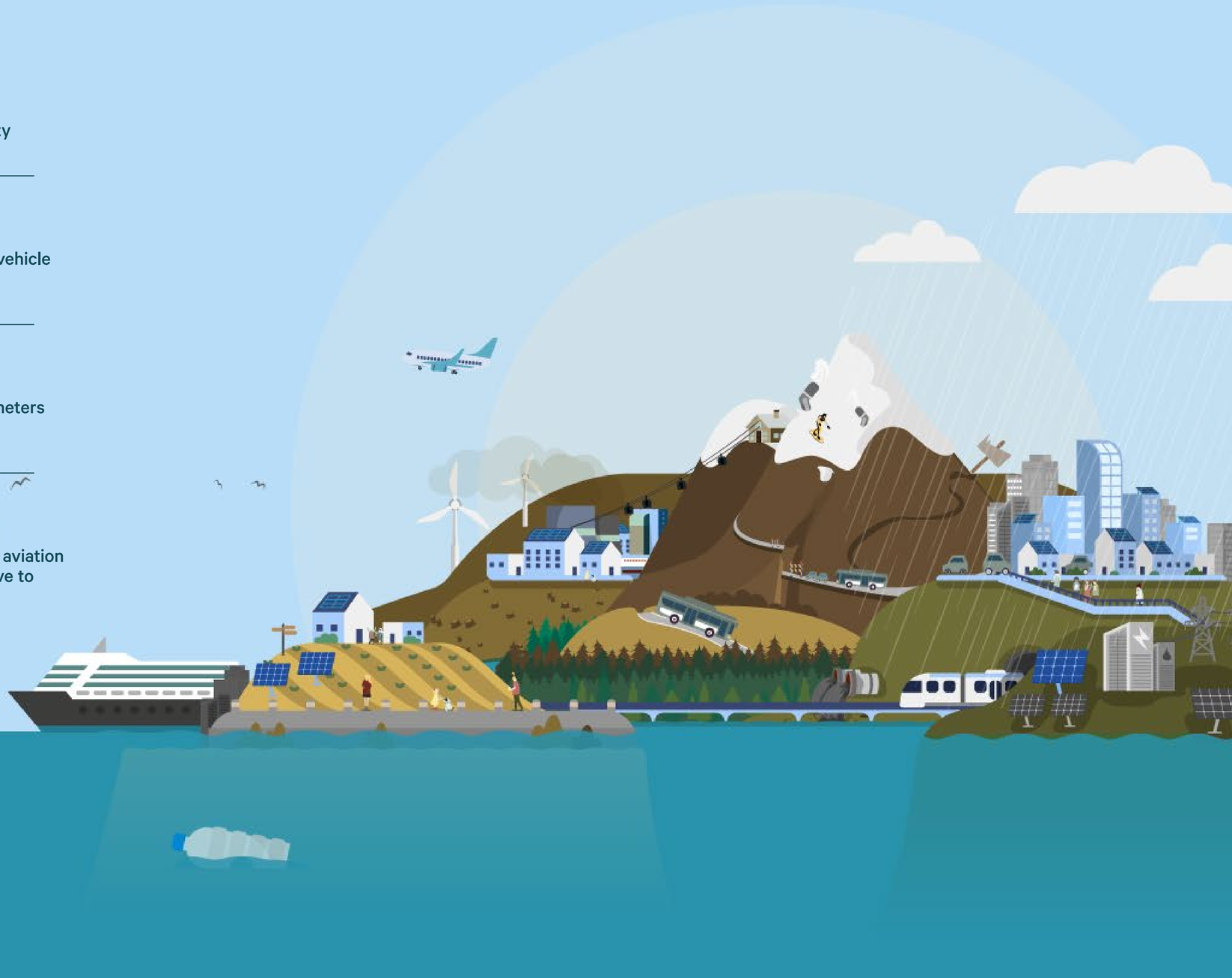
Key info 2050

96%
Renewable electricity

92%
EV light passenger vehicle kilometers travelled

87%
EV bus vehicle kilometers travelled

0%
Change in domestic aviation fossil fuel use relative to 2019 levels



Changes across the five drivers of change show how Aotearoa New Zealand has evolved over 30 years in the disorderly scenario

Environmental

Although we are less impacted by severe weather events compared to other countries, increased severe weather events have decreased operating days for visitor experience providers. Some coastal roads and popular visitor journeys are damaged intermittently, creating unreliable visitor experiences and health and safety concerns for operators. In parts of New Zealand some experiences have been lost altogether, including walking tracks, coastal and alpine areas.

Long-haul travel is expensive due to increased risk of disruption due to weather events, aviation fuel taxes and high-insurance costs. The increases in storm surge cause disruptions to domestic travel at multiple low-lying airports, including Invercargill and Hawke's Bay.

Iwi/Māori have a strong voice calling for environmental action and in many regions are seen as a more legitimate source of robust adaptation than governments.

Markets

International travel is increasingly a luxury service and many conscious travellers choose not to fly. There is an increase in Trans-Tasman travel compared to other international markets. Domestic travel grows as fewer kiwis venture offshore and the domestic market becomes more accessible. The loss of some taonga has impacted on Brand NZ. Operators have had to adapt to survive but adaptation remains a lower priority than mitigation. Legislation and government support are insufficient for small businesses to effectively adapt and a large number go under after 2032. It takes many years to recover from the economic shock caused by the dramatic introduction of stringent policy.

Tourism is seen as an increasingly risky investment as transport becomes more expensive. Accessing capital becomes much harder for visitor experience providers as banks reduce their exposure to high-risk assets. Experiences that can be accessed via efficient and affordable transport are more successful at accessing investment. A lack of coordinated funding mechanisms for tourism infrastructure and communities sees some regions shine and others fail, creating inequities.

Policy

The rush to create policies to rapidly reduce emissions results in a lack of cohesion and connection across policy settings. The predominant focus on climate change mitigation draws attention away from other important issues including biodiversity protection. Biodiversity loss and ecosystem decline are only addressed if there are co-benefits for emissions reductions.

While political parties are aligned on climate change, siloed policy is commonplace, creating a lack of systems thinking in the political landscape. The tourism sector is not considered a priority sector for consultation so policy is often not inclusive. Local Governments are empowered to take localised adaptation actions, so that regions have become resilient to the physical impacts of climate change, but mitigation actions are dictated by Central Government, so are often a blunt instrument that causes inequitable outcomes between regions.

We struggle to provide alternative energy sources in a timely manner so energy supply is poor. Poorly planned but rapid electrification leads to blackouts and high energy costs, making transport and electricity expensive.

Social

Due to the pace of change after 2032, some communities have been unable to provide a quality experience for visitors and consequently have been disenfranchised. This has been accentuated by restrictions placed on natural spaces in localised efforts to protect biodiversity and create carbon sinks, resulting in tourism operators having limited access. Displacement of communities to establish plantation forests has resulted in widespread loss of jobs, homes and businesses. Mauri and community identity has been adversely impacted across the nation.

Social pressure to limit travel and 'flygskam' (flight-shaming) is a strong motivator for some people to avoid high emissions travel. People still holiday, but travel tends to be closer to home and involve less frequent, long haul trips. International and domestic visitor expenditure has declined, and domestic travel dominates the market.

The Crown does its best to meet its Te Tiriti obligations and many Māori leaders have become powerful voices for progressive social change. Incorporation of Matauranga Māori is common in government agencies, but piecemeal across the private sector.

Technology

Technology change has been rapid since the early 2030s as governments significantly ramped up investment. New construction technologies and materials with lower embodied emissions proliferate but are costly in many cases. Some government support is introduced to ease the burden on businesses but it is insufficient and piecemeal.

Electric vehicle battery technology has improved dramatically and EVs now dominate the light and medium-weight vehicle fleet, but private vehicle ownership has declined. Uptake of SAFs starts to rapidly advance after 2032, although it remains expensive and the international aviation sector has not decarbonised. Some technology has emerged that could help the tourism sector adapt to climate change, including coastal protection and artificial snowmaking, but it comes with a hefty price tag. A new wave of tourism starts to emerge with the slow introduction of artificial intelligence. Taking New Zealand into virtual reality allows visitors to experience a holiday here without leaving home.

Delayed but strong action created real challenges for the tourism sector

The tourism sector takes a significant hit through the transition to a low emissions economy. Businesses either quickly pivot their business model, which often comes at high cost, or face even higher costs of operation. Many don't survive the transition, but those that do emerge as low emissions and resilient organisations that build climate risk and forecasting into their business models, and contribute to rebuilding the Mauri of Aotearoa.

Domestic tourism makes up the majority of visitor expenditure as long haul travel has dramatically declined. The cost of flying increases so strongly that land travel is more common, but private car ownership has decreased. Bus, train and guided tour travel has increased relative to other modes creating new opportunities for operators. Business travel does not recover to pre-COVID levels, but remains common, although alternatives to flying are popular.

Disruptive government policy means the tourism sector is not consulted or considered a 'priority sector' in need of support. The visitors who can afford to travel here from overseas tend to stay for long periods. Some visitors are committed to regeneration or sustainability and push parts of the tourism sector to play its role in the sustainability transition. Offering regenerative experiences is an opportunity for some tourism operators, especially Iwi/Māori to actively increase the Mauri of New Zealand and contribute to the transition to a low emissions economy.

Finance is difficult to access since the tourism sector is seen as high-risk. Loans have strong sustainability criteria. Due to the costs incurred with the transition, some smaller tourism operators struggle with the high costs of reducing their environmental footprint. The disruptions caused by the transition have produced a sector very different to the 2020s, with small players struggling to stay afloat, and big businesses that were able to withstand the transition now strongly embedded and dominant in the sector.

Hothouse – Wharewera Scenario

Hothouse describes a world in which emissions continue to rise unabated as no additional climate change policies are introduced. Fossil fuel use continues to increase and so global CO_2 emissions continue to rise and warming is expected to reach higher than 3°C by 2080. The physical impacts of climate change are severe. There are irreversible changes including glacial melt and sea level rise. Adapting to climate change has become the priority and it is assumed that physical climate events will impact the economy and financial system long term.

Current policies

The global situation

In Wharewera, global climate policy ambition dwindled in the 2020s and emissions have continued to rise. Investment in education and healthcare has improved quality of life for developing countries, but the physical impacts of climate change are wreaking havoc. Focus has shifted to localised adaptation actions. Global tensions are high as the physical impacts of climate change force mass migration. Salinated lands, food insecurity and overcrowding cause conflict on a scale never seen before. Displacements of entire territories in the Pacific and Caribbean contributes to the widening inequality gap as those with less are most affected. The International Panel on Climate Change (IPCC) process dissolves which stagnates international progress on climate modelling.

Aotearoa New Zealand situation

Our small population, abundant renewable energy resources and potential for large-scale forestry removals enable us to reduce our net CO_2 emissions to zero around 2050, much faster than other territories around the world. This is driven by the combination of forestry and the lowering cost of renewable energy and electric vehicles, rather than additional climate policy. Much of the Pacific has become uninhabitable and many Pacific nations have sought refuge in New Zealand leading to significant population increase. At the same time supply chain disruptions are common, creating food supply shortages and very high costs so we have increased food production to prevent domestic food insecurity. This means our gross emissions and emissions from agriculture remain very high by global standards.

Tourism remains a viable industry, and New Zealand is judged to be a destination of choice as climate change impacts are less severe here than in other parts of the world.

Economy

Economic growth is still prioritised by governments. Competition for natural resources dominates the geopolitical landscape driven by the exploitation of fossil fuel resources which are becoming much harder to exploit e.g. fracking and tar sands as the principal sources.

Technology

Technology evolves quickly but not in the climate solutions space. The continued push for growth and productivity has led businesses and governments to innovate in energy technology.

Social

Physical climate change leads to significant migration and has created some political tension, overcrowding in some places and high relocation costs have also created more diverse communities. Smart cities emerge as temperatures rise and water resources need to be managed. There are ongoing geopolitical tensions and the impacts of climate change have ruined the livelihoods of many, with the poorest communities most affected.

Incomes

Improvements in education outcomes have increased incomes in some of the developing world, but rich country incomes have stabilised or begun to decline. But, disruptions, conflict and food and water insecurity means huge numbers of people face enormous costs just to survive.

Aviation, Cruise and Transport

The desire for long haul air travel remains high, but disruptions are common due to climate change pushing up price of travel and causing regular disruptions. Cruise ships are the preferred mode of trans-Tasman travel. The shift to electric and hydrogen vehicles is slower than in other scenarios. But, New Zealand still suffers from severe weather events which affect biodiversity and natural landscapes, and cause the collapse of some ecosystems. This impacts tourism offerings and reduces Mauri.

(SSP5: Fossil-fueled development, RCP8.5)

Policy

Although some mitigation policy exists, the focus has shifted more towards localised adaptation projects, although these remain underfunded. There is a lack of long-term systems thinking in government. New Zealand does position itself as a 'leader' on environmental issues and is transparent about its views on countries that continue to increase emissions.

Ecosystems

The exploitation of natural resources continues as fossil fuel use and traditional agricultural practices remain common. Coupled with the physical impacts of climate change, this has devastated some taonga ecosystems and brought many to the brink of collapse.

Mauri

The Mauri of New Zealand is severely depleted as frequent and severe weather events devastate coastal communities and endemic flora and fauna. Lack of confidence in governments has led to a loss of pride in being a kiwi.

Physical climate change

The physical impacts of climate change have worsened considerably. Although New Zealand was initially insulated compared to the rest of the world, extreme weather events are so frequent and severe that significant damage has regularly been inflicted across the country.

Droughts and floods have become more common and severe across the country, and a number of communities have suffered through multiple compound extreme weather events especially in Northland and Eastern Bay of Plenty and the West Coast of the South Island. Small towns in fire-prone regions of Canterbury, Central Otago, Wairarapa and Hawkes Bay must brace themselves for wildfires every summer. Floods have devastated urban centres in Wellington, Auckland, Palmerston North and Dunedin where water infrastructure was neglected for decades.

Tipping points in the climate system have been passed so that we are locked in to several metres of sea level rise in the coming centuries. Coastal communities are forced to retreat. Risk-based pricing in the insurance sector has made home insurance unaffordable for great swathes of the population, increasing the reliance on government support.

The devastation of small communities, coupled with the grim outlook for the future, led to a strong fall in Mauri in the 2030s. Inequities are wide.

(SPANZ D, CCC Current Policy Reference)

Key indicators

Wharewera in 2050 (unless otherwise stated)

2.5°C

increase in global temp
(relative to pre-industrial levels)

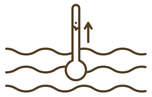
NZ Extreme rainfall

+22%

For 2040 relative to 1990

0.2Mha

NZ native forestry



0.32m

Sea level rise NZ
(for 2050 relative to 2005)

40Mt

NZ emissions (CO_2-e)

103Gt

Global emissions (CO_2-e)

26%

NZ population increase
(relative to 2020)

NZ Snowfall

-20 days

For 2040 relative to 1990

NZ Glacier retreat

-38%

For 2050 relative to 2005

NZ Extreme heat

+30 days

For 2040 relative to 1990

$157NZD

Global per barrel oil price

$35

Per tonne NZD carbon price

8%

Global population increase
(relative to 2022)

$754tn

Global GDP (NZD)

Key outcomes

- Severe weather causes frequent damage and disruptions to transport, infrastructure and food supply, making travel difficult and very expensive.
- Some ecosystems and key visitor draw cards have been lost entirely and others are on the brink of collapse.
- Adaptation is the priority and government support is consistent with this. Local governments are empowered to undertake local adaptation projects, but the costs grow inexorably.
- The desire for international travel remains high but disruptions due to climate change and geopolitical instability make the cost prohibitive to most people. Long haul visitors tend to stay for long periods and contribute more to the tourism sector.
- New Zealand still sets and meets emissions budgets but they are weak and take advantage of high renewable electricity and forestry.
- Domestic travel is higher than pre-COVID-19 levels as New Zealand remains one of few destinations where warming is lower than the global average.
- Cruise ships remain common, bringing trans-Tasman visitors but storms and high costs have reduced their popularity.
- The physical impacts of climate change have wreaked havoc across New Zealand. Local and National Adaptation Plans are common, but the costs are unmanageable for many.

Key info 2050

92%
Renewable electricity

80%
EV light passenger vehicle kilometers travelled

83%
EV bus vehicle kilometers travelled

20%
Change in domestic aviation fossil fuel use relative to 2019 levels

Changes across the five drivers of change show how Aotearoa New Zealand has evolved over 30 years in the wharewera scenario

Environmental

Widespread loss of species and ecosystems has occurred due to the physical impacts of climate change. Traditional economic models still dominate policy conversations, so biodiversity and ecosystem services are still valued financially. Whole biomes and taonga species are lost due to physical climate change resulting in a devastating impact on the Mauri of the land. Ecosystem services are drastically reduced.

The impacts of climate change are more severe overseas than here which prompts more visitors to come to New Zealand, but from 2040 the impacts here have become devastating, especially to biodiversity. Tropical cyclones now push further south than ever before and often cause flooding in parts of the North Island, and the South Island is pummelled by the extratropical storm track. Floods and storm surges are prevalent making many visitor attractions unreachable. The loss of Mauri through the degradation of land and taonga species has caused a loss of connection to land and place for many Māori.

Markets

Global financial crises have occurred as a result of worsening climate change impacts and rising global tensions and conflict. Fresh water becomes a tradable commodity.

The tourism sector has changed considerably. There are still high numbers of visitors but they are concentrated in regions, particularly those which are hotter and drier but provide respite from heat waves at certain times of the year in other parts of the world. Rising costs of long haul travel due to climate related disruptions means those that travel here stay longer. Worsening seasonal challenges and higher insurance costs result in tourism becoming unviable in other parts of the country that are too wet. Destination Management Offices close in some regions and expand in others. Despite all the disruption there are opportunities for the sector to leverage longer term visitors and longer tourism seasons.

For smaller sized operators, the costs of doing business sky-rocket and some experience providers that can't innovate with digital technologies fail. Health and safety costs are also excessive.

Policy

Globally, there is no climate policy ambition. New Zealand has made a small effort to reduce emissions, but the strong reductions achieved were mostly driven by fortunate circumstances and market forces rather than dynamic policy. Nevertheless, the government has closed the borders to some countries that continue to increase emissions and is transparent about doing so.

Out of necessity, adaptation has become the primary focus of policy. Funding is provided for local governments and councils to adapt to the physical impacts of climate change, but the costs rise inexorably. There has been a push by Central Government to embed transformative adaptation into its thinking, with some successes. While climate data is widely available the national projections have not been updated for 20 years this forces councils to work together to understand their climate risks.

Social

There has been a strong loss of social and cultural value in many regional areas due to loss of taonga species and iconic landscapes. Although economic growth is strong, due to the exploitation of abundant fossil fuel resources and investments in education and healthcare which improve opportunities for many people, the declining environment means Mauri is depleted and health outcomes decline. Air quality is poor. Opportunities for recreation have declined, with widespread impacts on wellbeing.

Regions that can no longer rely on visitors suffer and livelihoods deteriorate. This is exacerbated by the arrival of climate refugees with decreased employment options. Unemployment in regional centres increases and many locals are forced to shift to the main urban areas. Smart cities emerge as a way to alleviate the growing overcrowding and poverty. Some once thriving regional centres are now ghost towns as innovation takes experiences and attractions online and employment opportunities have dried up.

Technology

Technology advances slowly. Access to the latest technology is limited and what is available is very costly. This slows the uptake amongst smaller operators who become less competitive than the large companies that have better access to data systems, artificial intelligence and innovative visitor experiences. As a result, a sharing culture of resources and technology emerges in the sector to help keep the sector afloat. Desire for new experiences in place of travel drives innovation in alternative forms of tourism such as virtual reality, online simulations of attractions and web-based interactive tours. This allows visitors to experience once iconic natural and cultural assets that have been lost through climate change.

Technology advances are focused on energy source extraction and do not enable regenerative tourism. Some innovative forms of transport emerge in the push to improve resilience to the physical impacts of climate change.

Limited or no action on climate change means the physical impacts devastate tourism

New Zealand is seen as an attractive destination compared to the rest of the world so tourism remains viable. But, severe storms including lightning incidents, flooding, sea level rise near airports, economic shocks, disruptions and geopolitical tensions limit the numbers of international visitors, reduce tourism offerings, restrict areas open to visitors and increase the costs of flying both domestically and internationally. Cruise ships dominate the Trans-Tasman travel bubble. Skiing is only viable in the highest accessible elevations in the South Island and has a much shorter season, being highly dependent upon snowmaking. Continuing high rates of private car ownership means the kiwi road trip is still popular. But, high fuel and energy costs, and the potential for disruption, mean visitors tend to travel slower and domestic travellers stay closer to home.

A large number of attractions, including Great Walks in the Abel Tasman, the Chathams and the West Coast, have had to close due to constant storm damage. Others in Central Otago and the East Cape have become unpopular as ecosystems have declined and biodiversity disappeared. Heat in Central North Island means Mount Ruapehu is too exposed for visitors for longer periods of time. But, some regions have been able to capitalise on the changing climate as warmer or drier weather made them more attractive. In particular, some western and southern coastal areas formerly considered too cold now have pleasant summer climates.

Seeing the impacts that travel and visitors have on their communities through higher fossil fuel use, poor air quality and damage to already vulnerable infrastructure, many rural towns are no longer keen to accept visitors, and a small number of large organisations dominate the industry. Large resorts that are well-protected from physical climate change and insulated from the struggling communities around them have emerged and offer long-term visitors safe haven.

Innovative experiences, such as virtual reality, online simulations of attractions and web-based interactive tours, grow to become a larger part of the industry. Similarly, cultural travel is common, but mostly in the form of 'last-chance tourism'. Visitors seek out some Māori cultural sites and landscapes that do not have the resilience to survive the changing climate.

Appendices

APPENDIX ONE: Approach

Workshops

Kick-off Hui: 7 April 2022
The kick-off meeting involved the PwC Secretariat team, the Co-Chairs and the Leadership Group. This meeting confirmed the project scope, working definition of the tourism sector, initiative objectives, programme structure, work plan, accountabilities, governance structure and ways of working.

Risk Workshop: 3 May 2022
The Secretariat hosted and facilitated a climate-related risk identification workshop with the Technical Expert group of the Tourism Adaptation Roadmap workstream for the Aotearoa Circle. This workshop identified the top physical and transition risks for the tourism sector.

Scenarios Workshop: 7 June 2022
The Secretariat hosted and facilitated a climate scenarios workshop with the Technical Expert group of the Tourism Adaptation Roadmap workstream for the Aotearoa Circle on 7 June. This workshop developed the framework for a set of plausible climate change scenarios for the tourism sector.

Impacts and Challenges Workshop I: 5 July 2022
The Secretariat hosted and facilitated the first impacts and challenges workshop with the Technical Expert group of the Tourism Adaptation Roadmap workstream for the Aotearoa Circle on 5 July. This workshop identified the potential impacts and consequences of inaction on the tourism sector based on the Hiahia (orderly) and Tōmuri (too little, too late) scenarios. The potential challenges for industry participants were also articulated. The Tōmuri scenario was later removed from the scenario set after stakeholder feedback.

Impacts and Challenges Workshop II: 2 August 2022
The Secretariat hosted and facilitated the second impacts and challenges workshop with the Technical Expert group of the Tourism Adaptation Roadmap workstream for the Aotearoa Circle on 2 August. This workshop identified the potential impacts and consequences of inaction on the tourism sector based on the Pokanoa (disorderly) and Wharewera (hothouse) scenarios. The potential challenges for industry participants were also revisited.

Opportunities Workshop: 5 & 8 September 2022
In the final workshop for the workstream, we came together to identify the key opportunities for adaptation that exist for the sector, building on the work already done to identify the challenges.

Consultation and review

Following each workshop, the co-chairs and LG were consulted on the outcomes. Feedback on the outcomes was integrated and fed into the the next steps of the process.

Scenario development

PwC developed and utilised a comprehensive risk assessment approach, combining insights from best practice such as the Task Force on Climate-Related Financial Disclosures and the ISO14090:2019 – Adaptation to climate change standards, to develop a tailored and fit for purpose approach for this unique piece of work.

Our approach allowed us to create a comprehensive understanding of the most material climate related risks and the top driving forces that influence the sector before building the scenarios. This enhanced our understanding of how the risks then impacted the sector and the challenges that may present.

The steps taken were as follows:

1. **Identification of the most significant climate-related risks:** The top physical and transition risks were determined through discussions with the TEG and subsequently agreed with the LG and Co-Chairs.

2. **Development of a risk and scenario analysis model:** The most significant physical risk (extreme weather events impact on natural capital and infrastructure) and most significant transition risk (regulatory burden impacts operating costs and affordability of travel) were voted on and agreed to by the governance groups. These top risks were then used to create a 'scenario structure', whereby the range of scenarios covered the range of possible manifestations of each top risk. To ensure comparability and consistency with XRB requirements, we then reconciled these axes with the scenario framework set out by the Network for Greening the Financial System (NGFS).[8] Establishing this framework allowed us to develop climate scenarios that capture a broad range of plausible outcomes for the sector.

3. **Identification of key driving forces and development of scenario narratives:** With an understanding of the climate-related risks facing the tourism sector and scenario characteristics established, we worked with the TEG to identify the top driving forces that influence the sector. Driving forces are broad-scale factors that influence the sector and often create risks and opportunities. Once the key driving forces were identified, they were then used to develop scenario narratives that reflect critical influences on the sector. We then built out the scenario narratives using information from global and national reference scenarios and climate data. Reference scenario information was taken from scenarios developed by the NGFS, the Climate Change Commission and the International Energy Agency, and information included in Shared Socioeconomic Pathways and reported by the Intergovernmental Panel on Climate Change. We also used climate data from the National Institute for Water and Atmospheric Research.

8 Network for Greening the Financial System. (2020). Technical document: Guide to climate scenario analysis for central banks and supervisors. NGFS.

Key elements of the project

Risk assessment and materiality

The most significant physical and transition risks for Aotearoa New Zealand's tourism sector were identified. These were used to create the scenario framework.

Scenario Analysis

Three climate scenarios were explored. Ten driving forces and how they manifest under each of the three scenarios created the basis for the development of scenario narratives. The narratives build a picture of what the world may look like under each scenario.

Impact, consequences and challenges

The Secretariat collated and articulated the challenges experienced by industry participants, including the impact and consequences of doing nothing about climate change.

Opportunities

We evaluated the opportunities that the changing climate may bring to the tourism sector, including the opportunity to build in regenerative thinking.

Adaptation roadmap

Collectively agree pragmatic and tangible adaptation actions that respond to the effects of climate change and allow the sector to make confident and coordinated decisions.

This work builds on and complements other work across the tourism sector

The New Zealand Tourism Futures Task Force was created in June 2020 following the significant challenges COVID-19 posed to global travel and tourism. In their interim report, the Taskforce suggested switching from focusing on the experience the visitor had, to ensuring the wellbeing of the community hosting the visitor was prioritised: to protect the land and the people and enhance the resilience of the tourism sector. The report leveraged the concept of regenerative tourism and aligned its recommendations to the four wellbeing pillars (economic, environmental, social and cultural), and was shaped by the concept of Mauri. This workstream has aligned with this same concept and approach.[9] In order to empower communities, the Tourism Futures Task Force suggested a new legislative framework for destination management across local areas, towns and regions. This will determine how a 'destination' is experienced by visitors, communities and what activities occur. It is vital that these destination plans are created with and by communities and iwi to ensure long-term, regenerative outcomes.

The Parliamentary Commissioner for the Environment (PCE) has outlined four key focus areas for sustainable tourism: addressing tourism-related aviation emissions; government tourism funding through a sustainability lens, introducing environmental and social conditionality; protecting wilderness and natural quiet in public conservation land and waters; stronger requirements for self-contained freedom camping and improved oversight of the certification process. In their report, *Not 100% – but four steps closer to sustainable tourism,* the PCE also highlights Tourism New Zealand's (TNZ) goals for tourism following the pandemic, outlined in the thought leadership paper titled *Let's realign our tourism strategy closer to our Kiwi Values*. In this paper, TNZ pushes for New Zealand to move to a values-based industry so we can align the outcomes we want with what we believe to be important, such as restoring nature and being culturally inclusive.

The New Zealand Tourism Sustainability Commitment, which was put into place in 2017, intends to have every New Zealand tourism business committed to sustainability by 2025. This means:

- Ensuring tourism businesses are financially viable in the long term
- Protecting and enhancing the environment on which tourism depends
- Maintaining and enhancing support from local communities
- Ensuring customers have outstanding experiences with all tourism activities

Tourism Industry Association's Tourism Carbon Challenge aims for the New Zealand tourism sector to accurately measure carbon emissions and 'work together to significantly reduce emissions before 2030 and be net zero before 2050.[10] The first step in the challenge is to measure the sector's carbon footprint, which is currently underway.Other actions include industry-level carbon emission tracking, developing specific tracking metrics, global watching, business-level measurement, transparent disclosures and full coverage. In order to achieve these goals people within the tourism sector must be aligned with one another, engaged with Mana Whenua, engaged with consumers and the supply chain.

Regional Tourism Organisations (RTOs) are the connector of data, funding and awareness training from Government, and Regional/Local Councils to the tourism/iwi operators. The Green Room project which the Tourism Industry Aotearoa and RTOs are already doing is a vehicle to deliver the Adaptation Roadmap. The programme in the Bay of Plenty has transformed the participating tourism businesses into carbon neutral and waste minimisation businesses. The Regional Council have just completed a climate change risk assessment.

9 The Tourism Futures Taskforce (2020). The Tourism Futures Interim Report: We Are Aotearoa. Wellington. Ministry for Business, Innovation, and Employment
10 Tourism Industry Aotearoa. (2023). Tourism industry challenge to cut carbon.

APPENDIX TWO: Scenario characteristics

Paragraph 51 of NZ CS3 outlines the methodologies and assumptions that organisations must disclose as part of their requirements under the Climate-related Disclosures regime. A critical requirement is “a description of the various emissions reduction pathways in each scenario and the key assumptions underlying pathway development over time, including the scope of operations covered, policy and socioeconomic assumptions, macroeconomic trends, energy pathways, carbon sequestration from afforestation and nature-based solutions and technology assumptions including negative emissions technology”.

The table below sets out the key background assumptions in each sector based on the NGFS, SSP, IEA and CCC scenarios.

	Hiahia (Orderly)	Pokanoa (Disorderly)	Wharewera (Hothouse)
Energy	Energy supply is mostly decarbonised, with 98% of electricity from renewable sources, and 89% of total energy from renewable sources	Since 2030, there has been a rapid shift to low emissions energy, but there is still a way to go. 76% of total energy consumed is renewable	Energy remains reliant on high-emitting fuels. Renewable sources provide 46% of total consumed energy.
Transport	Since 2032, all new light vehicles entering NZ have been electric, and integrated transport systems, including walking, cycling and public transport are common in urban areas.	After a delay, all new light vehicles have been electric since 2040, but private car ownership has declined. Buses and trains are decarbonising quickly.	There are still ICE vehicles entering the country in 2050. Roads have been upgraded to accommodate more vehicles and public transport is not prioritised.
Buildings	Building standards have been implemented that mandate the use of sustainable materials and construction methods. New buildings must be carbon-neutral and old buildings have been retro-fitted with efficient heating and cooling systems.	Sustainable building standards were introduced in the 2030s.The costs of retrofitting existing buildings remains high, so only buildings new since 2035 are fitted out with low emissions in mind.	Building standards prioritise resilience to physical impacts rather than sustainability. Coal and gas boilers remain common and construction waste is high.
Land use	Large areas of land have been protected to reverse ecosystem decline. Iwi/Māori have a strong voice in what happens to the land in their local area.	There is no national strategy for land use. Since 2030, some areas have been rewilded as unsustainable farms have gone out of business.	Land use continues to go to those who can derive the greatest profits from it. Urban sprawl ensues and livestock agriculture remains widespread.
Afforestation and carbon sequestration	There is widespread use of carbon capture and storage (CCS) globally, though only a few cases in New Zealand. Pine and native forestry grows strongly, with biodiversity protection a key criteria for approval of new forests.	Focus on emissions reductions leads to large areas of pine monocultures. Rushed and costly global push for more CCS tech, though not really seen in NZ.	Little use of CCS globally. Pines continue to be planted for timber, but native forestry is not incentivised.

Scenario short, medium and long term indicators

Paragraph 10 of NZ CS1 requires reporting entities to provide "a description of the climate-related risks and opportunities it has identified over the short, medium, and long term". To enable this, we have provided key indicators and high level descriptors of each scenario across the short (2023-2025), medium (2026-2035) and long (2036-2050) term. Note that entities are also required to describe "how it defines short, medium and long term and how the definitions are linked to its strategic planning horizons and capital deployment plans" (Paragraph 14(a)). This means that reporting entities will need to assess the relevance of these time horizons for their business and, if other time horizons are more suitable, adjust them.

Hiahia (Orderly)	Short (2025)	Medium (2035)	Long (2050)
Physical climate			
Global temperature rise relative to preindustrial (°C)	1.4	1.5	1.6
Sea level rise relative to 2005 (m)	0.09	0.13	0.2
Socio-economic indicators			
Global emissions ($GtCO_2e$)	49	40	26
NZ population increase relative to 2020 (%)	3%	9%	16%
NZ carbon price ($NZD/tonne)	107	186	277
NZ net emissions ($MtCO_2e$)	65	35	6
High level descriptors			
	Physical climate is similar to today, with increasing flooding and fire weather events. Emissions pricing is beginning to cause changes to the NZ economy. Government direction on climate is clear – an inclusive and fast transition. Tourism practices are similar to today, but there is increased social awareness of high-emission travel and recreation.	Climate impacts have worsened but not too rapidly. Government has introduced a Future Tourism Strategy to enable optimisation and build resilience of existing tourism assets. There is a shift in focus towards innovative low-carbon tourism start-ups as a means to address the changing climate and retreat of existing tourism services. Technology is advancing rapidly in sustainable agriculture and shipping, and capital is accessible for these organisations.	The country and globe have transitioned to a low emissions economy. Entire sectors or large parts of sectors have disappeared or transitioned into more sustainable industries. The New Zealand tourism sector has become more innovative and offers a more bespoke sustainable tourism experience than other international destinations. Climate adaptation means communities and businesses are resilient to physical impacts.

Scenario short, medium and long term indicators

Pokanoa (Disorderly)	Short (2025)	Medium (2035)	Long (2050)
Physical climate			
Global temperature rise relative to preindustrial (°C)	1.4	1.7	2
Sea level rise relative to 2005 (m)	0.09	0.14	0.22
Socio-economic indicators			
Global emissions ($GtCO_2e$)	55	58	57
NZ population increase relative to 2020 (%)	4%	12%	22%
NZ carbon price ($NZD/tonne)	107	259	369
NZ net emissions ($MtCO_2e$)	67	49	24
High level descriptors			
	Physical climate is similar to today, with increasing flooding and fire weather events. There is still no concerted government effort to reduce emissions, but a very strong social push. Emissions prices remain relatively low.	Climate impacts have worsened with a number of compound weather events wreaking havoc on the sector. Focus has rapidly shifted to mitigation and a number of policies have been introduced. Emissions prices have risen fast. Globally, there is a strong focus on reducing emissions, leading to a rapid decrease in long-haul travel. Organisations are suffering from the shock of the sudden shift in Government priorities. Capital and insurance are suddenly hard to access for carbon exhaustive organisations.	The world still has some way to go to get to net zero emissions and stabilise warming, but a lot of the work has been done. The disruptive transition pushed a lot of organisations out of business, including many parts of the tourism sector who focused too much on single service offerings or high-emission outputs. Costs have risen due to a high emissions price and restrictive trade rules, and there is a lack of Government support for the sector.

Wharewera (Hothouse)	Short (2025)	Medium (2035)	Long (2050)
Physical climate			
Global temperature rise relative to preindustrial (°C)	1.4	1.8	2.5
Sea level rise relative to 2005 (m)	0.09	0.15	0.32
Socio-economic indicators			
Global emissions ($GtCO_2e$)	65	79	103
NZ population increase relative to 2020 (%)	5%	14%	26%
NZ carbon price ($NZD/tonne)	35	35	35
NZ net emissions ($MtCO_2e$)	69	60	40
High level descriptors			
	Physical climate is similar to today, with increasing flooding and fire weather events. There is still no concerted government effort to reduce emissions, but a very strong social push. Emissions prices remain relatively low.	The physical impacts of climate change are beginning to wreak havoc across the country, frequently interrupting travel and flight plans for tourists. Some destinations and tourism experiences have become unviable due to physical climate change.	Climate impacts devastate communities, tourism operators and supply chains. The toll on physical and mental health is high. Focus has shifted to strategic adaptation to the physical impacts of climate change, and local governments are empowered to adapt, but action has not been fast enough. Capital and insurance has become very difficult or impossible to access in some regions.

APPENDIX THREE: Long list of climate related risks

The following table represents the outputs from the Technical Expert Group climate risk identification workshop, following Leadership Group and co-chair review, identifying the most significant risks affecting the New Zealand tourism sector.
Risks were split into two categories of physical and transition risk.

Risk Category	Agreed risks
	Top prioritised risks by stakeholders
Top Physical	Inability to maintain New Zealand as an attractive destination: Rising sea levels, increased lake pollution, loss of iconic landscapes, changing seasonality could lead to the inability to maintain New Zealand as an attractive destination for visitors.
	Loss of species/biodiversity: Overuse of vulnerable resources, flood damage, rising temperatures could lead to a loss of key species and biodiversity that form a critical driver of the tourism sector.
	Inability to access attractions and locations: Destruction of infrastructure, rising temperatures, increased extreme weather could lead to a loss of access to key attractions and locations.
	Reduction in operating days/opportunities: Increased drought, higher temperatures, reduced predictability of weather, damage to infrastructure could lead to a reduction in operating days and opportunities.
Top Transition	Reduction in positive customer sentiment for Aotearoa New Zealand: Global sustainability trends away from long-haul travel, reduced perceptions of safety, operational disruptions from acute events, or perception of lack of action on climate change could lead to a reduction of customer sentiment towards travel to and within Aotearoa NZ.
	Increase in climate change regulation drives increased costs pressure on visitors: Increased regulatory requirements (including Zero Carbon, cost of carbon), failure of regulation/policy to keep up with emerging technology, increased climate disclosure requirements, ineffective climate change policy could lead to an increased cost burden on tourism sector operators and thus increased pressure on visitors willingness to pay more.
	Inability for the tourism sector to keep up with the rate of change: Working in isolation from other sectors, high cost of mitigation technologies, limited SME access to capital could lead to the inability for the tourism sector to keep up with the rate of change required of it to become more sustainable.
	Inability for operators to effectively conduct financially viable business: Increased difficulty in accessing capital, increased cost of insurance, increase in price elastic consumers, increase cost of access/use of facilities could lead to the inability for operators to effectively conduct financially viable business
	Other risks identified
Other Physical	Reduction in economic viability and employment: Increased CapEx spend on infrastructure replacement, increased OpEx maintenance and other costs could lead to a reduction in revenue and thus economic viability of tourism operators and employment levels.
	Systemic concern of visitor safety and operator liability: Increase in severity of weather events, increasing temperatures, increased risk of serious H&S event could lead to a systemic concern of visitor safety and liability for operators.
	Increased supply chain disruption: An acute physical risk event, such as a flood or extreme storm could lead to increased disruption across the supply chain.
Other Transition	Systemic increases in stress and wellbeing distress: Displacement of people, loss of social licence to operate, inability to manage increased costs of operation could lead to systemic increases in stress and loss of wellbeing within communities reliant on tourism.
	Inability for the sector to align or work collectively as part of required adaptation: Lack of inward investment, increased speed of transition, change in visitor/operator values and expectations, lack of climate literacy could lead to the inability of the sector to align or work collectively as part of required adaptation.
	Increased inequality amongst sector operators: Lack of sector inclusion in national climate change policy/strategy, lack of prioritisation of minority/vulnerable groups could lead to a transition to a lower carbon tourism sector that has increased inequality amongst players.
	Inability for the sector to afford carbon and comply with carbon regulation: Implementation or expansion of domestic/international policy regulating carbon, lack of measurement/consideration of embodied carbon dioxide, significant increase in the cost of carbon could lead to an inability for the NZ tourism sector to afford the market rate of carbon and comply with carbon regulation.

APPENDIX FOUR: Driving Forces

Social pressure to reduce travel	• Social licence to operate • Pipeline of visitors • Change to short versus long-haul market
Government Priorities	• Te Tiriti obligations • Immigration settings • Strength of climate policy
Biodiversity/habitat loss	• Quality of visitor experience • Loss of natural assets • Opportunities for conservation • Pipeline of visitors
Global displacement/geopolitical tension	• Supply chain challenges • Migration • Labour issues • Pipeline of visitors • Market uncertainty
Decarbonisation of air travel	• Cost of air travel • Pipeline of visitors • International agreements/regulation (e.g. ICAO) • Corporate business travel

Speed/access/cost of emerging tech	• Supply chain challenges • Costs issues for SMEs • Equity across sector • Access to sustainable aviation fuels (SAFs)
Pace of technology advances	• Supply chain challenges • Investment • Changing visitor expectations
Challenges accessing capital	• Product quality impacting visitor experience • Challenges electrifying or shifting to sustainable practices
Cost increases due to infrastructure needs/energy availability	• Cost structures change • Ability of SMEs to cope with costs • Visitor experience as operators/local communities can't cover costs
Severe acute weather events	• Disrupted access (airports, roads, etc) • Visitor experience impacts • Areas cut off • Perceptions of risk/safety

APPENDIX FIVE: Detailed climate scenario data

Orderly – Hiahia Scenario

Physical climate change		
Variable/indicator	**2031-2050 value relative to 1986-2005 (unless otherwise stated)**	**Source**
Temperature change above pre-industrial global in 2050	1.6°C	RCP 2.6 from SSP Database (Shared Socioeconomic Pathways) Scenario Explorer. https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=10
Annual mean temperature change NZ	0.7°C	Ministry for the Environment. (2018). Climate change projections for New Zealand. https://environment.govt.nz/publications/climate-change-projections-for-new-zealand/
Extreme rainfall (percentage change in depth of 1 in 100 year 1 hour rainfall event)	15%	Ministry for the Environment. (2018). Climate change projections for New Zealand. https://environment.govt.nz/publications/climate-change-projections-for-new-zealand/
Extreme heat (change in days over 25°C)	15 days	Ministry for the Environment. (2018). Climate change projections for New Zealand. https://environment.govt.nz/publications/climate-change-projections-for-new-zealand/
Snowfall (change in snowfall days)	-10 days	Ministry for the Environment. (2018). Climate change projections for New Zealand. https://environment.govt.nz/publications/climate-change-projections-for-new-zealand/
Glacier retreat (mass in 2050 relative to 2000)	0.68	Anderson, B., Mackintosh, A.N., Dadić, R., Oerlemans, J., Zammit, C., Doughty, A., Sood, A., & Mullan, B. (2021). Modelled response of debris-covered and lake-calving glaciers to climate change, Kā Tiritiri o te Moana/Southern Alps, New Zealand. Global and Planetary Change, 205, 103593.
Sea level rise 2005-2050	0.2m	Ministry for the Environment. (2022). Interim guidance on the use of new sea-level rise projections. https://environment.govt.nz/publications/interim-guidance-on-the-use-of-new-sea-level-rise-projections/

Global economic and social		
Variable/indicator	**2050 value (unless otherwise stated)**	**Source**
Global emissions (CO_2-e)	26 Gt	SSP-1 RCP 2.6 from SSP Database (Shared Socioeconomic Pathways) Scenario Explorer. https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=10
Global oil price (2020 NZD/barrel)	$43	International Energy Agency. (2022). Global energy and climate model. IEA. https://www.iea.org/reports/global-energy-and-climate-model/net-zero-emissions-by-2050-scenario-nze
Global population (mn)	8410	SSP-1 RCP 2.6 from SSP Database (Shared Socioeconomic Pathways) Scenario Explorer. https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=10
Global GDP (2020 NZD tn)	$629	SSP-1 RCP 2.6 from SSP Database (Shared Socioeconomic Pathways) Scenario Explorer. https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=10

Orderly – Hiahia Scenario

NZ policy, economic and social		
Variable/indicator	**2050 value (unless otherwise stated)**	**Source**
NZ net emissions (CO_2e)	5936 kt	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Tailwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
NZ gross emissions (CO_2e)	26287 kt	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Tailwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
Native forestry land area (Mha)	0.77	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Tailwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
Exotic forestry land area (Mha)	2.45	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Tailwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
Percentage of electricity from renewable sources	98%	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Tailwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
NZ carbon price (2022 NZD/tonne)	$277	New Zealand Treasury. (2021) CBAx Tool User Guidance. Central pathway. https://www.treasury.govt.nz/publications/guide/cbax-tool-user-guidance
NZ population (m)	5913	Stats NZ. National population projections: 2022(base)–2073. https://www.stats.govt.nz/information-releases/national-population-projections-2022base2073/
EV light passenger vkt (%)	98%	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Tailwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
EV bus vkt (%)	94%	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Tailwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
Domestic fossil fuel use in aviation (PJ)	4.79	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Tailwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx

Disorderly – Pokanoa Scenario

Physical climate change		
Variable/indicator	**2031-2050 value relative to 1986-2005 (unless otherwise stated)**	**Source**
Temperature change above pre-industrial global in 2050	2°C	RCP 4.5 from SSP Database (Shared Socioeconomic Pathways) Scenario Explorer. https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=10
Annual mean temperature change NZ	0.8°C	Ministry for the Environment. (2018). Climate change projections for New Zealand. https://environment.govt.nz/publications/climate-change-projections-for-new-zealand/
Extreme rainfall (percentage change in depth of 1 in 100 year 1 hour rainfall event)	18%	Ministry for the Environment. (2018). Climate change projections for New Zealand. https://environment.govt.nz/publications/climate-change-projections-for-new-zealand/
Extreme heat (change in days over 25°C)	20 days	Ministry for the Environment. (2018). Climate change projections for New Zealand. https://environment.govt.nz/publications/climate-change-projections-for-new-zealand/
Snowfall (change in snowfall days)	-15 days	Ministry for the Environment. (2018). Climate change projections for New Zealand. https://environment.govt.nz/publications/climate-change-projections-for-new-zealand/
Glacier retreat (mass in 2050 relative to 2000)	0.63	Anderson, B., Mackintosh, A.N., Dadić, R., Oerlemans, J., Zammit, C., Doughty, A., Sood, A., & Mullan, B. (2021). Modelled response of debris-covered and lake-calving glaciers to climate change, Kā Tiritiri o te Moana/Southern Alps, New Zealand. Global and Planetary Change, 205, 103593.
Sea level rise 2005-2050	0.22m	Ministry for the Environment. (2022). Interim guidance on the use of new sea-level rise projections. https://environment.govt.nz/publications/interim-guidance-on-the-use-of-new-sea-level-rise-projections/

Global economic and social		
Variable/indicator	**2050 value (unless otherwise stated)**	**Source**
Global emissions (CO_2-e)	57 Gt	SSP-2 RCP 4.5 from SSP Database (Shared Socioeconomic Pathways) Scenario Explorer. https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=10
Global oil price (2020 NZD/tonne)	$89	International Energy Agency. (2022). Global energy and climate model. IEA. https://www.iea.org/reports/world-energy-model/sustainable-development-scenario-sds
Global population (mn)	9189	SSP-2 RCP 4.5 from SSP Database (Shared Socioeconomic Pathways) Scenario Explorer. https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=10
Global GDP (2020 NZD tn)	$543	SSP-2 RCP 4.5 from SSP Database (Shared Socioeconomic Pathways) Scenario Explorer. https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=10

Disorderly – Pokanoa Scenario

NZ policy, economic and social		
Variable/indicator	**2050 value (unless otherwise stated)**	**Source**
NZ net emissions (CO_2e)	23956 kt	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Headwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
NZ gross emissions (CO_2e)	45658 kt	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Headwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
Native forestry land area (Mha)	0.53	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Headwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
Exotic forestry land area (Mha)	2.64	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Headwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
Percentage of electricity from renewable sources	96%	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Headwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
NZ carbon price (2022 NZD/tonne)	$369	New Zealand Treasury. (2021) CBAx Tool User Guidance. High pathway. https://www.treasury.govt.nz/publications/guide/cbax-tool-user-guidance
NZ population (m)	6156	Stats NZ. National population projections: 2022(base)–2073. https://www.stats.govt.nz/information-releases/national-population-projections-2022base2073/
EV light passenger vkt (%)	92%	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Headwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
EV bus vkt (%)	87%	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Headwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
Domestic fossil fuel use in aviation (PJ)	15.6	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Headwinds. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx

Hothouse – Wharewera Scenario

Physical climate change		
Variable/indicator	**2031-2050 value relative to 1986-2005 (unless otherwise stated)**	**Source**
Temperature change above pre-industrial global in 2050	2.5°C	RCP 8.5 from SSP Database (Shared Socioeconomic Pathways) Scenario Explorer. https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=10
Annual mean temperature change NZ	1°C	Ministry for the Environment. (2018). Climate change projections for New Zealand. https://environment.govt.nz/publications/climate-change-projections-for-new-zealand/
Extreme rainfall (percentage change in depth of 1 in 100 year 1 hour rainfall event)	22%	Ministry for the Environment. (2018). Climate change projections for New Zealand. https://environment.govt.nz/publications/climate-change-projections-for-new-zealand/
Extreme heat (change in days over 25C)	30 days	Ministry for the Environment. (2018). Climate change projections for New Zealand. https://environment.govt.nz/publications/climate-change-projections-for-new-zealand/
Snowfall (change in snowfall days)	-20 days	Ministry for the Environment. (2018). Climate change projections for New Zealand. https://environment.govt.nz/publications/climate-change-projections-for-new-zealand/
Glacier retreat (mass in 2050 relative to 2000)	0.62	Anderson, B., Mackintosh, A.N., Dadić, R., Oerlemans, J., Zammit, C., Doughty, A., Sood, A., & Mullan, B. (2021). Modelled response of debris-covered and lake-calving glaciers to climate change, Kā Tiritiri o te Moana/Southern Alps, New Zealand. Global and Planetary Change, 205, 103593.
Sea level rise 2005-2050	0.32m	Ministry for the Environment. (2022). Interim guidance on the use of new sea-level rise projections. https://environment.govt.nz/publications/interim-guidance-on-the-use-of-new-sea-level-rise-projections/

Global economic and social		
Variable/indicator	**2050 value (unless otherwise stated)**	**Source**
Global emissions (CO_2-e)	103 Gt	SSP-5 RCP 8.5 from SSP Database (Shared Socioeconomic Pathways) Scenario Explorer. https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=10
Global oil price (2020 NZD/tonne)	$157	International Energy Agency. (2022). Global energy and climate model. IEA. https://www.iea.org/reports/world-energy-model/announced-pledges-scenario-aps
Global population (mn)	8509	SSP-5 RCP 8.5 from SSP Database (Shared Socioeconomic Pathways) Scenario Explorer. https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=10
Global GDP (2020 NZD tn)	$754	SSP-5 RCP 8.5 from SSP Database (Shared Socioeconomic Pathways) Scenario Explorer. https://tntcat.iiasa.ac.at/SspDb/dsd?Action=htmlpage&page=10

Hothouse – Wharewera Scenario

NZ policy, economic and social		
Variable/indicator	**2050 value (unless otherwise stated)**	**Source**
NZ net emissions (CO_2e)	39643 kt	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Current Policy Reference. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
NZ gross emissions (CO_2e)	63054 kt	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Current Policy Reference. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
Native forestry land area (Mha)	0.2	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Current Policy Reference. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
Exotic forestry land area (Mha)	2.8	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Current Policy Reference. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
Percentage of electricity from renewable sources	92%	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Current Policy Reference. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
NZ carbon price (2021 NZD/tonne)	$35	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Current Policy Reference. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
NZ population (m)	6406	Stats NZ. National population projections: 2022(base)–2073. https://www.stats.govt.nz/information-releases/national-population-projections-2022base2073/
EV light passenger vkt (%)	80%	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Current Policy Reference. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
EV bus vkt (%)	83%	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Current Policy Reference. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
Domestic fossil fuel use in aviation (PJ)	18.2	He Pou a Rangi, Climate Change Commission. (2021). Scenarios dataset for the Commission's 2021 Final Advice (output from ENZ model). Current Policy Reference. https://www.climatecommission.govt.nz/public/Inaia-tonu-nei-a-lowemissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx

APPENDIX SIX: Use of reference scenarios

The scenarios presented in this report are the product of a collaborative effort bringing together experts across the sector. However, establishing the high level boundary conditions for the scenarios often required selecting information from the range of existing climate scenario frameworks. This process involves attempting to reconcile often disparate and inconsistent pieces of information from different scenarios. This section will outline the reference scenarios used in this report and the rationale behind those choices.

Network for Greening the Financial System (NGFS)

The NGFS framework has become a common tool for determining high level scenario narratives. It was decided that the 'Orderly', 'Disorderly' and 'Hothouse' scenarios best spanned the range of plausible futures for the tourism sector. 'Orderly (Net Zero 2050)" describes a world with a smooth transition to net zero carbon dioxide emissions, 'Disorderly (Delayed Transition)' describes a world with little change until 2030, before a disruptive and rapid reduction in emissions, and 'Hothouse (Current Policies)' describes a world with continuing high emissions.

Representative Concentration Pathways (RCPs)

RCPs describe emissions of greenhouse gases into the future and associated climate impacts. These were used to determine the physical climate characteristics of each scenario. At the time of writing, there were four RCPs: RCP2.6, 4.5, 6.0 and 8.5 that have been downscaled to make New Zealand-specific climate projections. The numbers relate to the heating effect of emissions on the climate. That is, the higher the RCP, the higher emissions are and the more warming the world experiences. Linking RCPs to the scenarios developed for this report was a relatively easy process.

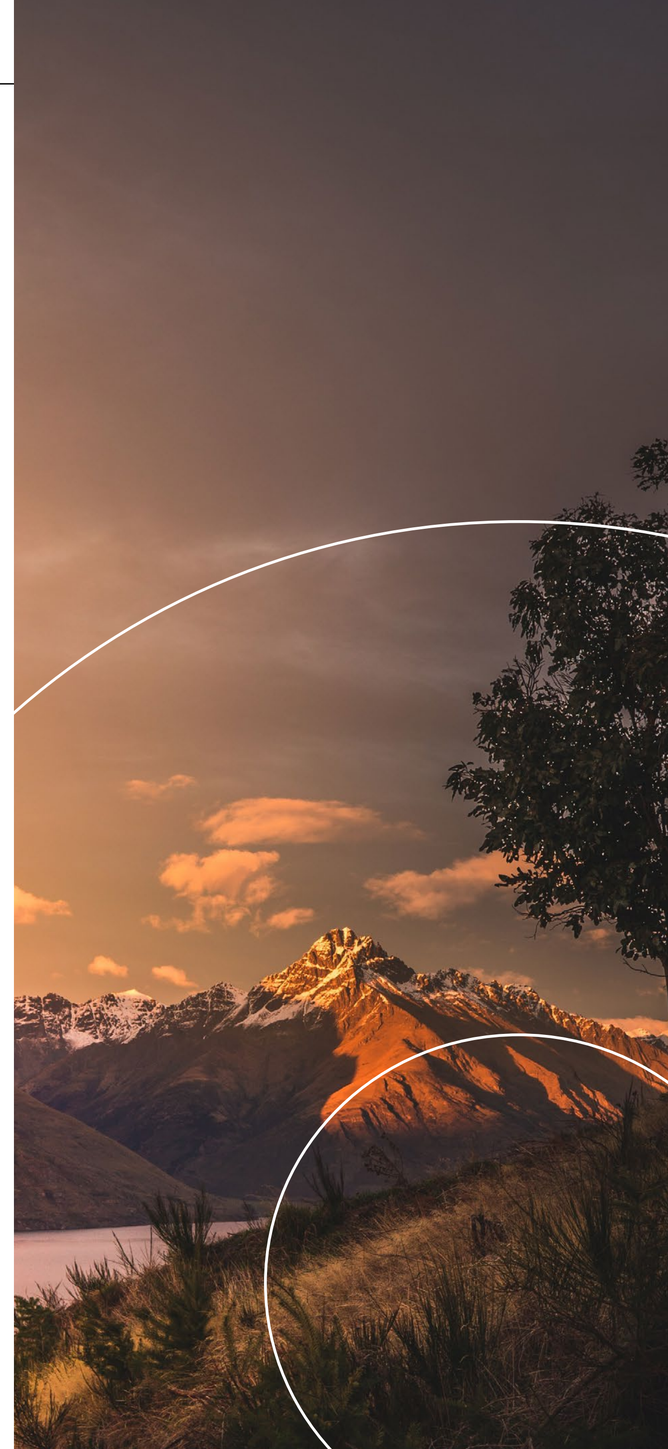
Scenario	RCP used	Rationale
Hiahia	RCP2.6	RCP2.6 is the most stringent mitigation scenario in which carbon dioxide emissions decline to net zero relatively quickly. It reflects a world in which warming is limited to around 1.5-2°C.
Pokanoa	RCP4.5	RCP4.5 sees global emissions peak around 2040 and slowly begin to decline thereafter. The climate impacts of this are similar to what we would expect in the disorderly scenario described in this report.
Wharewera	RCP8.5	RCP8.5 is a scenario in which emissions continue to rise, leading to severe physical impacts. There is some controversy around the use of RCP8.5 given its very high emissions. However, although the emissions trajectory in RCP8.5 may be becoming less plausible, the climate impacts of that emissions trajectory are possible even under a lower emissions scenario. It was therefore decided to use RCP8.5 for the Wharewera scenario.

These RCPs have been downscaled to the New Zealand context by NIWA. The New Zealand-specific climate impacts in these scenarios were taken from the downscaled NIWA data. The RCPs have also been linked to the Shared Socioeconomic Pathways (SSPs; see across) in recent years.

Shared Socioeconomic Pathways (SSPs)

SSPs were developed to examine how global society, demographics and economics might change over the next century. The SSPs are useful for linking local or sector-specific trends to a global context. The choices made in this scenario set are consistent with the examples used in the XRB guidance.

Scenario	SSP used	Rationale
Hiahia	SSP1	SSP1: Sustainability reflects a world in which ecological and human wellbeing is prioritised. There are 'low challenges to mitigation and adaptation'. This aligned well with the smooth transition described in Hiahia.
Pokanoa	SSP2	SSP2: Middle of the Road describes a world with largely similar social, economic and technological trends to today. There are 'medium challenges to mitigation and adaptation'. This aligns well with the lack of action until 2030 before a dramatic change after that.
Wharewera	SSP5	SSP5: Fossil-fueled development reflects a world in which economic growth is prioritised above progress on environmental issues, creating a world primed for transformative adaptation. There are 'high challenges to mitigation and low challenges to adaptation'.



He pou a rangi Climate Change Commission (CCC)

As part of *Ināia tonu nei: a low emissions future for Aotearoa*, the Climate Change Commission's advice to Central Government on the first three emissions budgets, the CCC published a set of pathways that outlined potential changes in land use, energy, transport and other economic indicators over the coming decades. Some of these pathways, including *Headwinds* and *Tailwinds*, reflect pathways that meet the emissions targets in the Climate Change Response Act. In the *Headwinds* pathway, technology uptake and behaviour change is relatively slow compared to Tailwinds, which has fast technology uptake and behaviour change. Some information from these two pathways was chosen for inclusion in the Pokanoa and Hiahia scenarios, respectively.

The CCC also published data from a *Current Policy Reference* scenario, in which policy remains weak. This was chosen for use in the Wharewera scenario.

Shared Policy Assumptions for New Zealand (SPANZ)

Frame et al. (2018)[11] sets out a framework for downscaling global SSPs to the New Zealand context. These scenarios provide a set of shared policy assumptions (SPAs)for New Zealand, which explore New Zealand's consistency with global policy trends, and outline some high level themes of national policy. Only small pieces of information were used from the SPAs in these scenarios.

Scenario	SPANZ used	Rationale
Hiahia	SPANZ F	In SPANZ F, adaptation and mitigation are prioritised and New Zealand leads global innovation in some areas. There is a strong moral push to lead the global transition.
Pokanoa	SPANZ B	In SPANZ B adaptation tends to be incremental and focused on short term gains. There is little long term vision associated with adaptation or mitigation.
Wharewera	SPANZ D	In SPANZ D, adaptation is strategic and at times transformative, but there is little attempt to meaningfully mitigate.

11 Frame et al. (2018). Adapting global shared socio-economic pathways for national and local scenarios. Climate Risk Management.

APPENDIX SEVEN: Acknowledgements

The Tourism Sector Climate Change Scenarios and Adaptation Roadmap has been created through the voluntary efforts of the following individuals. We would like to formally acknowledge each member of the Leadership Group, Technical Expert Group, and all others involved for their time and effort.

Co-Chairs

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- David Simmons – Lincoln University
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- Fergus Brown – Holiday Park Association
- Hamish Pinkham – Rhythm & Vines
- James Higham – Otago University
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- Jenny Sullivan – Air New Zealand
- Jennie Kennerley – Ministry of Business, Innovation and Enterprise (MBIE)
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- Jonathan Peacey – The Nature Conservancy
- Juhi Shareef – Tourism Holdings Limited (THL)
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- Jack Bisset – External Reporting Board (XRB)
- Susanne Becken – Griffith University

Te ao Māori Advisory

- Camilla Lundbak – Te Papa Atawhai – Department of Conservation (DOC)
- Joe Harawira – Te Papa Atawhai – Department of Conservation (DOC)
- Otene Hopa – PwC
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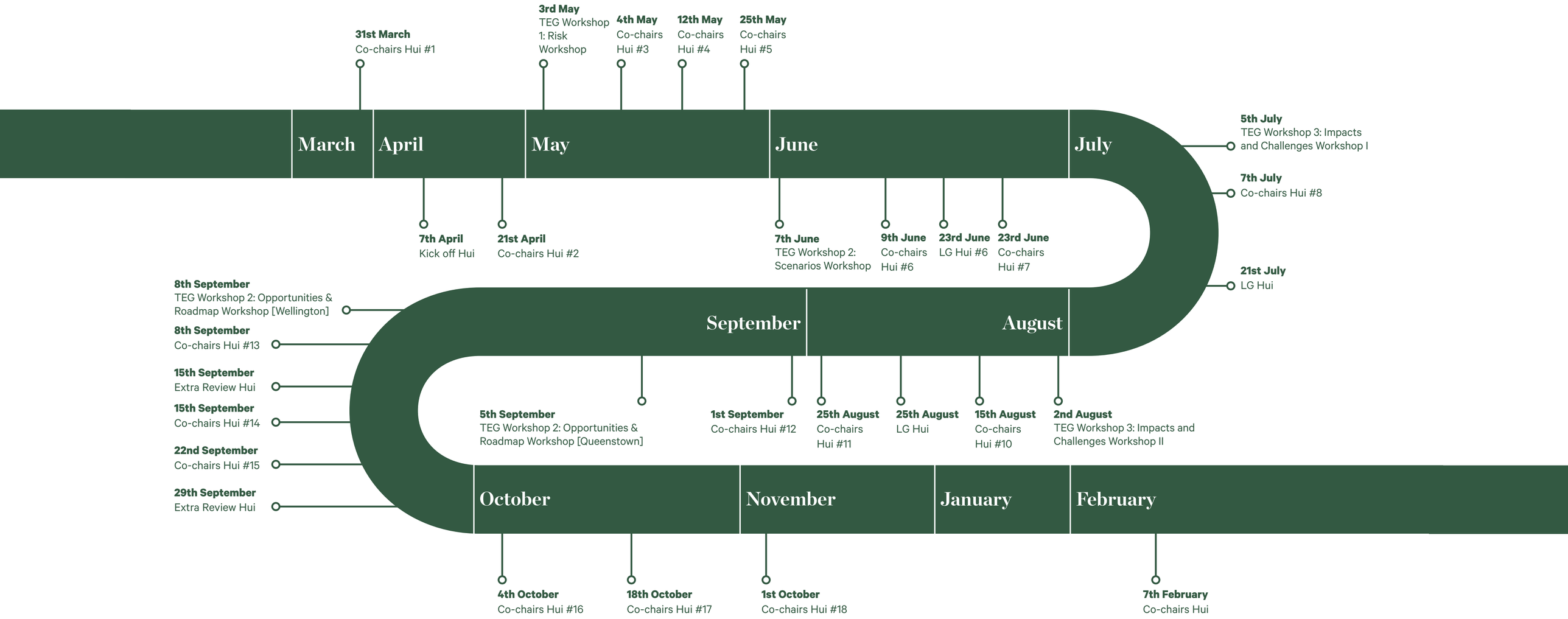
- Sir Jonathon Porritt – The Aotearoa Circle

Secretariat (PwC)

- Annabell Chartres
- Dr Victoria Hatton
- Dominic Thorn
- Ethan Kay
- Jessie Scott
- Electra Scott
- Jade Collins

APPENDIX EIGHT: Project plan



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