



Centre for Sustainability
Kā Rakahau o Te Ao Tūroa



Using Mapping to Support Collaborative Climate Adaptation

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Introduction

This research summary explores how maps and mapping can help with collaborative planning for climate change adaptation. It has a particular focus on Participatory Community Mapping – a method that encourages communities to show how they value different aspects of their physical spaces. It was commissioned to inform the South Dunedin Future programme which is a joint initiative between the Dunedin City Council and the Otago Regional Council to develop climate change adaptation options for South Dunedin.

Adaptation planning must consider physical realities. These include natural hazards such as rising seas and practical responses such as relocation of infrastructure. At the same time, planning must also consider intangible relationships and perceptions, such as social, cultural and historical associations with that place. Maps can help with both: they can illustrate physical features and processes as well as the implications of climate change for what people value. Mapping can support collaborative climate change adaptation by:

- Accurately locating physical hazards and impacts of climate change, and mapping changes over time.
- Capturing and illustrating community values, associations and aspirations as they relate to place.
- Co-developing adaptation options that can mitigate hazards and support community aspirations.

'Community' as used here includes mana whenua, residents, businesses and other stakeholders (e.g. people who use the area for recreation). Different engagement and mapping methods will be needed to suit different groups within the community. For mana whenua, Te Tiriti sets out the expectation of self-determination or at least a high level of engagement in decisions affecting their lands, resources and valued places. What is mapped and processes of mapping will need to be strongly guided by mana whenua.

1. Approaches to maps and mapping

Maps are a visual representation of an area or a place. The maps that we commonly use show physical features such as roads, buildings and coastlines. But maps can do much more than this. Collaboratively developed maps can help show what community members value about a place, tell the history of a place, and explore options for the future.

Maps of physical features

We are most accustomed to seeing maps like the ones to the right. In the past, maps were hand-drawn and printed, but increasingly they are available online. Digital techniques can provide pinpoint accuracy so that the sites of fence posts, individual trees and even storm water covers can be precisely charted. Digital layering allows both surface and hidden features to be shown. For example, vegetation cover, surface water, below ground infrastructure and underlying geology can all be included within the same layered map. When it comes to climate change adaptation, these kinds of maps are important to understand the physical implications of flooding, sea level rise and so forth.

Maps can be schematic or photographic. They usually imply that the viewer is located directly above ('eye of god' 2D view), but they can also take other perspectives such as a flyover (oblique 3D view).

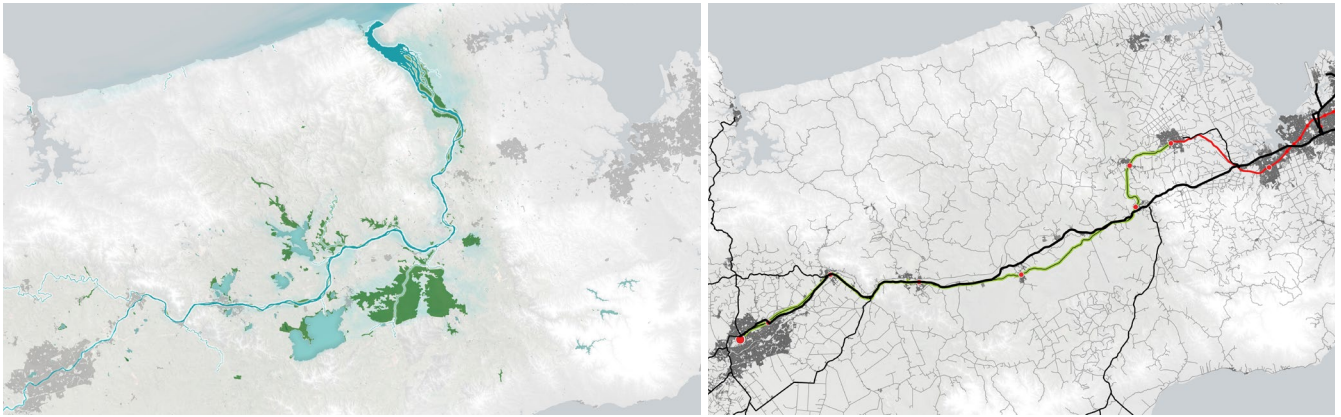
TOP RIGHT: Printed topographic map showing spatial location and arrangement of roads and other physical features.¹

BOTTOM RIGHT: Digital online maps can provide greater levels of detail. They can combine photographic images and symbols.²



Even ‘objective’ maps are subjective

It is not possible for a map to capture every feature of a particular location or place. What is included in a map depends on what is important to those creating the map, such as the features they want to record or the message they want to convey. So it is important to bear in mind that maps convey both objective information (what is physically there) and subjective information (what matters to people). This is why different maps of the same geographic location can convey very different understandings of a place.



Two views of the Waikato/North Franklin region. The left-hand map shows valued aspects of the awa (Waikato River) derived from the definition set out in the Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010, and the right-hand map shows road and rail infrastructure.³

Maps can also leave out a lot of information and give the impression that a place is empty of values, or that everywhere has the same qualities:



ABOVE LEFT: Early settler maps of Te Wai Pounamu omitted almost all sites of significance for Māori.⁴ In this map the absence of features suggests the land itself is empty and by inference available for settlement and development, despite it being already home for mana whenua.⁵

ABOVE RIGHT: In this map Kisbee Bay is shown as isolated apparently untouched part of Southern Fiordland.⁶ Yet 120 years ago this mining area was home to hundreds of people, complete with houses, hotels, a church and a school. Many physical traces of this history can still be found here though the absence of relevant categories in this map series means they are not shown. This same map is part of a series of maps covering all of Aotearoa New Zealand, which presents all the country's native forests as a single category of landcover with a single tone of green. As a result, there is no distinction made between a kauri forest at Waipoua and the beech forests of the Waipori Valley, or the multitude of other types of native forest that spans much of the country.⁷

Mapping community values

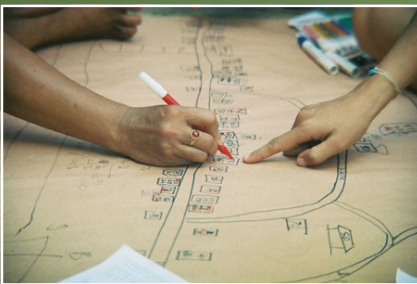
Values mapping involves different techniques to recording physical features, and the resulting maps can look very different. Formats can range from simple hand-drawn maps to collaborative GIS maps, story maps, 3D maps, and community memory maps. Community values mapping is used in many contexts including land use planning, heritage identification, urban safety programmes and health research.⁸

2. Participatory Community Mapping

Where people are directly involved in mapping their values and associations with place, it is often described as Participatory Community Mapping (PCM).⁹ Many kinds of information can be mapped, including:

- **Spatial values, perceptions, and attitudes** including sacred places, cultural and heritage values, and valued landscape features, as well as perceived problems and unpleasant experiences.
- **Spatial behaviour patterns, everyday practices, and activities** including regular mobility patterns, routes travelled and places visited, along with temporal qualities such as seasonality, duration and visit frequency.
- **Desirable place features** including mobility preferences, food gathering, recreation, perceived environmental quality, ecosystem services and wildlife observations.
- **Spatially-related future preferences and visions** including preferences for development types and locations, recreational areas, green spaces and other land-use changes.

In all cases, this data identifies both place-based qualities, and the implicit values that are important to the people identifying these qualities. For this reason it is critical for those who are running PCM exercises to consider the representativeness of those involved in contributing data, and the inclusiveness of the methods used.



Mapping events, workshops, wānanga and design charettes can all be effectively used for PCM. 'Mapping days' can include field-based studies where people walk and/or are driven around the community, as a prompt to directly trigger recall of place-based associations and activities. Material can be gathered using both digital and physical mapping tools, with the latter providing opportunities to create super-scaled maps.

Community-led design charettes can use this knowledge to model and design ways communities can innovatively reconfigure their future actions, activities and land-use to account for the future impacts of climate change. At all stages it is critical to encourage broad community involvement, and to use forms of visualisation and mapping that will accommodate multiple positions and voices.

LEFT: Examples of workshops being used to collect PCM data.¹⁰

During the PCM process, non-spatial data can also be collected about the respondents. These can include:

- **Socio-economic-demographic characteristics** including age, gender, education, and income levels.
- **Personal general values, attitudes, and preferences** including lifestyle preferences, environmental worldviews, beliefs, and norms.
- **Personal motivation and behavioural intentions** including personal goals, and likelihood to engage in community initiatives.
- **Personal well-being, happiness, health, and satisfaction** including perceived health, quality of life, and neighbourhood satisfaction.
- **Levels of trust in planning and decision-making processes for land use.**

Non-spatial data can assist in correlating participatory mapping data with wider demographic attributes as they relate to members of the community, or in extrapolating findings into other communities/regions.

3. Aligning Participatory Community Mapping (PCM) with Dynamic Adaptive Pathways Planning (DAPP)

PCM starts by engaging the community in identifying place-based values. Depending on the purpose and scope of the project it may then move on to two further phases: interpreting these values, and then modelling potential futures that take these values into account.

Climate change adaptation planning follows a similar phased approach as it seeks to consider uncertainty and risk across a range of social, economic, environmental and cultural considerations. The best practice approach recommended by the Ministry for the Environment (MfE) is called dynamic adaptive pathways planning (DAPP). As its name suggests, it identifies ways forward (pathways) despite uncertainty, while remaining responsive to change should this be needed (dynamic).¹¹ DAPP has typically has five phases. This research summary focuses on the first three: 'What is Happening?', 'What Matters Most?' and 'What can We Do?'.

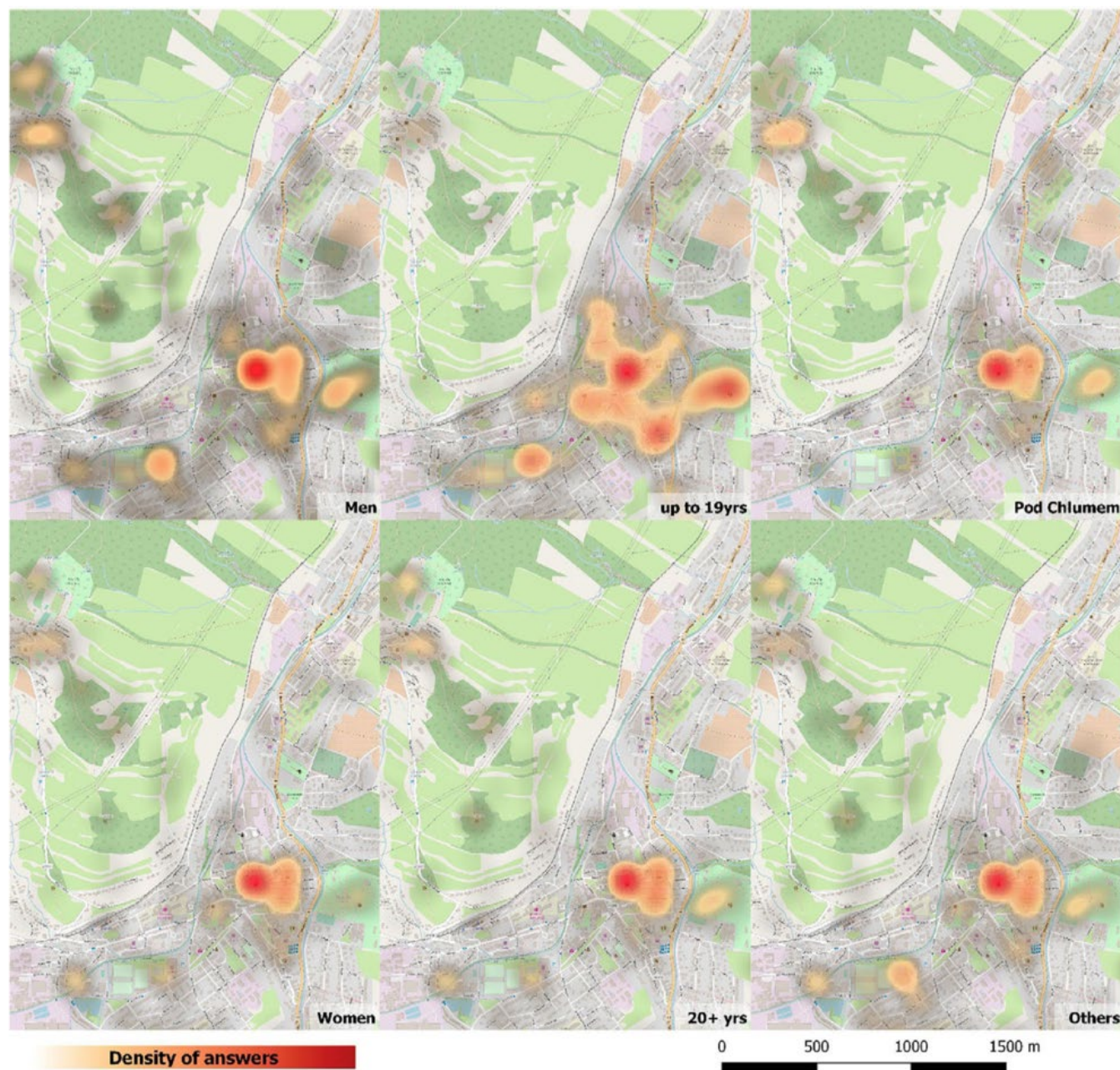
In Phase 1 of DAPP ('What is happening?') PCM can be used to explore values and aspirations:



ABOVE: Photos of participatory mapping of community values from Mapping Social Life website.¹²

Sometimes it is left to technical experts to analyse community-sourced data to determine feasible futures for the affected community. However, if the community is not included in developing and helping determine future pathways, this can generate tension between communities and council. For these reasons, participatory approaches should ideally be used in all phases of a PCM/DAPP project.¹³

In Phase 2 of DAPP ('What Matters Most?') community values can be spatially interpreted as in the figure below. This can be shared back with the community and inform the development of shared objectives.

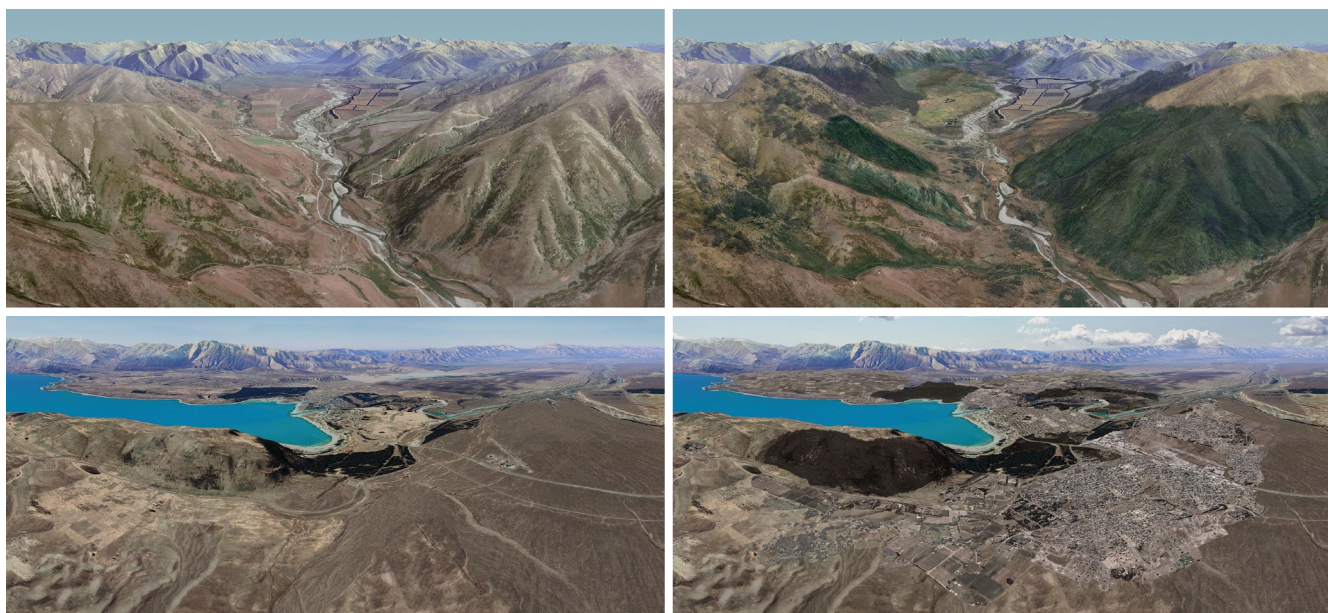


ABOVE: Maps showing differences among selected groups' answers to the question 'Where is it enjoyable in Jeseník?'¹⁴

Maps can also be a tool for visualising perspectives of the past, and possibilities for the future. In Phase 3, community members can work collaboratively with technical experts to help develop maps of the past, maps of potential alternative futures, and rank options for the future, as with the example below. This can help explore options for places that will be impacted by climate change and assist in discussions with the community.



ABOVE: Mapping the past. In these studies, Google Earth maps showing present day views of Te Manahuna Mackenzie Basin (left) have been modified to show likely past landscapes when it was glaciated (top right) and had a more varied ecology (bottom right).¹⁵



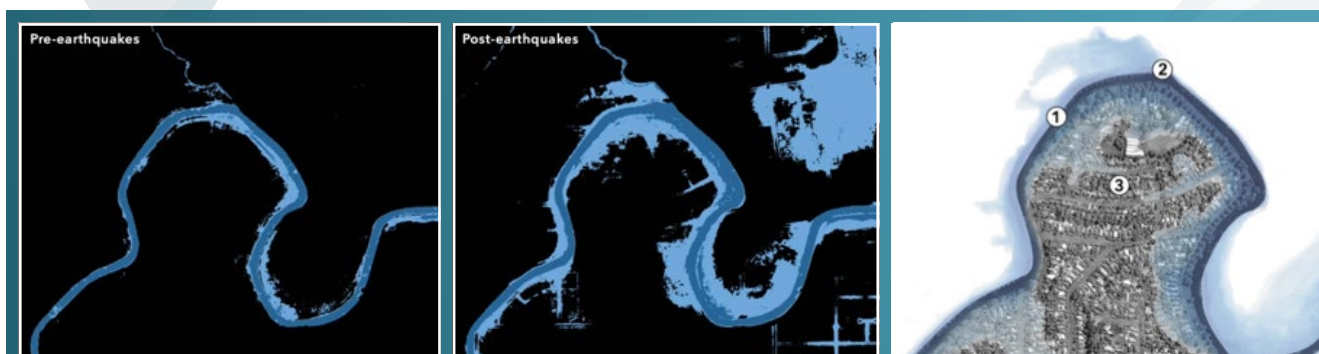
ABOVE: Mapping possible futures. This approach has also been used to explore potential futures in Te Manahuna Mackenzie Basin. The future views (right) show landscapes with more forests (top right) and urban growth (bottom right). Maps are helpful in considering futures as they can show a spread of possible futures rather than one single option.¹⁵

Table 1: How PCM can support DAPP across its first three phases

	Phase one	Phase two	Phase three
Dynamic Adaptive Pathways Planning (DAPP) phases	What is happening? Build our understanding of the physical environmental and natural hazards, the communities affected, and how this might change over time.	What matters most? Develop our understanding of community values, objectives, vulnerability, and the risk presented by natural hazards, then agreeing to overall objectives.	What can we do? Identify our options for managing likely changes to the physical environment, the resulting hazards and risk, then selecting options and pathways that will best meet objectives.
Participatory Community Mapping (PCM) phases	Explore: Data collection, engagement, identification and communication of shared understandings and place-based values.	Interpret: Determine which associations, values and the sites linked to them, are most significant to individual, collective and community wellbeing.	Develop options: Model the effects of future intentional and/or external changes on community-based understandings and place-based values. Collaboratively incorporate these values into options and pathways.
Contributions of PCM to DAPP process at each phase	Generates better understanding of current place-based values and attributes of project site.	Relates community-held associations and place-based attributes to the site's other environmental attributes.	Shows how these values and attributes could change and be changed in the future; and how community values can inform the design of future options.

4. Using map-based analysis to support each phase of DAPP

There is also significant value in using a broader range of mapping techniques to assist with DAPP. This can help visualise increasing risk, as with the images below.



ABOVE: The use of mapping to show the effect of the 2011 Christchurch earthquake had in terms of increased flooding risk that was equivalent to an overnight 0.5 metre rise in sea level.¹⁶

Table 2: Contribution and benefits of mapping techniques at each stage of DAPP

	DAPP Phase one	DAPP Phase two	DAPP Phase three
Contributions of map-based analysis (incorporating PCM data) at each phase	<ul style="list-style-type: none"> Quantitative and qualitative evaluations Visually explore spatial patterns Thematic maps. 	<ul style="list-style-type: none"> Combine spatial and non-spatial PCM data with other data (e.g. demographics, land-use) Spatial pattern analysis Feature density Clustering, dispersion, and proximity analysis. 	<ul style="list-style-type: none"> Incorporate predictive models with PCM and non-PCM data (e.g. sea level rise models, flooding models).
Benefits of using mapping techniques (including PCM) for adaptation planning	<ul style="list-style-type: none"> Generate strongly visual community maps that synthesise material generated from engagement and identification phases Allow all involved to understand the manner and scope of place-specific associations and values important to the community. 	<ul style="list-style-type: none"> Combine community values with expert analysis of the project sites, including identifying key sites, nodes and levels of representativeness of key values etc. 	<ul style="list-style-type: none"> Identify how external factors (such as sea level rise, changing transport modalities etc) could impact study site including community values Evaluate options and interventions that seek to deliver beneficial change.
Effort and resource required	<ul style="list-style-type: none"> Effort is focused on community engagement, data collection, and sharing data and insights with project facilitators, participants, stakeholders and decision makers. <p>Relatively low resource requirement.</p>	<ul style="list-style-type: none"> Builds on 'Explore' phase: incorporates other technical and expert spatial understandings of the project site More rigorous assessments of data representativeness, validity and significance Requires strong GIS and PCM technical expertise. <p>Moderate to high resource requirement.</p>	<ul style="list-style-type: none"> Builds on 'Explain' phase, to model long term changes to community values, identity and the project site Requires strong GIS and PCM technical expertise, and high levels of futures, planning and project context expertise. <p>High resource requirement.</p>

5. Conclusion

When seeking to identify space and place-based options and opportunities for any urban and/or landscape setting, no 'single map' (or series of maps) will encapsulate all dimensions of the project. Instead, the focus must be on effective 'mapping' as an engagement process and as a tool for investigation.

Participatory Community Mapping invites a variety of different approaches to identifying significant community values and associations, and can facilitate continuous engagement of the community through Phases 1-3 of DAPP. Other mapping work can integrate community values with physical features and natural hazards, and assist in developing adaption options.

Aligning PCM with the stages of DAPP can help identify robust options for the future which have beneficial outcomes for community values and identity.

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Endnotes

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