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The science behind disaster citizen science: an autoethnographic exploration
of the Zero Carbon Act campaign in Aotearoa New Zealand.

A thesis presented in partial fulfilment of the requirements for the degree of

Doctor of Philosophy
in
Emergency Management

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Abstract

My research sought to understand how citizen-led science can contribute to disaster and climate resilience. The structure of the thesis was split in two parts. The first half of the thesis research focused on a literature review and the development of a Disaster Citizen Science Project Development Framework to understand how citizen science can build community resilience against disasters, including for current and future hazard impacts of the climate crisis (Part One). The second half of the thesis (Part Two) used an autoethnographic study of a citizen-led science and policy project: the Zero Carbon Act campaign for new climate change law in Aotearoa New Zealand (2016-2019).

Around the world, citizen science is being used to increase community resilience to hazards, including climate change impacts. However, without careful design, there is potential for citizen science to reinforce current societal inequities. An intersectional and reflexive approach to citizen science project design is presented as a way to lessen inequities in this science.

I undertook an autoethnographic exploration of my participation in the Zero Carbon Act campaign to better understand how reflexive analysis could be applied to citizen science projects, to reduce some of the possible inequitable outcomes. The Zero Carbon Act campaign for new climate change law in Aotearoa New Zealand was used as an example of citizen-led science and policy development, led by youth climate change group Generation Zero. Analysis of the Zero Carbon Act campaign explored reflexive and vulnerable project participation, and looked at how project design can help turn project participants' values into actions (praxis). Several key themes were analysed through my autoethnographic exploration, including action coping, action bias, urgency narratives, burnout, collective visioning, and justice-based climate action.

My research concluded that climate change focused citizen science projects can have the best of intentions, but without reflexive and intersectional approaches they can be problematic, especially when causing harm to already marginalised communities. Being reflexive takes a degree of personal vulnerability, but it is a necessary tool when including social justice approaches to citizen science and research.

Prologue

2016

Personal diary entry - January 6th 2016

I wrote the following diary entry on a plane home from Europe to Aotearoa New Zealand, after attending the 2016 Paris Climate Change Negotiations (COP21) as a youth activist co-leading the New Zealand Youth Delegation (NZYD). The diary entry was written two months before a number of friends and I started a campaign for a new climate law in Aotearoa New Zealand, that we called the Zero Carbon Act.

The reality of climate change has taken a huge toll on me, both emotionally and physically.

Going to the Paris United Nations climate change conference last month was one way I tried to confront this. To lean in rather than shy away. I had tried to push the realities out of my mind ever since my first climate talks in Warsaw two years earlier. The thought of acknowledging and feeling those climate issues was too emotionally daunting. Too much complexity, too many competing issues, too much harsh reality for one brain to handle. I was completely full of climate impact facts and figures, stories and anecdotes, images, realities, truths.

Sometimes I need to acknowledge that working in the climate change space sucks. It is really hard work and emotionally exhausting. I'm continuously discussing the fate of millions and millions of people. People that I don't know, but why does that make them any less important? I discuss them like facts, dehumanizing them. People forced to leave their homes due to sea level rise, people killed by increased storm intensity, people with no food due to increased droughts. I discuss them as the 'other' - as if I won't be affected by the same impacts. In many ways, I won't be. My activism is from a place of extreme privilege in a world littered with deeply ingrained structural inequities.

While at the Paris conference, the countries signed a deal. Finally. I was bearing witness, yet not trusting. My soul wept, "it's not enough" it screamed. I found myself getting caught up in celebrations about promises that, in reality, may never be fulfilled. A step in the right direction, yes. But for whom? Maybe it was as good as it was ever going to get. It is hard to have hope that we can win this fight, but it's scarier not to have it [sic].

2019

Diary entry - November 13th 2019.

I wrote the following diary entry in 2019 after a trip to Aotearoa New Zealand's Government House to watch the Governor General sign the Climate Change Response (Zero Carbon) Act 2019 into law.

We did it. It's real. It's a thing. It exists. Aotearoa New Zealand has a new climate law. A real climate law. A Zero Carbon Act.

Were we ever going to get a perfect law in an imperfect political system whilst trying to achieve cross-party support for the law...? No. Our main aim for the law was to have it as a cross-party piece of legislation so that the law remains in place through the inevitable changes in government during the coming decades. We needed a long term plan as a country, emission reductions goals, and an independent group of experts to hold current and future governments to account for their actions or inaction.

Our draft climate law was intended to be a framework to catalyse and force the tough changes we need to be making as a country. It is now the government's framework, Parliament's framework. What I'm worried about is the substance of the policies that will be created to fill in this framework. We've already seen politicians using our law to take cheap shots at each

other. I have no doubt the complexity of the underlying policy nuance will be equally taken advantage of to spread distrust in climate action.

What a long journey to get to this point. But it is heart-breaking to know we have only just scratched the surface.

I'm left feeling that the Zero Carbon Act is still not enough. Paris wasn't enough. That has been made very clear four years on. Aotearoa New Zealand's new climate law will likely not be enough either. Not after the politicians messed with it. It's a bandaid, the ambulance at the bottom of the cliff. It's a start. But it is too late in the game to just be starting. We need the finale. We need the big finish. We need the fireworks and the crescendo.

We don't just need it, we deserve it. We deserve better than a continuation of the last decades of political inaction. Our most at risk communities and our future generations all deserve better going forward.

Our pacific island neighbours and their diaspora who have settled in Aotearoa New Zealand and around the world deserve better – those who have been championing the issues around climate change for decades, and who are fighting for their islands and their existence.

Our workers who are trapped in sunset industries deserve better – the communities who have intergenerational identity tied to their work and who are feeling attacked for their way of life because there isn't a helpful, nation-wide conversation guiding them through this transition.

Our indigenous Māori communities deserve better – tangata whenua who have been fighting for centuries against colonisation and land degradation which has sat at the heart of the climate crisis and wider environmental issues.

Our disabled people deserve better – those who are not only suffering from the impacts of the climate crisis at a disproportionately high rate, but who are so often excluded from having their solutions heard in the ableist government decision making processes.

Our farmers who are feeling crushed beneath the weight of the new policy regulations deserve better – many of whom are now fighting against policies they see as contradictory, unhelpful or confusing because they have been used as pawns by their community leaders to fight the anti-climate change agenda for decades.

Our women and people of oppressed genders deserve better – those forced to live within the deeply entrenched nuanced layers of a patriarchal system, a system designed to keep real power out of their hands from birth, many of whom cannot escape increased rates of violence and poverty directly linked to the climate crisis.

Our students deserve better – those young people who are spending tens or hundreds of thousands of dollars rote learning ways to stay within traditional social, political, and economic systems that are failing the planet and who will unknowingly continue to amplify this social and environmental mess we are in.

Everyone in Aotearoa New Zealand deserves a Parliamentary response to climate change that actually works. And I fear the Zero Carbon Act will not be enough to make that happen [sic].

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I've witnessed first-hand that it takes a whole community to get a PhD finished. I could never have got to the end of this process without the many people and organisations involved in my journey. There is no way I can name every single person who made this thesis happen, from the countless baristas who made the essential coffees, to the cleaners at the university who helped keep our offices nice places to spend long hours, and the many people I've had conversations with about all aspects of the PhD topic as it evolved over the duration of the project. The following section aims to highlight a few of the people and organisations that had a significant impact on me during this PhD journey.

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The Zero Carbon Act campaign team were the inspiration for the second half of this PhD. I'm not sure if we always realised it at the time, but we did something pretty impressive. I'm so proud of our team.

And lastly, my supervisors: Distinguished Professor David Johnston, Associate Professor Julia Becker, and Associate Professor Emma Hudson-Doyle. I can say with 100% certainty that this PhD would not have got over the finish line without your support and guidance. From the project scoping and development way back at the start, right up to coaxing me through the (what felt like never-ending) editing process, you were all there. After my neurodivergent diagnosis towards the end of the journey, you took it in stride and made the adjustments needed to help me get the PhD completed. I would have given up without your kindness and unwavering commitment to being great mentors. I'm incredibly grateful to have had each of you on my team.

My PhD is dedicated to everyone who worked on the Zero Carbon Act campaign for a new climate law. Each person was a piece of the puzzle that made that campaign a success. I hope the law remains ambitious in its purpose and stays in place for years to come.

My PhD is now also dedicated to my supervisor, Distinguished Professor David Johnston, who tragically passed away too soon a few weeks before my thesis oral defence. David, my thesis is one thread in the rich, colourful tapestry that is your legacy. I am a better human for knowing you.

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1 Chapter 1 - Introduction

Ko Tararua te maunga e rū nei taku ngākau

Tararua ranges are the mountains that speak to my heart

Ko Ruamāhanga te awa o mahea nei aku māharahara

Ruamāhanga is the river that alleviates my worries

Nō Wairarapa ahau

I am from the Wairarapa region (North Island, Aotearoa New Zealand)

Ko Lisa McLaren tokū ingoa

My name is Lisa McLaren

E mihi ana ki ngā tohu o nehe, o Rangitāne o Wairarapa nō Ngāti Kahungunu ki Wairarapa e noho nei au

I recognise the ancestral and spiritual landmarks of Rangitāne o Wairarapa and Ngāti

Kahungunu ki Wairarapa iwi and hapū ['tribe'/'sub-tribe'] where I live.

1.1 Who am I?

I'm an activist and an academic, in training in both. It has taken me three years to feel comfortable talking about these two critical parts of self in the same space. To some of my fellow climate activists I am too 'mainstream', too 'much part of the institution', too 'driven by connecting policy-to-science' in a world that they feel needs 'bodies on the line'-type resistance. In contrast, many of my pre-PhD experiences within academic institutions had led me to believe that no one would take me seriously as a 'real' academic if I was one of those pesky climate change activists. If I was one of 'the troublemakers', the ones that 'aren't afraid to rock the boat and make people in power uncomfortable', the ones that 'are calling for a safe liveable future which doesn't exclude our already impacted, structurally oppressed, frontline, and indigenous communities'.

This is my story of how my two worlds have crashed together as one, culminating in a complex and chaotic few years that I have been privileged to call my PhD journey.

1.2 A thesis of two halves

The structure of this thesis has been split in two halves, in alignment with how the research was conducted, and how the topic was redirected in the middle of the PhD process. Part One focuses on a literature review and the development of a framework to understand how citizen science could build community resilience against disasters, including for current and future hazard impacts of the climate crisis. Part Two uses an autoethnographic study of a citizen-led science and policy project: the Zero Carbon Act campaign for new climate change law in Aotearoa New Zealand (2016-2019). The campaign was successful and led to the establishment of the Climate Change Response (Zero Carbon) Amendment Act in 2019 (henceforth referred to as the Zero Carbon Act, or ZCA).

1.2.1 Part one: Literature review and disaster citizen science framework development

When picking a PhD topic, I was trying to keep front of mind how this thesis' findings could be used, by who, and why. I wanted a topic that was practical and would produce findings that would be of value to at least one community impacted by climate change. My experiences of working in local government had shown me that participatory approaches were effective in helping communities take back agency in local decision-making processes. Previously, I had seen local decision-making processes as disempowering, confusing, inaccessible, and often without the provision of any good storytelling of the 'why' behind decisions. People directly affected were often confused, anxious, angered, and distrustful of decision-making processes. I saw citizen science, which covers a wide range of different projects where volunteers participate in scientific discovery (Bonney et al., 2009b), as one way that communities could become more empowered within local decision-making.

Researchers at the Joint Centre for Disaster Research involved in the Resilience to Nature's Challenges – Kia manawaroa – Ngā Ākina o Te Ao Tūroa programme submitted an application for PhD funding to explore the 'science behind citizen science', and apply it to the New Zealand natural hazards and disaster context in a way that would build community resilience. As the successful candidate, when I started the PhD I interpreted the link between community resilience and citizen science at a theoretical level to mean exploring how citizen science could be used to increase community resilience. Based on my previous work experience, I knew that important elements of citizen science worthy of exploration could include project design, community knowledge, participation, engagement, trust, articulation of issues, and actions. I intended to build a framework that included such elements, and outline suggestions for how disaster researchers could include citizen science more effectively into their work. The initial research question I began my PhD with was:

‘How can citizen science build community resilience against disasters, including current and future hazard impacts of the climate crisis?’

1.2.2 Part one - Topic scoping, literature review and thematic analysis

Having settled upon a research question, I scoped the topic further through reading a wide range of citizen science-based content, including academic and community-based work. When doing the initial scoping I drew inspiration from the following Muki Haklay quote:

Extreme Citizen Science (ExCiteS) is a situated, bottom-up practice that takes into account local needs, practices, and culture, and works with broad networks of people to design and build new devices and knowledge creation processes that can transform the world (Haklay, 2015, p. 8).

Haklay’s conceptualisation of ‘extreme’ citizen science gave me hope that citizen science could enhance community resilience, as the quote implies participation and engagement, which links into community resilience building practices. Further scoping work highlighted that citizen science is a developing field which has its roots in the physical sciences, especially biology and environmental science (Bonney et al., 2009b). Citizen science has been slower to develop in the natural hazards and disaster research and response fields. However, there are now science projects covering a range of different hazards, including Aotearoa New Zealand’s own GeoNet Felt Reports¹ which is a very popular tool amongst citizens for reporting earthquake events. Internationally, there are citizen science projects for different hazard events including tornadoes, volcanoes, and flooding (Marchezini et al., 2018), however, in the project scoping I discovered that the impact of these projects on the participants and their wider communities had not been well studied. There was even less written on the impact ‘extreme’ (high participation) citizen science projects could have on the community resilience of an area (Haklay, 2013; Haklay, 2014). Thus, there appeared to be a gap in the research as to how participation in these hazard-based projects could increase a community’s resilience, which this project initially sought to fill.

There were several options which could be pursued to fill gaps in knowledge related to natural disasters, citizen science, and community resilience: a literature review of current knowledge on

¹ <https://www.geonet.org.nz/>

these topic areas; use of an existing hazard or disaster-related citizen science project as a case study to explore citizen science and resilience; or development of a new citizen science project to explore these concepts. A literature review comprised one key part of this gap-filling exercise (see Chapter Two). However, due to the timeframe and budget of the PhD process, there was not an opportunity with this research to create a new citizen science project with the express goal of analysing the processes of citizen science and the impacts the project had on the participants and researcher(s). Therefore, an existing project was sought to explore the research gap. The following paragraphs outline my thought processes as I moved through the literature review process and project selection.

I initially did everything I could to keep two of my worlds (academia and climate activism) separate, starting with a deliberate choice of a PhD topic that was focused on citizen science and natural hazards and therefore broader than climate change. I began researching citizen science in the literature, including community-led science, and analysing how people could use it as a tool for building community resilience to disasters. I researched the challenges and benefits of citizen science approaches and looked in-depth at the concept of ‘science for change’ where communities could take back agency from oppressive structures or systems and sometimes even gain a seat at the decision-making table through their participation in science. I looked at themes such as power dynamics, local context, motivations, partnerships and the power of language.

I was drawn to the concept of community-led science, as a subset of citizen science, for its dual education and activism potential, and was interested in how the power of the researcher or project lead could dramatically shape the development and management of the project. I decided to investigate researcher reflexivity within citizen science as it related to disaster or climate change-based citizen science project development.

After considering the wide range of aforementioned aspects related to citizen science, I wrote up an in-depth literature review which outlined the important components of disaster-focussed citizen science that could build resilience, and presented a framework to guide the development of future citizen science projects, which included a section on project reflexivity.

At the same time, I was becoming more critical in my thoughts around the concept of ‘resilience’, and in particular the concept of ‘community resilience’, which was central to my topic. My main concern was that community resilience-building felt like a band-aid being stuck on broken social

systems, especially in the face of climate change and wider social injustices. I was learning that building community resilience to disasters needed to include systematically dismantling the unjust and unsustainable social and economic structures that are currently the underlying causes of many disaster impacts, including climate change impacts.

I was always interested in citizen science as an education tool, and how social change could be brought about through personal change through participation in projects. For example, I originally expected that if people 'see' or 'experience' the science themselves it might help them believe it and resist the necessary changes less. But now I was looking at the power of citizen science to go beyond education. Scientists, educators, and activists had been telling people the science of climate change for three decades but, due to numerous factors, momentum for effective, lasting action at a scale which could make a real difference was still failing. There were not yet many conversations that centred a climate justice approach within community resilience research. Teaching people that climate change existed was shown not to be effective for creating action to solve it; instead, there needed to be a way for communities to examine the role social inequities, politics, and power dynamics played in influencing climate change responses. I felt that citizen science could be an effective way of citizens convincing their politicians to act on climate change.

My change in thinking was due to a range of factors, including a change in how scientists were publicly discussing climate change, my developing knowledge on the concepts of justice, phrases used to describe aspects of climate change such as 'climate crisis' and 'climate emergency', and my role within climate activism. Mostly, I was inspired by the environmental justice talks and workshops at the 2019 American Citizen Science conference in Raleigh, North Carolina. It was through these interactions with citizens, researchers, and government officials who had been central to environmental justice campaigns and projects over the last few decades that I finally felt comfortable connecting my climate activism to my academic work. The keynote speech by Dr Max Liboiron (2019) 'The Power (Relations) of Citizen Science' showed me there were already people working in ways that centred topics I was interested in within the citizen science field, such as justice and power. This conference was the 'turning point' in my PhD and allowed me to pivot my topic to focus on my own community of practice, the Zero Carbon Act campaign team, and being part of the youth climate activist community which became the PhD case study project.

1.2.3 Part two: Zero Carbon Act autoethnographic study

I really connected to the concept of power dynamics and how they worked within the citizen science field, as outlined by Liboiron (2019). I also started investigating stories and narratives, art and design, and other ways of connecting with people that could be integrated into citizen science methods. I did not want to start a research project from scratch for many reasons, including budget and timeframe as previously outlined, but also because I didn't want to start another climate project in a year that was already saturated with them – the rise of Extinction Rebellion (XR) and the School Strike for Climate movement (SS4C), the Zero Carbon Act campaign, the work of other existing climate change organisations such as 350 Aotearoa, Te Ara Whatu, and the Pacific Climate Warriors, as well as a myriad of environmental policy reviews. There was an increase in the number of people participating in the wider Aotearoa New Zealand climate space and holding interpersonal and inter-group relationships between different climate organisations was becoming increasingly complex. To add to the complexity, some of the interactions within and between groups was inharmonious and contentious, so I didn't want to add more pressure to already stressed volunteers or the wider climate moment by adding in another climate project.

I realised through exposure to the amazing environmental justice groups within the citizen science field on my PhD journey that our Zero Carbon Act campaign was, in fact, an example of a citizen-led science and policy project. I decided to include the campaign as the central study area of my PhD. I used a method focused on the story of self – an autoethnographic account of analysing activism and academia. Through this analysis, I explored what community resilience looks like to young activists in the face of the challenges and injustices of the climate crisis. I was initially confused at using an individualistic method such as autoethnography within a context of exploring citizen science and climate activism, both of which have deep roots in collaboration and teamwork. I can only speak to my own journey within the campaign. However, my journey is so deeply connected to the journeys of others and I have attempted to highlight those connections throughout this thesis, as evidenced from this excerpt from my diary on 19th September 2019:

I have really loved working out what type of researcher I want to be after my PhD. It has been the joy of the PhD process. And I'm glad I kept my topic flexible enough to shift in directions that line up with my values. I don't regret taking such a long time to work out my case study. I owed a community more than to swoop in, start something with basically no funding, extract the data, then move on. I couldn't have guaranteed that the project would

continue after my PhD and I wasn't out to start my work in academia with bad practice. There is inconvenience in doing things the right way. In academia there are good and bad ways to research, and there are also a bunch of grey areas in the middle that are a combination of the two. It would have been so much easier to just do the research with no thought to consequences; consequences of how the work or my approach impacts people, impacts communities, and especially impacts minority or structurally oppressed groups. It is a privilege to just bowl on through and complete research in an ignorant or offensive way. A privilege that is also deeply wound in white male privilege, and general pāhekā research privilege too.

For my PhD topic journey I couldn't work out where my own lines were for this. I couldn't decide what I wanted those ethical boundaries to be for me as a researcher. I knew the lines existed, or at least they should, I'd been well trained before I'd even started the PhD by my amazing Masters supervisor, Dr Jessica Hutchings. She was especially influential on my thoughts around cross cultural research. For this new PhD work, I didn't know if I was crossing the lines accidentally, because I couldn't see them properly yet. Like balancing on a tightrope, on the edge of falling off into the 'bad research' on one side, or falling behind time-wise in my PhD research on the other. I found my safe harbour in my own climate community. I knew the boundaries and unwritten social rules, I knew the group members, I knew the stories and anecdotes. So to become that researcher wasn't a stress, it was a relief. Plus I really value the story we have to tell for the Zero Carbon Act project. My only concern is that, because of my chosen methodological approach, autoethnography, for many people my research isn't "proper" research, which could feel really hurtful if I let it. But being able to dedicate paid time, through my PhD scholarship, to give voice to all the volunteers and allied organisations that worked on our campaign is an incredible privilege and worth the vulnerability and uncomfortableness [sic] (PhD Diary – 19/9/19).

I share this story with the Zero Carbon Act campaign team, our wider supporter organisations, and the hundreds of volunteers who gave their time to the campaign during those four years. Because I was already leading a citizen-led science and policy project, it made sense to research and write about it for the PhD. However, I feared that I may be un-hireable post-PhD due to using autoethnography, a research method that is perceived as unorthodox by some physical science-focused disaster researchers. I also feared undertaking a significant topic change halfway through the PhD, in case it could be misread by others as indecision or lack of planning. Explicitly focusing activism within my work was driven by my desire to be my authentic self as a researcher.

The Zero Carbon Act story was unique as a citizen science project. Therefore, I was confident that the outputs of the thesis would contribute new and different ideas to the citizen science field. I chose to embed a personal narrative alongside a campaign critique of the Zero Carbon Act, which links the work to both community resilience and citizen science with a youth climate activism lens. I focused on my internal narrative as the National Convenor of the ZCA Campaign, as well as insights from other core team members through semi-structured interviews. My topic explored how citizen science projects can be used as a tool for community activism on climate change. I used the Ganz (2009) 'Story of Self, Story of Us, Story of Now' concepts for framing the three discussion chapters and used the theories of praxis (Freire, 1970) and vulnerability (Brown, 2015; Brown 2018) to analyse my findings.

1.2.4 Language

I use intentional changes in tense (1st person, 2nd person, 3rd person language) throughout the thesis; 1st person language when sharing my experiences or views, 2nd person language when describing joint participation in the Zero Carbon Act campaign as it was a group project, and 3rd person language when outlining literature or theoretical concepts. I have also intentionally used plain English where possible to keep the thesis more accessible to those not in higher academia (New Zealand Government, 2022). I have included personal stories and experiences throughout, in line with the methodological approach of autoethnography. And I use the terms 'climate change' versus 'climate crisis' interchangeably throughout the thesis as my personal use of the phrases changed over the course of the PhD process.

1.3 Research questions and overview of thesis structure

Now that I have provided some context about my thought processes and experiences that drove the approach to this PhD, I outline the final research questions I set out to answer. These questions are broken into Part One and Part Two, reflective of the focus on citizen science and resilience building for disasters and climate, followed by a focus on the exploration of the Zero Carbon Act campaign as a citizen-led project and the value it provides in terms of citizen science and resilience-building.

1.3.1 Final research questions

The final research questions for the PhD are included below, split between parts One and Two of the thesis design.

Part One: Literature review and disaster citizen science framework development

- 1a) What elements / criteria / ingredients make up a citizen science project?
- 1b) How can project leads (researchers and/or community groups) be more reflexive of their development of and participation in disaster citizen science?
- 1c) How can citizen science projects be designed to intentionally increase community resilience to disasters and the climate crisis in a way that honours the participants involved, their communities, and works in non-harmful ways?

Part Two: Zero Carbon Act autoethnographic study

- 2a) What lessons can an autoethnographic analysis of the Zero Carbon Act campaign contribute to future community-led climate change projects, as well as wider disaster and climate change citizen science practice?

These questions will be explored in detail throughout both Part One and Part Two of the thesis. The following diagram (Figure 1) summarises the outline for the whole thesis to guide the reader. Part One, the focus on citizen science, disasters, climate and resilience, is covered by Chapters 2 and 3, while Part Two on the Zero Carbon Act is covered in Chapters 4 through 7. The thesis concludes with further discussion and conclusions in Chapter 8.

1.3.2 Research overview

The following diagram gives an overarching view of the different thesis chapters.

	Prologue	
	Acknowledgements	
	Chapter 1 – Introduction	Topic scope Thesis of two halves Research questions Researcher positionality
Part One	Chapter 2 – Literature Review	Research approach and method Community resilience literature Citizen science literature
	Chapter 3 – Framework paper submitted to ‘Progress in Disaster Science’	Disaster Citizen Science Project Development Framework paper
Part Two	Chapter 4 – Zero Carbon Act case study	Zero Carbon Act campaign overview Theory: praxis and vulnerability Autoethnography methodology Data collection and analysis
	Chapter 5 – Results and Discussion; the Story of Self	Disasters and mental health Action coping
	Chapter 6 – Results and Discussion; the Story of Us	Power of connection and collective action Stories creating shared visions and narratives
	Chapter 7 – Results and Discussion; the Story of Now	Urgency trap and action bias Reflexivity to navigate intersectional approaches to injustice Tools for reflection - Justice-based campaign funnel - Justice-based climate action spectrum
	Chapter 8 – Conclusion	Concluding reflections Alignment with general citizen science practice Unique contributions Limitations Future research ideas
	Epilogue	Reflections on the research process
	References	
	Appendix One	Disaster Citizen Science Project Development Framework
	Appendix Two	Statement of Contribution form

Figure 1 – Overall outline of the thesis and topics covered in each chapter

1.4 Positionality

1.4.1 Positionality within academia

Central to the PhD topic is the view that ‘positionality’ as a concept is key to transparency within academia (Secules et al., 2021). The term positionality can be described as both a position taken on a particular issue, and as an individual’s worldview (Foote & Bartell, 2011). When conducting qualitative research, and arguably all research, it is important to clearly establish and review the positionality of the researcher. Positionality in the academic context encompasses worldview and assumptions. It includes how researchers are impacted by their beliefs, ethics, and values, as well as other factors, such as race, sex, religious faith, social class, and location (Sikes, 2004; Wellington et al., 2005; Greenbank, 2003). As an emerging researcher, I am aware of the political, social and cultural contexts which influence how I react in situations and have chosen to be critically aware of how fluid and context dependent my positionality has been throughout my PhD journey (Greenbank, 2003).

Given its importance, an initial positionality statement was developed at the commencement of the research and is included below.

I am an early 30s Pakeha female, who was raised in a predominantly white, middle-class rural community. I am now Wellington based, having spent a lot of time within Western education systems in Aotearoa NZ; primary school, high school, te wānanga and two universities. In terms of formal qualifications, I have a BA in Anthropology, BSc in Environmental Studies, Certificate of Small Business Management, and a Masters in Environmental Studies, with a focus on educating for the wicked problem of climate change. I am relatively new to accurately learning about Te Tiriti o Waitangi, and its importance as our founding document. I am now continually upskilling my knowledge of its place in how Aotearoa NZ moves forward this century as a nation. I have worked for four years in local government in resilience policy and emergency management roles. I also lead a nationwide climate change legislation campaign. After attending two UN climate change negotiations (Warsaw, 2013 and Paris, 2015) and meeting hundreds of people who are directly suffering from the impacts of climate change, I have since dedicated my free time to helping mobilise

climate change action within Aotearoa NZ. I like to learn about what makes people behave in certain ways around disaster and environmental issues, and explore what are the best ways to engage with them. I really believe that science is a great way to introduce some complex, multi-dimensional, and sometimes politically charged issues into a community and give them a safe space to have those conversations [sic] (PhD confirmation report, 2018).

I want to acknowledge that I could have constructed this story thousands of different ways, using different examples and prioritising different parts of my upbringing, interests or influences. The story of self I have included throughout my PhD is a carefully constructed example of positionality which is intended to give the reader a clear picture of my background and how that background has shaped how I view the world, what I view as important, and how I view knowledge.

1.4.2 Whiteness and belonging in a colonised country

My brain is racist and I have to tell it off all the time [sic] (PhD Diary – 20/11/20).

I acknowledge that Māori² sovereignty was never ceded and that I live on stolen land. I also acknowledge that He Whakaputanga o te Rangatiratanga o Nū Tīreni (1935)³ is the written constitution of Aotearoa New Zealand. I acknowledge the only correct version of The Treaty of Waitangi, signed in 1840, is Te Tiriti o Waitangi⁴ (the Te Reo Māori⁵ version) which was signed by Māori with the intention to create rules for how pākehā⁶ (non-Māori settlers) would live when they arrived under the kāwanatanga (governance) of the English Queen. Power and authority, forcefully taken under the guise of the English mis-translated version of the Treaty, should still have laid with the hapū ('sub-tribe'), and particularly with Rangatira (authority figures) of the hapū. The Matike Mai⁷ report signals the need for constitutional overhaul and provides guidance on this process. I am relatively new to learning about the accurate history of Te Tiriti o Waitangi, and its importance as our country's founding document. I am now continuingly upskilling my knowledge and ways of

² Indigenous peoples of Aotearoa New Zealand

³ Declaration of Independence written in 1835

⁴ Te Tiriti o Waitangi (1840), known in English as The Treaty of Waitangi, was an agreement between the British Crown and many local Māori leaders on how joint governance would be established in the country

⁵ Māori language

⁶ People who are not Māori, especially non-indigenous New Zealander

⁷ <https://matikemai.maori.nz/>

engaging with Te Tiriti as a pākehā, and I still struggle with what that identity means in a country where the rights of mana whenua aren't being upheld by the Crown.

I have learnt to hold space in my brain for conflicting thoughts. It is okay to be proud of my ancestors for making dangerous journeys to a world new to them and for making a life for themselves. But I also have to sit in the deep uncomfortableness of the historical and present-day trauma these colonial processes caused indigenous communities, and my ancestors' role in the construction of this settler colonial state. I also have to acknowledge the benefits and privilege this colonial legacy has afforded to me in the form of family land wealth, and the social shield of growing up white in a colonised state. I'm a product of conflicting layers. My ancestors of Scottish, Welsh, and Northern Irish heritage were colonists when they moved to Aotearoa New Zealand, and their lands had also been colonised by the English for centuries. My ancestors were colonisers from a mix of different socio-economic backgrounds, from farming peasants through to members of the ruling class including a UK Chancellor of the Exchequer and wealthy members of the landed gentry who owned castles.

While I have been mocked in jest all my life for my very pale skin tone, the inescapable fact is my life would have been harder if I was black, indigenous, or a person of colour, and I will never personally understand those experiences. No matter where I grew up in Aotearoa New Zealand, the forces of systemic racism would have touched my life negatively if I was Māori. For most of my life I took whiteness and the privileges it brings for granted. I didn't see whiteness because of the dominance it plays in all aspects of society within a colonial settler state like Aotearoa New Zealand. All my work is from a place of privilege. And while it might not always feel like it, it's something I try to hold onto in my work and relationships with others. I have a lot of internalised racism to work through. The first step of which has been to recognise and acknowledge it, then work to dismantle it within my brain. Beginning a journey with te reo Māori, connecting with local hapū in my area, and being critical of the assumptions made in my day-to-day thoughts have been among my personal work in this space to date.

My love of the land around me isn't enough to belong to it - because it's stolen. My solutions are created through a lens based in my upbringing of neoliberal capitalism. My feelings of grief are not tied up in intergenerational trauma of being colonised. My ancestors were colonists, and I am a result of that settler colony legacy [sic] (PhD Diary – 02/11/18).

I didn't grow up with a sense of responsibility to the whenua (land). I grew up with an appreciation for it. A connection to it through growing up rurally, my family ties to the farming industry, and the sense of peace I feel being out in nature. But it was not an intergenerational cultural connection. I've always really wanted to have a deep sense of belonging to somewhere, and in the last decade I've been learning that the very places I thought I connected to in that way actually belong to mana whenua⁸ who have very different ways of viewing concepts of 'ownership' and 'belonging' to the dominant land ownership discourse held by many pākehā. I know that I have a lot more learning around this to do, and to work in a true climate justice way means that I need to continually develop a good knowledge of my role as tauīwi⁹ in helping shape the future of Aotearoa New Zealand.

1.4.3 Justice-based climate change values

Anthropogenic climate change is real, is caused by humans, and one of the most pressing issues of our time, though it is not isolated from other major issues. Climate change will exacerbate all the other social issues facing the world (poverty, malnutrition, food security, slavery, racism, environmental degradation, disaster impacts, war, and terrorism, etc). Climate justice and equity need to be embedded in mitigation and adaptation action. Different people have different ways of 'fixing it' – the climate movement is not homogenous, and we need to work with different groups to stimulate change in multiple contexts and within different communities. In Aotearoa New Zealand, indigenous rights and genuine Te Tiriti o Waitangi partnerships need to be actively centred into climate change campaigning.

Action needs to acknowledge that Aotearoa New Zealand is a colonial settler state, and that there are many issues the country needs to work through on the re-indigenisation (decolonisation) journey. Solutions to climate change need to be based on a 1.5 degree Celsius limit, not 2 degree Celsius limit, and highlight New Zealand's historical responsibility, and its responsibility to do more than 'fair share' as a developed nation. While different solutions are needed, we need to work across different intersectional approaches and promote those voices and solutions that are often overshadowed, especially from indigenous people and those on the frontlines of climate change impacts (henceforth 'frontline communities'). I have 'played nice' with a variety of different groups or unlikely allies to 'get stuff done', even if this doesn't always line up with my personal values. For example, working with groups to change their views on climate change whose ways of working or

⁸ Māori iwi/hapū/whānau or tribe/'sub-tribe'/family who hold customary authority in an identified area

⁹ people who are not Māori, especially non-indigenous New Zealander

values I might strongly disagree with. However, values are a huge part of our 'stories of self' (Ganz, 2009). Thus it is easier to connect with people and convince them of the importance of climate change issues when using particular values that connect us with them.

1.5 [Link to Chapter 2](#)

Having outlined my thought processes and experiences that drove this PhD, followed by the subsequent development of my research questions, and my positionality, I now move into discussing my world view, research approach, methodology, methods, and results for Part One of this thesis. Chapter 2 describes the research approach undertaken to help understand how citizen science can build community resilience to disasters, including for the climate crisis. The research was undertaken by means of a literature review which helped unpack the key components of citizen science in building disaster and climate resilience (Chapter 2), which was then reorganised in the form of a framework (Chapter 3) for use in developing and running future disaster and climate-related citizen science projects.

2 Part One: Chapter 2 - Literature Review

In the Introduction chapter I outlined how I initially focused on conducting a literature review on citizen science in the disaster context. I wanted to investigate what goes into the development of a citizen science project and whether there were universal ingredients for creating and running a successful project. I also wanted to investigate what a 'successful' citizen science project looked like and how a researcher could measure the impact of a citizen science project (for example, in terms of building resilience), especially when the concept of success is so subjective. The research approach for the literature review is outlined below, with the key results of the review presented. As mentioned previously, these were then reorganised into a disaster citizen science framework, which will be discussed later in Chapter 3.

2.1 Research approach for literature review

In approaching the literature review it was important to recognise that a researcher's worldview contains research paradigm assumptions, ontological assumptions, epistemological assumptions, and assumptions about human nature and agency. Because of these assumptions it is important that the researcher outlines their positionality and is reflexive about the impact of this on the research process, as outlined in the positionality section of the previous chapter (Sikes, 2004).

Many different research paradigms exist, and all research that is being done will be informed by the researcher's paradigm whether this is explicit or not (Held, 2019). A paradigm can be defined as "philosophical and theoretical framework of a scientific school or discipline within which theories, laws, and generalizations and the experiments performed in support of them are formulated" (Merriam-Webster, 2024). It includes agreements or beliefs that are shared which focus on how problems can be understood and addressed (Anand et al., 2020). Given previous discussion about my background and approach to this thesis, my research seemed to fit within the context of critical theory or what is described as a 'transformative' paradigm by Held (2019), whereby there is recognition of multiple and historically shaped realities which may result in social differences between groups of people, and where power and trust issues may exist. These concepts framed my ontological world view and my epistemological and methodological approach to the literature review.

2.1.1 Critical pedagogy

Taking reflections on critical theory a step further, I also considered how critical pedagogy might play a part in understanding and developing disaster citizen science. Critical pedagogy, as described by Brazilian educator and philosopher Paulo Friere, is the belief that the role of the educator is to help learners to challenge the status quo and connect patterns of inequalities and power structures. It encourages teachers and learners to explicitly centre issues of democracy and social justice (Freire, 1970). Friere argues that education can be a 'practice of freedom' which allows people to have agency in their own lives and shape their own life journeys (Glass, 2001, p. 19). Critical pedagogy is different to critical theory (which constitutes a higher-level research approach) or critical thinking (which is more abstract and individualistic), as outlined in Figure 2 below. However, interactions and similarities do occur between the three. A key point when comparing all three of these is that critical theory, thinking, and pedagogy may have crossovers between the critical interpretation of research (e.g. in a literature review context), the actual undertaking of citizen science research, and the development of future citizen science projects.

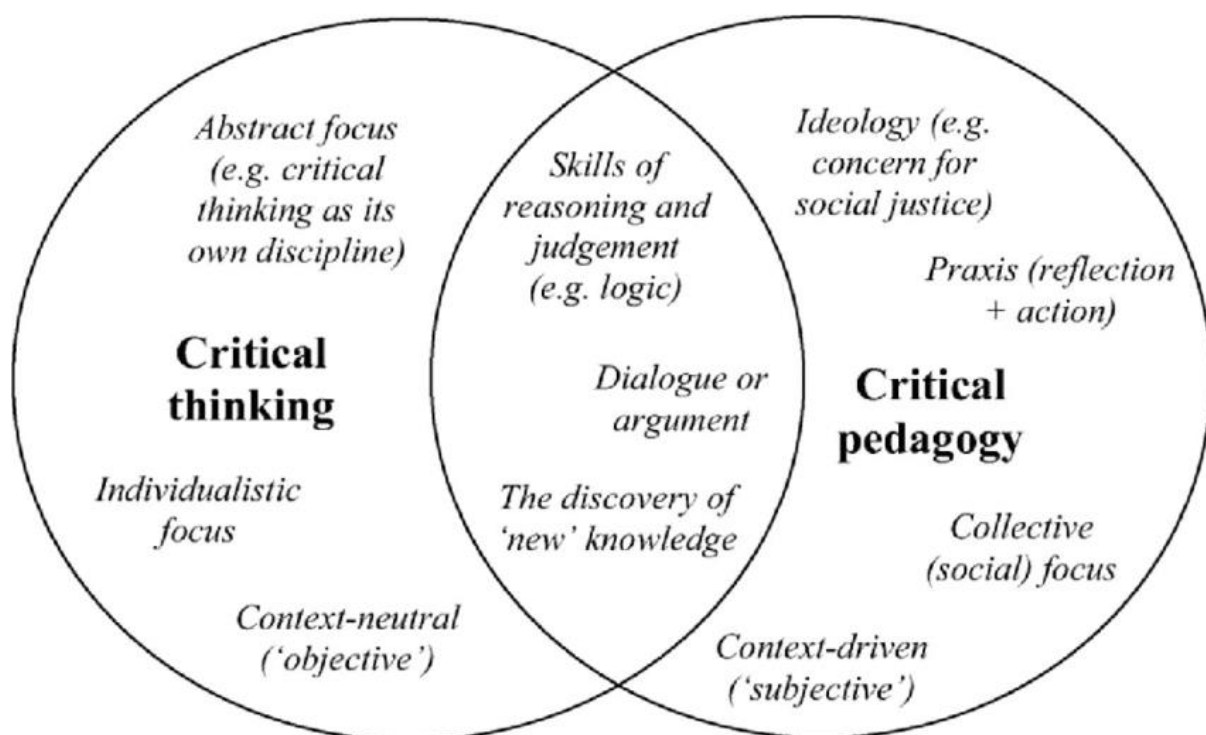


Figure 2 – Intersection between critical thinking and critical pedagogy (Johnson & Morris, 2010)

In terms of developing citizen science projects, providing learners with the skills to be critical of underlying issues such as motivations, power dynamics, and bias, can have multiple benefits at a societal level (Tierney et al., 2021). For example, science fields have a history of strategic use against

oppressed groups, and science education systems have been integral to colonisation and cultural assimilation (Tierney et al., 2021), and critical thought about these aspects might help with the development of successful citizen science projects. Additionally, teaching people how to critically analyse their sources of information may help reduce the spread of misinformation or conspiracy theories, recently prevalent in fields such as climate change, the Covid-19 vaccine, and the 2016 United States election results (Cook, 2022; Zhou & Shen, 2022; Gabarron et al., 2021; Oehmichen et al., 2019). Such mis-information, dis-information, and anti-science campaigns often attract those who have grown up without adequate levels of education, often as a result of poverty, racism, systematic oppression, and intergenerational marginalisation within the education sector (Gerosa et al., 2021).

Thus, the literature review section of this thesis aimed to use critical pedagogy as a lens to view citizen science. This was of twofold use: (1) When undertaking the literature review itself and identifying the universal ingredients that may be present in creating and running a successful citizen science project; and (2) When developing the citizen science framework (Chapter 3) which was aimed at helping people be more critical of aspects like underlying social structures within the experience they are designing as they develop citizen science projects.

2.2 Methodology

Conducting research within a transformative paradigm often involves use of qualitative methodologies, although mixed-method approaches are also possible (Held, 2019). It could be argued that a literature review approach more readily aligns within the bounds of interpretivism, rather than transformative research. Interpretivism is often associated with qualitative processes of data gathering for in-person research projects and is usually made up of investigations with small participant sample sizes and in-depth analyses. It seeks to explore and understand people's views of the world and their experiences (Creswell, 2002). A challenge with an interpretivist approach is that it can be harder to generalise data from studies due to their subjective nature (Creswell, 2002), although this may be less applicable in a traditional literature review sense. In the context of an interpretivist-focussed literature review, a researcher would search for, read through, and interpret literature to better understand viewpoints and evidence related to successful citizen science projects. In the context of a transformative paradigm, however, interpretivism would go beyond a basic exploration of ideas and opinions, to reflect on wider contextual, social, and historical factors. This thesis sought to take that extra step in order to create potential for more impactful uptake of research findings.

2.2.1 Initial topic scoping

As highlighted in Chapter 1, the initial PhD topic idea submitted to the Resilience to Nature's Challenges - Kia manawaroa - Ngā Ākina o Te Ao Tūroa programme was based on the idea of exploring the 'science behind citizen science' as applied to the New Zealand natural hazards and disaster context, and looking at ways citizen science could build community resilience. Based on this focus, topic scoping work was carried out through reading and discussions with the PhD supervision team and other academics.

While the initial topic focus was on hazards and disasters only, I felt a constant pull towards climate change, and a real responsibility to focus on this issue due to its urgency and critical nature. Climate change is a disaster exacerbator and also reduces people's ability to build or keep resilience. Therefore, from a very early stage in the project, I spent time working out how I could connect hazards and disasters with my sea level rise passion while still working on the citizen science topic. I wanted to include some climate change exacerbated hazards, even if the whole PhD wasn't climate change focused. So, as well as investigating citizen science projects for geohazards (Komac & Zorn, 2013) such as earthquake, landslide, volcano, and tsunami, I also spent time researching High Impact Weather (HIWeather)¹⁰ events such as urban flood, wildfire, localised extreme wind, disruptive winter weather, urban heat waves, and air pollution.

I discovered there were a number of hazard-based citizen science projects for a wide range of hazards, including earthquakes, tornadoes, volcanoes, and flooding (for example, the GeoNet Felt Reports in Aotearoa New Zealand). However, while details of the projects are provided in the literature, the impact of these projects on participants and their communities are not well studied in terms of community resilience. Little was also written about the exact types of projects and their impact – for example whether more resilient outcomes arose from highly participatory or community-led projects, such as those described as 'extreme' citizen science (Haklay, 2018; Haklay 2014; Stevens et al., 2014), particularly when compared to crowd-sourced projects with limited participation. Thus, there appeared to be a research gap about whether and how participation in such natural hazard and disaster-focused citizen science projects might increase community resilience.

¹⁰ <https://public.wmo.int/en/projects/high-impact-weather-project-hiweather>

The scoping review culminated in the development of the following main research question and sub-questions, that the literature review sought to address. The questions contained elements of citizen science, disasters, climate and community resilience, with a lens of critical thinking and pedagogy to guide the direction and recommendations of the review.

2.2.2 Final research question and sub-questions for the literature review

Part One: Literature review and disaster citizen science framework development

- 1a) What elements / criteria / ingredients make up a citizen science project?
- 1b) How can project leads (researchers and/or community groups) be more reflexive of their development of and participation in disaster citizen science?
- 1c) How can citizen science projects be designed to intentionally increase community resilience to disasters and the climate crisis in a way that honours the participants involved, their communities, and works in non-harmful ways?

2.2.3 Literature review method

An inductive, qualitative research method (Creswell, 2002; Garner & Scott, 2013) was applied using thematic analysis (Braun & Clarke, 2006; Doyle et al., 2019; Grant & Booth, 2009). Qualitative research identifies linkages, patterns of meaning, and connections within data (Braun & Clarke, 2006; Doyle et al., 2019; Grant & Booth, 2009). Inductive research supports the identification of those patterns and meanings by allowing the researcher to collect and analyse data from the bottom up, rather than based on pre-conceived categories. It aims to not jump to conclusions without thorough investigation into the complexity of issues (Creswell, 2002). As part of the inductive research approach, thematic analysis brings together the identified linkages, patterns and connections within data, which are then developed into generalisations and theories (Braun & Clarke, 2006; Doyle et al., 2019; Grant & Booth, 2009).

The literature search initially focused on two research questions linked to the original conceptualisation of the PhD idea; ‘what is citizen science?’ and ‘what is the science behind citizen science?’ Later searches also contained elements related to the final research questions listed above. Literature on hazards, disasters and climate, citizen science and community resilience were accessed. Search terms included citizen science, types, fields, definition, data quality, participation, problems, benefits, and challenges.

Two-hundred and sixteen academic articles were found in Google Scholar between June 2017 and June 2018 and the abstracts were read to ascertain relevance to the topic. Of these 216 articles, 160 were chosen to be read in full and evaluated for their usefulness in helping understand different characteristics of citizen science projects. The sources were then read, and notes taken on the document and on a separate analysis sheet. The analysis sheet was divided into categories that sought four different types of information: key themes, useful information, good quotes, and new references to look up. Each source was rated out of five stars for its usefulness and how big a part it would play in the literature review write up. One star was hardly relevant, three stars was moderately useful, five stars was a sign that it would be a key resource in the write up. Thematic analysis (Braun & Clarke, 2006; Doyle et al., 2019; Grant & Booth, 2009) was undertaken on the content of the 160 articles which identified 36 main themes and 221 sub-themes. The main themes were chosen as they were umbrella concepts for four or more sub-themes.

Exploring all 221 sub-themes for the PhD process was unworkable due to the timeframe of the project. Therefore, main themes were chosen to be expanded on further as they were umbrella concepts for four or more sub-themes. The thematic analysis had been used to group all the sub-themes together into 36 categories. For example, the theme of 'Learning' was used as an umbrella concept for the following sub-themes as they relate to citizen science; community education, civic education, learning outcomes, teaching, awareness, different ways people learn, capacity building, taking volunteers on a journey, environmental education, experiential learning, adult / lifelong learning, formal education, educational institutions, mutual learning.

One limitation is that the literature search was restricted to English-language articles and therefore may not represent the breadth of material available across different nations, languages, and cultural contexts, leading to some themes perhaps being missed.

The key themes that were identified were used to help develop the citizen science disaster framework presented in Chapter 3. To begin with, however, I will first elaborate upon the key concepts that were highlighted as important to this research from the literature review, to show how these have been considered and used in the past.

2.3 Results: Key concepts from the literature review

The key concepts identified from the literature review are presented under the following two sub-headings: Community Resilience and Citizen Science.

2.3.1 Community resilience

Resilience is a nuanced and complex umbrella concept which has no official definition nor is it owned by any specific research or science field. This section will briefly cover the history of 'resilience' as an academic concept and then explore why increasing community resilience is strived for in the disaster risk reduction (DRR) and climate change mitigation and adaptation fields. The section will also highlight different types of measurements and indicators of resilience, and outline some of the initiatives that have developed to build resilience. It will use previous community resilience literature to explore who and what has been missing in earlier resilience-building projects and will be the basis for comments later on in the thesis on possible future uses of community resilience planning within citizen science projects.

Resilience as a concept has stemmed from two distinct fields; ecological resilience and social resilience (Adger, 2000). First is the ecological strand, which emphasises disturbance events, system memory and feedback loops. From this school of thought, resilience is seen as the adaptive capacity of an ecologic system to withstand disruptive events. The second is the social strand, which emphasises agency and self-organisation, values and beliefs, and social networks (Walters, 2015). The concept of building resilience encompasses a wide range of different topics and fields including infrastructure resilience (Zebrowski and Sage, 2017), individual/psychological resilience (Shaffer & Coffino, 1996), resource management and land-use planning resilience (Holling, 1996; Saunders & Becker, 2015), organisational resilience (Lengnick-Hall et al., 2011), and community resilience (Paton et al., 2001). The concept of resilience is also commonly linked to emergency management, sustainable communities, and community planning (Schneider, 2002), the treatment of hazardous waste (Maco, 2018), sustainable development and poverty reduction (Godschalk, 2003), and environmental stewardship/management (Schneider, 2002; Godschalk, 2003).

2.3.1.1 Disaster resilience

The concept of developing resilience to hazard and disaster events became prominent in the literature around the 1980s and gained traction through the 1990s. Work on resilience and preparing for disasters was initially focused around geo-hazards such as earthquakes (Gavalya, 1987; Comfort, 1994), volcanoes (Paton & Johnston, 2001), and landslides (Guariguata, 1990), as well as meteorological hazards events such as tornadoes and hurricanes/typhoons/cyclones (Tobin, 1999; Herbert et al., 1999; Schoedinger et al., 2018). Much of this early work on resilience and hazards still focused on ecological disturbance post-disaster, rather than human resilience, however the concept

of resilience has broadened over the years to cover aspects such as societal adaptation to disaster. Sclosberg et al. (2017) for example, suggests that adaptation is often thought of in terms of disaster management and risk analysis. The work on resilience in the disaster research fields has also expanded over the last few decades to include preparation for, and response to, a wider range of hazard events such as pandemics (Crouse Quinn, 2008), snowstorms (Chan & Schofer, 2016), heatwaves (Hatvani-Kovacs et al., 2016), wildfire (Abrams et al., 2015), and tsunami (Seng, 2013).

Resilience is often discussed alongside the concept of 'vulnerability to disaster events' because of their interrelated nature (Manyena, 2006; Fordham, 1999). There are different ways of conceptualising resilience and disaster vulnerability. Oulahen et al. (2019) state that vulnerability can be thought of in four distinct ways; as a threshold, as an exposure to hazards, as a pre-existing condition, and as an outcome. They similarly break down the concept of resilience into three parts: as resistance, as recovery, and as creative transformation (Oulahen et al., 2019). The concepts of vulnerability and resilience are commonly associated with the hazard and disaster management fields, and it is here where a lot of the literature is centred. One important thing to note is that concepts such as 'vulnerability' and 'resilience' are not always applicable or transferable to other cultures due to them being predominantly Western constructs (Kelman, 2011). The lack of universal applicability of terms is useful to recognise when working with indigenous groups or other non-Western contexts.

In more recent years, research work on resilience and disasters has also broadened to include a deeper analysis of the role past and current social inequities play in the resilience of individuals, communities, and countries. This critical analysis focuses on issues such as socioeconomics, race, gender, and disability. Understanding the human/social aspect of disaster occurrences, rather than just focusing on the technical aspect of resilience, has become a prominent part of this resilience literature shift (Orencio & Fujii, 2013). Many authors argue that taking a more social lens on resilience leads to better outcomes as resilience is complex and is influenced by social, cultural, political, economic, physical, and ecological factors (Ensor, 2018; Tobin, 1999). Competing challenges to economic, sociocultural and environmental systems, including poverty, environmental degradation, decreasing job security, and changes to migration, are already eroding resilience in many areas and will continue to do so into this century as risks become more globally complex in nature (Cutter et al., 2013; Keys et al., 2019). This is exacerbated due to climate change (Leichenko, 2011). Therefore, building resilience at all levels is a key global development priority (Jones et al., 2018). Much of the knowledge generated in the last few decades of (published) resilience research is

relevant to the climate change field which was a central focus of this thesis. For example, the connections previously made between sustainable land-use planning and resilience to hazards, such as earthquakes (Saunders & Becker, 2015), could be expanded to discuss climate change adaptation and mitigation potential.

2.3.1.2 Climate change and its impacts

Before I discuss climate resilience, I will touch briefly on some of the impacts of climate change. Human induced climate change is expected to increase the occurrence of dangerous storms like cyclones / typhoons / hurricanes, and we are already seeing such storms intensifying at faster rates.

Warmer waters mean hurricanes are now losing only about half their strength within 24 hours of passing overland, compared to previously losing around 75% of the energy after making landfall (Li & Chakraborty, 2020). Storms are stronger for longer because of climate change. The 60 million people living along the Atlantic and Gulf Coast in the United States are being put at risk by the ability of big storms to travel 270 miles inland in a day. 2020 was the stormiest year on record in the Atlantic with 28 named storms, a dozen of which struck the US Coast (Li & Chakraborty, 2020). In November 2020, governments from Panama to Guatemala rushed to move people away from hillsides and bodies of water, fearing that Hurricane Iota would bring similar destruction as Hurricane Eta, which devastated central and southern Central America and southern Mexico a few weeks beforehand (RNZ, 2020). The significant impact of Hurricane Eta in a few days cost Honduras the equivalent of around 20% of its GDP (McKibben, 2020). More recently, the April 2024 flooding in Dubai, UAE, where a year's worth of rain fell in 24 hours, significantly impacted major infrastructure, including the international airport (Gilbert, 2024).

Over in the Pacific Ocean, Cyclone Winston hit Fiji in 2016 in what was then one of the most intense cyclones ever recorded in the southern hemisphere. The cyclone destroyed or damaged over 40,000 homes and significantly affected roughly 40% of Fiji's population. The total damage was estimated at \$1.4 billion and a state of emergency remained in place in Fiji for 60 days following the cyclone (Al Jazeera, 2020). With climate change, these events are going to get increasingly worse, and these small island states will continue to bear the brunt of the cost of response and recovery from these events (Al Jazeera, 2020). The year 2020 saw the world's largest wetlands catching fire in South America (Kottasová et al., 2020), as well as unprecedented bushfires in Australia. Many firefighters described the 2020 bushfires as something they had never experienced in 50-year firefighting

careers, leading many leaders within the firefighting community to call on the Australian government to implement tougher climate change actions (Mullins, 2020).

The increase in severe weather events has led to insurance premiums going up, house prices changing, food becoming less nutritious and more expensive, and heat waves that are killing more people (Fleming et al., 2018; NOAA, 2023). Additionally, there has been a sharp rise in climate migrants who are motivated (or forced) to move by climate related concerns. For example, South Asia could see a three-fold surge in internal migration due to the impacts of climate change; according to one report nearly 63 million people could be forced from their homes in this region by 2050 due to rising seas, flooding and drought, affecting homes, livelihoods and the ability to grow food (Rowling, 2020).

Another multi-agency report released in October 2020 titled “The state of the climate in Africa 2019” (WMO, 2020) has shown that food security and socio-economic development in Africa is again at risk after decades of improvement because of weather and climate issues, including increasing temperatures and sea levels, changing rainfall patterns, and more extreme weather events. Flow-on impacts include threats to human health and safety, food, and security, through increased pest damage, drought stress, and flood impacts resulting in reduced crop productivity. The report predicts that the main yield will reduce by up to 8% in East and Southern Africa (WMO, 2020). Thus, climate change acts as a threat multiplier, exacerbating existing vulnerabilities, increasing poverty and inequality, and putting stress on already highly vulnerable populations (Miller et al., 2020).

Climate change has had a prominent impact on indigenous societies. For example, cultural ceremonies are being disrupted by reduced fish abundance in North Western Washington due to climate change induced impacts causing a vanishing habitat and warming waters, and some local indigenous groups are being forced to buy and freeze fish for ceremonial purposes rather than catch it directly (Paukert et al., 2021; Morrison, 2020).

Disasters can be very traumatising, and climate-induced disasters are no exception (Fritze et al., 2008). Negative psychological response to disasters is seen across different individuals, communities and countries, though presenting in culturally different ways, and children are often psychologically impacted more severely than adults (Fritze et al., 2008). Psychosocial impacts of climate change are such that the Florida division of emergency management has hired a mental health coordinator for disaster recovery whose job is to work with state agencies, relief organizations, and private

counsellors, to coordinate services so that the state can respond to residents' needs during the recovery process (Madson, 2020). Climate change is also factoring into people's decisions about whether to have children or not, especially within rich Western nations. One study that surveyed 600 people in the US between the ages of 27 and 45 found that 96% of those surveyed were very or extremely concerned about the well-being of future children in a climate-changed world (Schneider-Mayerson & Leong, 2020). These impacts are but examples of the breadth of impacts that climate change will have. Given such wide-ranging impacts, it is important to consider what climate resilience might look like.

2.3.1.3 Climate resilience

As discussed in the Disaster Resilience section of this thesis, a strong history exists of adaptive capacity, resilience building, and hazard mitigation in the Disaster Risk Reduction (DRR) field (Paton & Johnston, 2006). There is an equally strong history of mitigation and adaptation framing in the newer, though incredibly fast growing, climate change research and practice field (IPCC, 2011; Metz et al., 2007; Parry et al., 2007; Adger et al., 2003; Pelling, 2010; Smit et al., 2000; Lindner et al., 2010; Smith et al., 2003; Smit & Wandel, 2006). As the research worlds are so closely connected, especially with climate change exacerbating long studied natural hazards, there has been an increasing convergence of the two fields over the last decade.

The term 'climate resilience' has gained traction in academic literature since the early 1990s (Adler et al., 2015). Terms like 'climate resilience' and 'climate-proofing' are increasing in frequency, and connections are being made about how communities can engage in resilience building activities for climate related shocks and stresses (Leichenko, 2011; O'Brien et al., 2008). However, these connections are still slow, especially in the research and planning spaces, for a variety of different reasons, including siloed funding, institutional research/topic preference, and the more politically challenging nature of climate change science. The response to climate change related hazard events, and the climate change related policy decisions, are still largely separate (Finkbeiner et al., 2018; Mal et al., 2018).

One of the main reasons for this continued disconnect is the separation of the two fields at the global governance/United Nations (UN) level. The UN Office for Disaster Risk Reduction (UNDRR)¹¹

¹¹ United Nations Office for Disaster Risk Reduction (UNDRR) formerly known as the United Nations International Strategy for Disaster Reduction (UNISDR) - <https://www.undrr.org/>

and the United Nations Framework Convention on Climate Change (UNFCCC)¹² are the two UN organisations that create the plans and roadmaps for increasing disaster risk reduction and decreasing climate change impacts respectively. This separation has led to policy development and planning covering similar issues being more disjointed than necessary. For example, there is weak crossover between disaster response agencies and climate change planning agencies (Serrao-Neumann et al., 2015; Seidler et al., 2018), despite the evidence that climate change will also increase vulnerability to non-climatic hazards as well (O'Brien et al., 2006).

Seidler et al. (2018) highlight the need for joining up climate change adaptation and DRR policy development. There have been multiple studies conducted on how resilience plans and climate change plans compare, including the synergies between them (Serrao-Neumann et al., 2015; Woodruff et al., 2022). Woodruff et al. (2022) suggest that DRR resilience plans and climate change adaptation plans are alternative and possibly complementary approaches to preparing for climate change. There are growing calls for including climate change more in all disaster related planning and management approaches. There are opportunities to do this in both climate change mitigation (reducing emissions) and adaptation (adapting to climate changes already set in motion) which will be explored in the following two sections.

2.3.1.4 Climate mitigation

Climate change mitigation, or greenhouse gas emission reductions (i.e., reducing the amount of greenhouse gases that are emitted into the atmosphere, or actively sequestering emissions from the atmosphere), is inherently linked to resilience in the DRR field through its ability to reduce the severity of future climate-related disaster events (Lindell, 2019). While this link is not commonly discussed in the literature, there is a small but growing call for climate change mitigation to be prioritised alongside more traditional disaster mitigation efforts, such as built environment resilience and increasing warning effectiveness for weather events.

At a global level, climate mitigation efforts are seen to be imperative to reducing greenhouse gas emissions. In a December 2020 speech, entitled “State of the planet”, the Secretary General of the United Nations, Antonio Guterres warns that, “our planet is broken” (Rowlatt, 2020), and that humanity is waging a suicidal war on nature. He demanded nations put a price on carbon, phase out fossil fuel finance and fossil fuel subsidies, shift the tax burden from income to carbon and from

¹² United Nations Framework Convention on Climate Change (UNFCCC) - <https://unfccc.int/>

taxpayers to polluters, to connect goals of carbon neutrality to all fiscal policies and decisions, and for countries with more resources to help those who are already facing the dire impacts of climate change around the world (Rowlatt, 2020). This is reiterated in documents like the IPCC report (Allen et al., 2018), which alongside climate projections, makes suggestions for mitigation efforts.

IPPC reporting also highlights the fact that the world needs to aim for temperature increases to remain under 1.5C to help prevent the worst climate change related impacts (Allen et al., 2018). Because of this, low carbon living, and policies and regulations that aid that transition, are now resilience enablers (Fazey et al., 2018) and the concept of community resilience needs to adjust with this change. Fazey et al. (2018) highlight that it is important that plans are nuanced in nature to make sure resilience isn't simply returning a community/region/ecosystem into a now unsustainable system. They outline 10 essentials for building community resilience in a 1.5C world: "enhance adaptability; take account of shocks and stresses; work horizontally across issues; work vertically across social scales; aggressively reduce carbon emissions; build narratives about climate change; engage directly with futures; focus on climate disadvantage; focus on processes and pathways; and encourage transformations for resilience" (Fazey et al., 2018, p. 30). They highlight how the traditional 'bouncing back' from disaster narrative within community resilience research could backfire as associated activities could be unsustainable within the context of a changing climate.

There are an increasing number of countries that have developed or updated their climate change plans with ambitions to incorporate stronger mitigation measures. Within those plans, many nations are indicating they will make stronger commitments under the Paris Agreement than initially tabled. On the contrary, other countries are falling behind, including Brazil, the United States, Canada and the United Kingdom (Climate Vulnerable Forum, 2020). While some countries are failing to act at a national level, action at a state or regional level is sometimes a different story. For example, every single state and territory in Australia has established a net zero by 2050 target, even though the federal leadership is failing on any ambitious climate action (Joshi, 2020). The Australian federal government is now more exposed for their inaction, especially with research from consultancy firm Deloitte suggesting that by 2070 a staggering \$680 billion and over 250,000 jobs would be added to Australia's economy from choosing a new growth pathway rather than staying with the status quo (Deloitte, 2020). Such forecasts indicate that Australia has the choice to create a new climate for growth. The Deloitte study shows three visions for an Australian economy: inaction, mis-action, or preventing climate change, and highlights that the success of the economy will be measured against climate change actions (Deloitte, 2020).

Resilient societies could look very different to what we have now, as communities adapt and change to respond to the current and ongoing challenges posed by the climate crisis. The Australian example above highlights that in Western developed countries, we need to, and indeed can, change every aspect of how our societies function. For example, jobs that are based in an office five days a week, eight plus hours a day, are already being contested due to their impacts on the environment and human health (Graeber, 2020). Graeber (2020) suggests that much of this office-based work is entirely pointless and perpetuates dangerous systems, such as extreme consumerism exacerbating the climate-harming pollutants that are destroying the planet. Consequently, there are opportunities to apply climate mitigation solutions across the broader functions of society, from employment arrangements (as an example), through to making use of policy mechanisms.

However, it is useful to apply some caution when considering societal and policy mechanisms. It is noted that there are wide ranging policy nuances to do with a transition to a low emissions society. Not all solutions are created equal, and some solutions that look like they would be effective on the surface may have wide ranging unintentional negative consequences. One such example can be seen in Norway, where Europe's largest land-based wind farm was constructed in a place that violated Sámi reindeer herders ancestral lands (McKeown-Gilmore, 2024). On the surface of the issue, more wind power can be seen as a good thing for increasing the amount of renewable energy available, however, in this instance it came at a high cost for the indigenous Sámi people. In 2021, the Supreme Court of Norway ruled that the Sámi have a right to enjoy their own culture under Article 27 of the United Nations' International Covenant on Civil and Political Rights (ICCPR) and that the wind farm's construction violated their indigenous rights (McKeown-Gilmore, 2024). There is tension around the transition to renewable energy technologies, including how it should be done and by whom, and what our global energy sector should look like in the future. Proposed solutions may add to the problem more than they solve it, or create other unforeseen problems, as the transition is not as clear cut as simply switching technologies. Caution is needed to ensure any new technological solutions aren't going to create other problems (Santa Barbara, 2020), especially among communities already impacted by centuries of environmentally-exacerbated stigma and racism.

2.3.1.5 Climate adaptation

Climate adaptation (i.e., adapting to climate changes already set in motion) is the second opportunity for action in relation to climate change. Links between DRR and climate change adaptation have been evident to researchers and policy makers for decades, even if they haven't

always been joined in practice (Mercer, 2010; Chmutina et al., 2017). The concept of adaptation has been historically centred within resilience literature using the term ‘adaptive capacity’ (Cinner et al., 2018). ‘Adaptation’ became a key term in reference to the climate crisis in the early 1990s. The use of adaptation as a method of reducing climate impacts is recognition that there will be warming and impacts already locked into the system from the last century of anthropogenic climate change (Allen et al., 2018). Societies and ecosystems will be faced with climate-related or exacerbated hazard events, many on scales of severity that haven’t been previously dealt with (Allen et al., 2018). Use of adaptation-based approaches allows researchers and planners to consider the already locked-in changes in climate, such as sea level rise projections for 2050 that will occur even if emission rates were reduced to zero today (Church et al., 2013). Adaptation can include a wide variety of technical interventions that increase the adaptive capacity of an area, including constructing sea wall defences, raising houses on to stilts, and changing the types of crops grown.

However, adaptation should not be reliant only on technical solutions to solve climate change problems. Instead adaptation should address the underlying social, political, environmental, and economic drivers of the issues (O’Brien & Selboe, 2015). Adaptation approaches that increase positive social outcomes, such as poverty alleviation or social cohesion, as well as increasing community resilience to disaster impacts, are known as co-benefit approaches. Nature-based solutions are growing in popularity as adaptation approaches that provide co-benefits for the environment as well as disaster resilience, which can include increasing or restoring wetlands, increasing or reverting back to previous river channel size to account for flooding, and rewilding or replanting natural areas with indigenous plant species. Local action is a key focus of climate change adaptation, and it is seen by some academics as planners “operationalizing concepts of climate resilience and vulnerability” (Tyler & Moench, 2012, p. 311).

Adaptation in an indigenous context looks different from Western constructs. In the first instance the term ‘climate change’ doesn’t account for indigenous relationships with the environment or the significant intergenerational cultural knowledge, customs and practices related to changing climate (Baird, 2008). Indigenous people have also suffered through Western practices, for example, by being stripped of their control of the relationship they have with the land and bodies of water, thereby limiting traditional adaptive practices. Consequently, adaptation needs to be considered in the context of each indigenous grouping. First, it is important for such peoples to be able to tell their own stories of climate change, rather than have them reported by others (Pasisi, 2020). Second, adaptation language, such as ‘managed retreat’, also needs to be reframed, so that people's

self-determination is respected. Terms like ‘forced migration’ and ‘community relocation’ make assumptions about who is deciding what is an appropriate adaptation response. Also, it is important to note that indigenous communities are often missing (or deliberately excluded) during managed retreat and adaptation discussions (Maldonado et al., 2020). The lingering effects of colonisation are also making countries less financially and infrastructurally resilient to changes needed to fight the climate crisis, with this history of colonisation increasing their vulnerability (Bordner & Ferguson, 2020).

These confounding effects, and other changes to local traditions, have forced many indigenous groups to create localised climate strategies to protect their lands and cultures (Morrison, 2020). Within Aotearoa New Zealand, solutions to both climate mitigation and adaptation need to be developed with iwi, hapū, and whānau at the decision-making table, and for those solutions to be created with a co-governance approach (Awatere, 2022). This call for engagement has also been seen from prominent climate change economic think tank Motu¹³, who have suggested that “additional support, access to expertise, effective communication and more finely tuned policy could increase the uptake of afforestation opportunities and better enable Māori land decision makers to realize their aspirations for the land in the future” (Pohatu et al., 2020, p. 31). Some iwi and hapū groups have aspirations for progressing native forest blocks for their whenua that will gain income through the emissions trading scheme whilst allowing them to be kaitiaki of those areas (Pohatu et al., 2020).

Now I have considered community, disaster and climate resilience, and the mitigation and adaptation actions that might apply to climate resilience, I now look to the literature that relates to both building and measuring community resilience.

2.3.1.6 Building and measuring community resilience

Before delving into the complex nuances of building and measuring community resilience, it is first prudent to define what ‘community’ means in the context of this research. Walters (2015) noted that trying to define ‘community’ when approaching resilience can be complicated and can influence the outcome of the research. The explanation of community from Feng et al. (2018) has been chosen as the working definition for the remainder of this PhD thesis.

¹³ <https://www.motu.nz/>

“Community” can be defined as a group of people linked through their having some common characteristics or shared interests, such as geography, interests, occupation and culture (Feng et al., 2018, p. 44).

Different definitions of the concept of community have been shown to influence results from community resilience studies. Walters (2015) suggests that the ‘community’ aspect of community resilience literature has been underdeveloped, particularly within urban contexts. It is not possible to generalise populations by geographic area, because many people may not relate to, or interact with, other people in their immediate area. Instead, people may consider their community to be people with similar interests, culture, or area of work (Paton & McClure, 2013).

No singular definition exists for community resilience (Paton & Johnston, 2017; Ainuddin & Routray, 2012; Meng et al., 2018; Deeming et al., 2019; Walters, 2015). Magis (2010, p. 1) defines community resilience as “the existence, development, and engagement of community resources by community members to thrive in an environment characterized by change, uncertainty, unpredictability, and surprise.” The definition of community resilience tends to be moulded depending on the context it is used in. For example, promoting community resilience is central to contemporary emergency management (Paton et al., 2001) and the Aotearoa New Zealand-based Wellington Region Emergency Management Office (WREMO) use the following definition of community resilience in their Community Resilience Strategy as, “the capability to anticipate risk, limit impact, and bounce back rapidly through survival, adaptability, evolution, and growth in the face of turbulent change” (WREMO, 2012, p. 8). The definition focuses on a ‘turbulent change’ aspect which is in line with the disaster preparedness angle of their work.

The last decades have seen the development of a range of different ways to measure resilience. These include resilience indices, indicators, metrics, characteristic enablers, and identifying factors that foster resilience (O’Neal, 1999; Orencio & Fujii, 2013; Leal Filho et al., 2018; Hung et al., 2019; Cutter et al., 2008; Burton, 2015; Lam et al., 2018; Cutter et al., 2014; Alam et al., 2018; Cutter, 2008; Brown et al., 2018). There are at least five different categories that resilience concepts or initiatives fall into, including social, economic, institutional, physical, and natural (Ostadtaghizadeh et al., 2015). Within these categories there are many different ways that community resilience can be measured. Baseline measurements are sought after by local and national governments as it means that progress (or lack thereof) can be shown from resilience building initiatives that are implemented in specific communities (Cutter et al., 2008).

A large amount of work on resilience indicators and measurement has been led by Susan Cutter and team (Cutter et al., 2014; Cutter et al., 2008; Cutter, 2008). Other resilience measurement work includes a cross-country comparison by Leal Filho et al. (2018) who aimed to compare vulnerability and adaptive capacity of coastal areas. They compared different adaptation strategies and explored which areas were more vulnerable as a result. Orenco and Fujii (2013) created an index for disaster resilience focusing on coastal communities at a local level, and focused on environmental and resource management, sustainable livelihood, social protection, and planning regimes. While much of the resilient indicator work has been focussed on developing and implementing national or regional indicators, local contexts have been shown to directly influence resilience. Tyler and Moench (2012) argue for city resilience planners to use resilience enablers and measurements that are context-specific and work for their particular area. Kwok et al. (2016, 2018) found a similar need with their research on local communities in Aotearoa New Zealand and the United States of America, and advocate that resilience indicators should be developed from the ground-up, with a community.

One way of conceptualising resilience was provided by Paton (2006) through his resilience diagram below (Figure 3). This model shows the interactions and interrelated nature of resilient characteristics across three different categories (personal, community, and institutional environment). The relevant characteristics are wide-ranging but include empowerment and trust, as well as procedural and distributive justice – topics which have already been identified as important for this thesis. It also shows characteristics that are relevant to a particular category, such as self-efficacy in the personal resilience category, and collective efficacy in the community category.

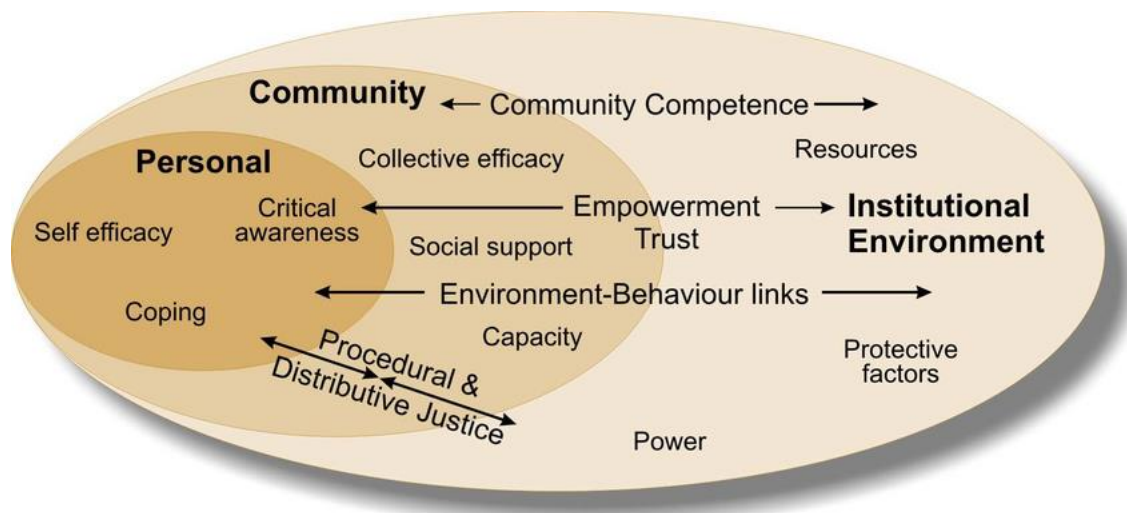


Figure 3 – Multi-level resilience model (Paton, 2006, p. 311)

Looking back at the earlier discussion on resilience versus vulnerability, it is important to note that groups who are highly vulnerable do not necessarily lack resilience. Cutter (2016) provides the example of the Vietnamese community in New Orleans East in the aftermath of Hurricane Katrina, based off the research of Leong et al. (2007). The Vietnamese community was one of the first communities to return to New Orleans post-Hurricane Katrina and rebuild, however, they were classed as a vulnerable community with high rates of immigrants and non-English speaking and low incomes. The community showed high levels of social capital, an indicator and enabler of resilience, with their connections through self-reliance as a community, religious networks, and shared place attachment (Leong et al., 2007). Consequently, given the complexities of resilience, and its interactive nature, some academics are asking for community resilience to be thought of as an emergent property of dynamic social-ecological systems, more than simply the sum of a range of capabilities or characteristics (Faulkner et al., 2018).

The increased focus on resilience globally has come about because of its perceived benefits. According to Becker et al. (2011, p. 2) community resilience is important because it has been shown to:

decrease recovery time post event; increase community self-reliance, reduce demands on limited emergency response resources during response and recovery, and increases the availability of community members to assist recovery; result in a better community response to warnings; lower casualty numbers and associated costs; reduce built environment and

property damage; increase the chances of businesses surviving after a disaster; reduce psychosocial problems, such as trauma and stress; and reduce the overall economic costs of a natural disaster.

Groups and organisations have developed initiatives to build resilience to a wide range of hazards, including volcanoes (Paton et al., 2001; Tobin & Whiteford, 2002), tsunami (Park et al., 2018), drought (Mihunov et al., 2018), coastal hazards (Hung et al., 2019; Hummel et al., 2018), and river basin flood management (Gustafson et al., 2018; Kim et al., 2018). Within the different hazard-focused initiatives, projects themselves have focused on varied aspects of resilience at the core of their development. For example, projects centred on social capital and climate justice when investigating flood resilience (Kin et al., 2018) and focussed on values-based and placed-based work to avoid potential inequalities from adaptation strategies and climate impacts (Graham et al., 2018). Differing methods are also employed, such as simulating alternative future scenarios (Mills et al., 2018) and using social media to build community disaster resilience (Dufty, 2012), as well as storytelling as method for enabling resilience, termed 'bibliotherapy' (Theron et al., 2017). Many resilience initiatives now combine a bottom-up and top-down approach. This is usually in the form of a mix between science research and community-led approaches (Birchall & Bonnett, 2019; Gustafson et al., 2018) or combining policy and community-based planning (Hung et al., 2019), or a combination of the two.

Education is a big component of developing community resilience. An example is the National Ocean and Atmospheric Administration's (NOAA) Environmental Literacy Program, USA (Schoedinger et al., 2018) which aims to teach students and their wider community about how they can become more resilient to extreme weather events and other environmental hazards, as well as giving them a way to become involved in resilience-building activities. There are also programmes which teach communities how to map their own hazards, localising disaster education in the process (Cox & Hamlen, 2015; Brand et al., 2019). The students in the Map Your Hazards programme (Brand et al., 2019) are taught to identify hazards, collect survey data from their social networks and then suggest recommendations to local stakeholders for creating more resilient communities. Informal Disaster Education, based on the work of Feng et al. (2018), highlights how the promotion of a more informal education approach can also be used to increase a community's resilience, as well as increase personal resilience in the participants. Informal education can be described as unstructured, doesn't come with certification for completion, and often happens during daily activities that can be related to home or work life, including community groups, recreation or religious groups and other social

networks (Feng et al., 2018). For example, a Facebook group moderator sharing disaster response information with their online community after a hazard event is a type of informal education (Irons & Paton, 2017).

Citizen science can be a type of informal education within community settings used to educate around local hazard conditions and disaster preparedness (Sittenfeld et al., 2018; Becker et al., 2011). The crossover between informal education and citizen science also provides context for the role of the researcher (or project lead) in developing an educational aspect to a project. I will elaborate more on the role of citizen science later in Chapter 2.

2.3.1.7 Equity-focused community resilience

In this century, with a rapidly changing climate and immense pressure already being forced on our other planetary boundaries (Richardson et al., 2023), resilience that aims at bouncing back is no longer an option. Adaptation and resilience planning now needs to be transformative in its approaches (Schlosberg et al., 2017). We need to remain critical in our view of resilience and vulnerability for many reasons. Some systems that are resilient are also inequitable or otherwise undesirable (Mochizuki et al., 2018), and as communities are not homogenous, resilience can look different within diverse communities (Maguire & Hagan, 2007). Cutter (2016) suggests that principles of access to resources, fairness, and equity need to be included when creating resilience so as not to privilege one part of a community over another.

Focusing on relationships, intersectionality, inequities, and power is important when analysing how to build resilience (Fazey, 2018). Resilience research is used to study populations who are considered to be more vulnerable due to societal barriers and inequities (Theron, 2020), and who are seen as having reduced adaptive capacity (Joerin et al., 2012). These include displaced people (Crnčević & Orlović Lovren, 2018), structurally oppressed communities (Theron, 2020), street children (Malindi, 2014), transient populations (Wilson & Simmons, 2019), informal settlements (Harte et al., 2009), and some groups of women who have strict societal controls on them and of whom many are not allowed to work due to cultural and religious reasons (Kamal et al., 2018). The vulnerability of women is underpinned by the cultural, economic or societal contexts and processes in which they live. For example, women are not inherently more vulnerable than men, however, controls or restrictions placed upon them, often developed by men, can cause this increased vulnerability within patriarchal systems. It is these root causes of vulnerability that need to be addressed within resilience planning, otherwise the plans and policies end up entrenching further inequity. Jordan

(2019) provides an example of intersecting gender and resilience planning within Bangladesh, where they state that a failure to deal with the underlying causes of vulnerability to climate stress can reinforce gender inequalities. The current use of resilience as a concept does not adequately provide understanding of how socio-cultural norms and practices are embedded in intersecting vulnerabilities. Reducing these intersecting vulnerabilities requires promotion of democracy, equality, and social equity in formation of disaster and climate policies (Huynh & Stringer, 2018), a factor that now needs to be central to resilience planning initiatives.

Aldrich and Meyer (2015) in their work on urban resilience politics call for resilience planning to have a more critical approach, where projects do not just focus on the resilience for whom and what, but also dig into the where, when and why of resilience planning. Using case studies of Brisbane (Australia) and Dhaka (Bangladesh), Walters (2015) compared the local community and government response to flood events. Even though there were strong local communities within Dhaka, this was not necessarily a determinant of higher resilience due to the extremely high levels of poverty. Indicators could not be looked at in isolation when comparing two very different cities. Resilience building is a multi-layered concept, and what works for one group of people does not necessarily work for another. Furthermore, communities cannot be treated as stand-alone phenomena as they are tightly linked with their wider social, economic, and governance context (Cutter, 2016).

In response to this quickly evolving climate crisis, some authors are connecting the concepts of resilience and resistance. For example, Nelson (2014, p. 1), researched how the current dominant views of adaptation and resilience are based on “integrating flows of social, natural and monetary ‘capital’ in a continuous framework of financial control” and proposes that resilience theory should instead be used as a critical tool to inform radical ecological politics. Connected in with capitalist extractive economies and current unsurmountable environmental degradation, Armitage and Johnson (2006) considered the connection between resilience and the disruptions to socio-ecological systems caused by globalisation, and how the concept of resilience is an objective or goal to help manage the rapid changes globalisation is creating. The nature of the shift needed in resilience planning processes is summed up well by Norris et al. (2008) who state (p. 127):

To build collective resilience, communities must reduce risk and resource inequities, engage local people in mitigation, create organisational linkages, boost and protect social supports, and plan for not having a plan, which requires flexibility, decision-making skills and trusted sources of information that function in the face of unknowns.

Schlosberg (2017) provides an example from Australia where their research explored how local governments, environmental groups, and local residents engaged in adaptation policy development and adaptation planning. They found that the inclusion of social and climate justice within adaptation planning was underexplored and that there was a discursive disconnect between “governmental focus on a risk or resilience-based approach and a community concern with the vulnerability of basic needs and capabilities of everyday life” (Schlosberg, 2017, p. 413). But they also found that “deliberative engagement in adaptation planning can both address issues of justice and represent a transformative practice” (Schlosberg, 2017, p. 413). They cite foundation work by Paavola and Adger (2006) which situates justice as a central concern to adaptation through the concepts of social vulnerability, participation, and fairness. There are many other examples globally of projects that connect social capital and climate justice as a way to enhance community resilience (Kim et al., 2018), that insert local values and monitor fairness as an outcome (Graham, 2018), and that aim for producing co-benefits to the communities through resilience planning (Helgeson, 2018).

Research in the resilience space has often focussed on more tangible aspects such as awareness of risk and actions that can be taken to increase resilience; however less reflexivity and effort has gone into understanding the role of social contexts, including justice and power issues. This thesis will explore these aspects in Part Two, in the context of the Zero Carbon Act campaign. Next, however, I will outline the key concepts related to Citizen Science, as highlighted from the literature review.

2.3.2 Citizen science

Citizen science is a term which covers a wide range of different projects where volunteers participate in scientific discovery (Bonney et al., 2009b). There is a spectrum of citizen involvement within these projects, from some being led by professional researchers who encourage citizens to take part, through to community-led projects which may not include scientists. The projects can be complex and have multiple purposes, and research shows that they can be used to both gather data and educate the public on disasters, climate change and risk reduction, with the aim of mitigating hazards and increasing community resilience. The following sections aim to provide an overview of what has shaped citizen science into the concept it is today. I will then highlight examples of what goes into the creation, management, and evaluation of a citizen science project.

2.3.2.1 Citizen science overview

Citizen science is a broad term which encompasses a variety of different types of projects where the general public work with researchers to undertake scientific research. Citizen science has its roots in

the physical and natural sciences, especially biology and environmental science (Bonney et al., 2009b) but has expanded to many others, including natural hazard and climate change research (Marchezini et al., 2018). Today there are millions of volunteers engaged in citizen science projects around the world in a variety of different fields. They are responsible for collecting, categorising, transcribing, and/or analysing data. These projects span more traditional science topics such as conservation biology, archaeology, astronomy, ornithology, and population ecology (Silvertown, 2009; Haklay, 2014), as well as more recent additions such as ecological restoration, water monitoring, conservation, meteorology, public health, telecommunications, disaster response, and climate change (Haklay, 2014; Silvertown, 2009; Bowser & Shanley, 2013; Bonney et al., 2014). Some projects involve crowdsourcing data on rare events such as earthquakes and violent space weather (Tapia et al., 2014), while others include specific projects such as species monitoring, star observations, storm identification, and tracking illegal deforestation (Bonney et al., 2014; Haklay, 2014). There are multiple names for ‘citizen science’, including community science, participatory biodiversity assessment, community-based monitoring, and volunteer biological monitoring (Shirk et al., 2012). These names represent the specificity of research domains and highlight the prevalence of citizen science in the fields of environmental monitoring and biological sciences.

There is a basic agreement amongst the literature that the term “citizen scientist” refers to people who participate in a citizen science project and is synonymous with “volunteer,” “participant,” and “user” (Straub, 2016). Most studies agree that these citizen scientists volunteer their time, usually unpaid, and collect or analyse data in some way (Tweddle et al., 2012; Peters, 2016; Straub, 2016; Silvertown, 2009; Haklay, 2014). The amount of involvement the citizen scientist has in the development of the project, and the processing or analysing of the data collected, depends on the type of project, including its purpose. Meanwhile, the motivations, design, and outputs of citizen science projects vary widely. Some projects are highly participatory, where the citizens are involved in the project design, data collection, and analysis. In this way, the projects can be more labour, time, and resource intensive. However, other projects are designed and coordinated solely by the scientist and the citizens only contribute limited amounts of their time and effort. All types of citizen science can be effective for producing new knowledge and creating scientific outputs (Bonney et al., 2009a; Shirk et al., 2012; Haklay, 2013).

2.3.2.2 History of Citizen Science

There are many early examples of citizens being involved in ‘scientific’ research. Amateur scientists have been around for centuries, and in fact many of the now famous early ‘scientists’, including

Charles Darwin and Benjamin Franklin, earned their living in other professions (Bonney et al., 2009b; Silvertown, 2009; Eitzel et al., 2017).

Public participation in scientific research is not new. Lighthouse keepers began collecting data about bird strikes as long ago as 1880; the National Weather Service Cooperative Observer Program began in 1890; and the National Audubon Society started its annual Christmas Bird Count in 1900 (Bonney et al., 2009b, p. 978).

Silvertown (2009) highlights that scientific research as a paid profession is a relatively recent concept, only really beginning in the late 19th century. He also states that citizen scientists have remained in many fields, especially those where observational skills can outweigh the importance of expensive equipment. Bonney et al. (2014) notes that members of the public have collected, transcribed, or processed data that has shaped much of our current understanding of our natural world. A good example of this is described by Peters (2016) who stated that data has been collected for centuries in Finland by amateur ornithologists, and that these types of long-term observations are valuable for identifying trends or patterns which are informing studies on both evolution and climate change impacts.

The following quote from Eitzel et al. (2017) succinctly sums up the progression of early citizen participation in science fields to the modern understanding of citizen science:

‘Citizen scientist’ (meaning scientist independent of institutions) was used at least as early as 1912 (Scott 1912). ‘Participatory Action Research’ (PAR), also termed ‘Community Action Research’ (CAR), became popular during the social movements in the 1960s and 1970s, especially in Latin America (McTaggart 1991, Torres 1992, Kindon et al. 2008). ‘Citizen science’ as a democratic concept was used in the 1990s (Solomon 1993; Irwin 1995), around the same time that Bonney first used ‘citizen science’ to describe his long-running participatory data collection projects (1996). ‘Crowdsourcing,’ as a term to describe an open call to a wide group to aid in some kind of labor, originated in WIRED magazine in a 2006 article; even in this first use, the term included examples of crowdsourced science and research (Howe 2006) (Eitzel et al., 2017, p. 6).

The following section expands on the Irwin and Bonney definitions of what is now considered to be modern citizen science. These two strands were developed independently in the mid-1990's and are explained below.

Alan Irwin - Scientists as active citizens for policy change

Irwin (1995) published a book titled 'Citizen Science: A study of people, expertise and sustainable development'. The book focused on developing 'scientific citizenship' through democratic citizen science. The aim was to emphasise the responsibility of science to society and to involve the public in issues related to risk and environmental threat (Eitzel et al., 2017; Bonney et al., 2016; Riesch & Potter, 2014). One research thread that emerged from this definition was the concept of 'scientists as citizens' and what that meant for their role in shaping policies and social change. Stilgoe (2009, p. 13) states that over the years scientists have had to redefine the idea of scientific responsibility, especially in relation to chemical, biological, and nuclear weapons.

As science grew in power, scientists accepted responsibilities far beyond their own laboratory walls...Their role and their interests have changed as the issues that animate civil society have changed. One of Albert Einstein's last acts as a scientist and citizen was to collaborate with philosopher Bertrand Russell on a manifesto highlighting the new dangers of nuclear weapons and advocating peaceful conflict resolution (Stilgoe, 2009, p. 12).

He argues that scientists should not have to give up their careers when they feel they need to bring moral issues into their work. An example of this was the Nobel Prize awarded to Rotblat in 1995, which was won for his work on nuclear disarmament rather than physics, though he was an eminent physicist (Stilgoe, 2009).

Rick Bonney - Citizens as active scientists

Also in 1995, the staff at the Cornell Lab of Ornithology used citizen science to describe their growing number of research projects which included large numbers of participants collecting data about birds (Bonney, 1996; Bonney et al., 2016). They described citizen science as "public participation in scientific research, in particular, with members of the public partnering with professional scientists to collectively gather, submit, or analyze large quantities of data" (Bonney et al., 2016, p. 3). These types of projects were born from the long history of participants gathering data on flora and fauna across the US and the UK, contributing to what is known in biology and

ecological research (Bonney et al., 2016, p. 3). The definition given to citizen science through the work of Bonney and others from the Cornell Lab of Ornithology has now come to dominate the citizen science sphere.

The term 'citizen science' was added to the Oxford English Dictionary in 2014 as "Scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions" (OED 2016a, from Eitzel et al., 2017, p. 5-6).

The literature review will have a specific focus on projects where participants engage in scientific research with academic or industry researchers, as is the focus of the focus on the Bonney et al. (2014) definition. However, there are many ways in which the Irwin (1995) definition is now increasingly included in this wider modern citizen science definition. For example, Ceccaroni et al. (2017) focus on the intersect between these two types of citizen science definitions. They look to define citizen science "in relation to civic education as work undertaken with citizen communities to advance science, foster a broad scientific mentality, and/or encourage democratic engagement, which helps society address complex modern problems" (Eitzel et al., 2017, p. 5-6). The following sections of this literature review will focus more on the convergence of these two definitions.

2.3.2.3 Defining a Citizen Scientist

There are many different variations of the definition of 'citizen scientist' and the following section aims to outline the most common uses of the term. Following on from the earlier section on the differences between the definitions of 'citizen science', there can be two types of 'citizen scientists' which match these distinct concepts. Haklay (2014, p. 3) provides descriptions for each of the two types of citizen scientist:

- (a) a scientist whose work is characterized by a sense of responsibility to serve the best interests of the wider community (now rare);
- (b) a member of the general public who engages in scientific work, often in collaboration with or under the direction of professional scientists and scientific institutions; an amateur scientist.

To keep the scope of this literature review smaller, the following section will continue to focus on the 'participatory' branch of the citizen science sphere, as described in (b) above. There is a basic agreement amongst the literature that the term 'citizen scientist' refers to 'people who have contributed to a citizen science project and is synonymous with "participant," "volunteer," and "user"' (Straub, 2016, p. 10). Most studies agree that the citizen scientists volunteer their time (are usually unpaid) and collect data in some way (Silvertown, 2009; Straub, 2016; Tweddle et al., 2012; Peters, 2016; Haklay, 2014). How much involvement the citizen scientist has in the development of the project and the processing or analysing of the data collected depends on the type of project.

Some researchers include crowdsourcing data as part of the citizen scientist definition, others exclude it. Tweddle et al (2012, p. 1) use the term 'citizen scientist' for those participating in a wide range of projects, including "crowd sourcing, long-term monitoring schemes and environmental surveys". This is reinforced in a quote by Soleri et al. (2016, p. 1) when referencing the work of Collman (2014) and Shirk et al. (2012):

We also are cognizant that "participation" can be interpreted as engagement in research agendas established solely by scientists, but we use it here to represent engagement in all possible forms of partnerships to advance scientific understanding. Those partnerships can range from fairly conventional, scientist-driven research projects that have been extended to encourage community engagement, to crowdsourcing initiatives that depend on wide networks of members to collect data, to "co-created" projects that are often community-driven and formulated to support communities' own research needs.

One thing to keep in mind is that the interpretation of the term 'citizen' is becoming increasingly divisive with current global issues, for example, there are questions about whether certain groups like refugees can come under the definition of 'citizen'. The term citizen can range from "membership in a group by virtue of participation in its social body, to strict legal interpretations associated with specific territories" (Soleri et al., 2016, p. 1). It is the latter definition that can throw up complexities when dealing with diverse communities, like refugees (Irwin 1995; Riesch & Potter 2014). Legal interpretation can be restrictive of who is considered a 'citizen' in that country and can create power dynamic and exclusion issues. Thus, Soleri et al., (2016, p. 1) point out that an "emphasis on the term "citizen" may be counterproductive for both historical and contemporary

reasons when trying to make science relevant and useful to more people”. Another interesting point was highlighted by Peters (2016, p. 8) who acknowledges that ‘citizen scientists’ themselves may not identify with that term or even register that the work they are doing is in fact ‘science’. They may choose their own term such as ‘birdwatcher’ or ‘volunteer weather observer’ (Peters, 2016, p. 8).

2.3.2.4 Fields of Citizen Science

As mentioned previously, the origins of citizen science tended to be in the physical and natural sciences, especially biology and environmental science (Tweddle, 2012). For example, the British Trust for Ornithology was founded in the United Kingdom in 1932 to help increase science knowledge and nature conservation through the use of volunteer birdwatchers (Silvertown, 2009).

Today there are millions of volunteers engaged in citizen science projects around the world in a wide variety of different fields and they are responsible for collecting, categorising, transcribing, or analysing data. The projects span the more traditional topics such as invasive species, conservation biology, archaeology, astronomy, ornithology, and population ecology (Silvertown, 2009; Haklay, 2014) through to more recent additions such as ecological restoration, water monitoring, conservation, meteorology, public health, telecommunications, disaster response, and climate change (Haklay, 2014; Silvertown, 2009; Bowser & Shanley, 2013; Bonney et al., 2014). Within these different fields, the projects involved cover a breadth of topics “from microbiomes to native bees to water quality to galaxies” (Bonney et al., 2014, p. 1436).

2.3.2.5 Citizen Science Organisations

As with the rise in citizen science fields, there has also been a rise in the development of citizen science organisations internationally, including various citizen science associations, research centres and the well-established journal, ‘Citizen Science: Theory and Practice’, which are all dedicated to the promotion of citizen participation and engagement in science. The American Citizen Science Association (CSA) is an organisation of professionals who create, manage and research citizen science projects. It held its first-ever conference in San Jose, California, in February 2015. The conference attracted more than 600 attendees from 25 countries. The CSA was set up to help promote organisation, best practice and innovation in the area of citizen science, including issues of ethics, evaluation, methods, and data quality (Bonney et al., 2014, p. 1437). There are also many other citizen science associations around the world. For example, in 2016 there were two other international citizen science meetings run by the European Citizen Science Association (ECSA) and the Australian Citizen Science Association (ACSA) (Bonney et al., 2016, p. 2-3). Additionally, there

are also research institutes that currently prioritise citizen science within their work programmes including the Cornell Lab of Ornithology (Bonney et al., 2009b, p. 977).

Through the work of these citizen science organisations, guidelines and codes of conduct have been established to promote the need for effective, engaging and ethically sound citizen science projects. Some of these resources have been designed by researchers to allow anyone conducting a citizen science project to add them into their project's toolbox, whereas others are custom made for a particular project during the design phase, either by the researchers or participants involved, or a co-creation by both (Bonney et al., 2016; Bowser & Shanley, 2013; Silvertown, 2009). One of the more well-known guidelines for citizen science was produced by the Scottish Environment Protection Agency. Titled 'When and how to use citizen science to monitor biodiversity and the environment', the guidelines were produced in 2014 and form a shortened and adapted version of: 'A strategic framework to support the implementation of citizen science for environmental monitoring' (Pocock et al., 2014; Peters, 2016, p. 31). The European Citizen Science Association developed 10 guiding principles for best practice within citizen science projects¹⁴ which are a great initial starting point for researchers wanting to start a project. Each of these guiding documents and approaches are examples of outputs from the decades of work which has shaped the citizen science field. They both shape the internal culture of the citizen science field and provide practical guideposts for new and current academics working in this space.

2.3.2.6 Benefits of Citizen Science

The following sections will focus on how citizen science is beneficial due to its ability to engage non-professional scientists in various types of scientific investigation, and also for its ability to gather large amounts of data that would not be possible without the free labour given by volunteers (Bonney et al. 2009a; Dickinson and Bonney 2012; Becker-Klein et al., 2016; Bowser & Shanley, 2013). Other benefits include aspects like citizen education and the use of science to create positive change.

2.3.2.6.1 Gathering large data sets

Citizen science can be used to gather large samples of data using the help of the general public. Many scientists are primarily interested in the scientific outputs of projects, and citizens can be seen

¹⁴ <https://www.ecsa.ngo/2016/05/17/10-principles-of-citizen-science/>

as a way to increase the capacity of the research team and to gather large data sets or data from a wider variety of places (Riesch & Potter, 2014; Silvertown, 2009; Tweddle et al., 2012; Bonney et al., 2016; Bonney et al., 2009b). A study by Theobald et al. (2015) investigated these types of projects and found that 388 unique biodiversity-based projects had an estimated 1.36-2.28 million volunteers working on them. These projects have led to an estimated 446 scientific publications, and between UA\$667 million and US \$2.5 billion in in-kind contributions (Bonney et al., 2016, p. 4-5).

2.3.2.6.2 Citizen education

Citizen science can allow members of the public to step away from just an observer/recipient role, into being more of an active participant in scientific research (Orchiston et al., 2016). Citizen science can play an important role in giving context and support to informal education and has the potential to significantly improve scientific literacy. Silvertown (2009) states participation helps the public to understand and appreciate science. It can also help to create diversity within formal science-based fields and lead to more diverse communities solving problems using participation in science (Eitzel et al., 2017; Soleri et al., 2016; Bonney et al., 2009b). Some citizen science projects see public education or awareness building as a “fortunate side-product” of including citizens in their work, but it might not be the intended goal or main focus of the research design (Riesch & Potter, 2014, p. 108).

Depending on the purpose and design of the project, citizen science can thus be a ‘win-win situation’ for both researchers looking to get assistance from the public, and the citizens who are able to contribute to, and learn from, genuine scientific study (Riesch & Potter 2014, p. 107). However, as pointed out by Tweddle et al. (2012), projects with education elements need to allow for additional support and ongoing engagement with the participants.

2.3.2.6.3 Science for change

Many academics are now using scientific research to work towards social change, especially within disadvantaged communities (Baum et al., 2006, p. 1). Bonney et al. (2016) highlight how some citizen science projects are designed to have social justice outcomes or attempt to democratise science involvement. Silvertown (2009, p. 470) describes how an activist’s slogan from the 1970s, “science for the people”, has now morphed into the more inclusive aim of “science by the people”. Baum et al. (2006) describe the work of Freire who used Participatory Action Research methods to

help low socio-economic communities to analyse the reasons behind their oppression. Bonney et al. (2014) suggests that citizen science can address community-driven questions and give opportunities for people of a wide variety of different backgrounds to get involved. They suggest that citizen science projects can have the dual impact of both scientific objectives and significant social outcomes.

One example of a citizen science initiative creating social change is the West Oakland Environmental Indicators Project. This project collected air-quality data in a very poor neighbourhood in California, USA, and was used by the community to help understand how air pollution was impacting local residents (Bonney et al., 2014). The project team developed a series of recommendations, including that trucks that are waiting for port pick-ups should be prevented from idling. This is one example of how citizen science projects are shaping resource management and policy (Bonney et al., 2016).

However, researchers query whether citizen science is living up to its early ideals. For example, Bonney et al. (2016, p. 3) question whether the explosion of citizen science globally is truly “democratizing science in ways that Irwin envisioned in 1995?”. The work of Eitzel et al. (2017) provides a good answer to that question:

Elitism, whether or not intentional, permeates many science and policy-making processes, from setting research priorities and study design (e.g., often determined by institutional funding) to conducting analyses and interpretation (e.g., which may require specialized equipment or data literacy), and communication of results (e.g., through scholarly journals, many of which are behind paywalls). Citizen science can take place “in the peripheries of established institutions” and thus be considered a form of resistance to elitism (Kullenberg 2015). In this case citizen science is a sibling of the open science movement, which aims to purge barriers to accessing science. A truly democratic science would involve the public in all aspects of science, potentially combining open science and citizen science (Eitzel et al., 2017, p. 7-8).

Soleri et al (2016, p. 3) also identified an equity problem in science, and within that an additional participation problem, evidenced by the gender and racial composition of the general USA population not being represented in professional scientists.

Such inequity leads to a failure to address the needs and goals that arise from diverse human and social experiences, for example, a lack of attention to issues such as environmental contamination that disproportionately impact under-represented populations, and a failure to recognize the wide-reaching effects of structural racism. Inequity also may encourage mistrust, scepticism, and unfamiliarity with science and scientists (Soleri et al., 2016, p. 3).

The equity problem could be responded to by increasing diverse participation in science (Soleri et al., 2016, p. 3), such as using citizen science as a community engagement method. An example of this is from the resilience strategy of the City of Boulder, Colorado, U.S. which includes citizen science as a prioritised part of its community engagement (Eitzel et al., 2017, p. 7-8). However, in their keynote speech at the Raleigh-based American Citizen Science Association conference in 2019, Dr Max Liboiron outlined how there is a difference between equity and equality, and that taking an equality approach can engrain current power imbalances and marginalisation. Liboiron described equality in this context as “treating everyone exactly the same” whereas an equity-based approach “recognizes that people start from very different social, political, and economic locations and tries to both address and overcome those unevennesses” (Liboiron, 2019). Therefore, increasing equity does not mean quotas of certain types of participants or simply adding more diversity to project participation, and that the inclusion model helps with equality not equity-based outcomes. Liboiron (2019) outlines that it is not sufficient to bring people into a space that isn’t designed for them, such as bringing a diverse range of people into a citizen science project which isn’t set up in a culturally competent way (Liboiron, 2019).

While citizen science could have the ability to help democratise the scientific process (Eitzel et al., 2017), it has also been critiqued for becoming a neoliberal tool for its use of unpaid labour without giving the participants control over the outcome of the project (Brown & Prince, 2015). Eitzel et al., (2017) suggest that some projects do not have to achieve social or environmental justice outcomes, however, they should give consideration to these concerns during their project development. van Eijck (2010) highlight that ecojustice, place-based education, and indigenous knowledge are overlapping concepts, and it is hard to completely separate them.

2.3.3 Community resilience and citizen science

The previous section discussed considerations about the benefits of citizen science in that it can create ‘science for change’. It is possible then, that participation in citizen science could create changes in ways that improve disaster and climate resilience. Using examples, the following sections briefly explore how citizen science, as one form of community participation in disaster research, can be an effective tool for creating more disaster resilient citizens in the face of the current climate crisis.

Involving citizens in Disaster Risk Reduction (DRR) activities is an essential element in achieving desired outcomes. As mentioned earlier in the previous citizen science literature section, participation can take many forms within citizen science, from the contribution of data through to the creation of project research questions and data collection methods. During the development of the Sendai Framework, there was acknowledgement of the role of science in DRR efforts. Citizen science sits at a natural boundary between the scientific discovery and community engagement goals of the Sendai Framework. Similarly, citizen science has been used within UN projects for over a decade, with crowdsourced data playing important roles within disaster response and humanitarian relief programmes (Shanley et al., 2019). There are critiques of these projects, however, especially with regard to how they can be extractive and exclusionary of local knowledge and expertise. The following section explores how citizen science, as one form of community participation in disaster research, can be an effective tool for creating more disaster resilient citizens in the face of the current climate crisis depending on how projects are created and managed.

2.3.4 Disaster citizen science and participatory approaches to disaster risk management

Citizen science is becoming increasingly popular in the Disaster Risk Management (DRM) field. There are various different projects that aim to either build community resilience to disaster events or to help communities respond or recover when an event happens. Natural hazard data gathered by citizen scientists can help scientists and emergency managers add to their response and recovery planning processes. The DRM field is yet to work out the unique ethical impacts that will affect how citizen science can be integrated into the field more (Orchiston et al., 2016, p.1).

Disaster risk management and community planning are directly linked, though have previously been thought of as separate and unrelated fields, and often have been isolated from the communities they aim to assist. Projects that encourage citizens to participate in disaster risk management increase their chances of success by providing solutions tailored to that particular community. Research suggests that local community members must be the ones to decide what they are willing

to lose to hazard events, and not be told by outside organisations. They should also be given the tools to help manage their own environment and resources. Members of the community need to feel invited to be part of the solution and be equipped with the right type of information. Providing information only, and not the chance to participate, is not as effective (Pearce, 2003).

There has also been increasing interest in co-management, which displays a move towards a related perspective – the shared power perspective – which is based on citizen empowerment. According to Dorsey and McDaniels (1999, p. 23): Participation in voluntary associations, embodying norms of trust, reciprocity, tolerance, and inclusion, and activating networks of public communication, are believed to build and maintain the social capital upon which the vitality of the governance system and sustainable development are dependent. Providing citizens with information is of course essential, but it is not sufficient (Pearce, 2003, p. 219).

Participatory action research (PAR) is one way that community groups can get involved in local research and decision-making. PAR is being used by researchers to help determine the vulnerability of groups to disaster events. It aims to include participants as partners in the research and work collaboratively to unpick the issue and solve it. It also aims to create an action from the research that the participants can undertake and to create original scientific research. It is similar to citizen science (Kelman et al., 2011, p. 63) and participation in citizen science in the hazards space can lead to education and engagement in wider hazard-related issues. Bonney et al. (2014) suggest that citizen science could be used more in the fields of natural or human-caused disasters. They feel that many existing citizen science projects could be used to collect data during and after disaster events and they note two examples where citizen science is already being used in the disaster space. The first example, from Jamaica, focuses on training volunteers for reading river level gauges to help with gathering data for flood protection initiatives. The second example they use is citizens from around the world submitting data on rainfall and food prices to help the Famine Warnings Systems Network in ensuring food security (Bonney et al., 2014, p. 1437).

Citizen science projects are well placed to act as a catalyst to engage communities, particularly if they have easy entry points that can then turn into discussions around more complicated issues (Fatti & Vogel, 2011, p. 63). For example, Fatti and Vogel (2011, p. 63) demonstrate how trying to

begin a discussion on climate change using thunderstorms as a focus can be an effective way to approach such a technical, complex topic. Orchiston et al., (2016, p. 8) state that lack of relevant data is one of the challenges faced by Disaster Risk Reduction communities. One way this is countered is the use of community-based risk assessments, where community members submit data with the help of local government and relevant agencies. The communities can assess their own vulnerabilities and capacities as well as the specific hazards they face.

Hazards such as earthquakes and tsunamis are often thought of as more costly types of hazards. But there are various factors that contribute to how susceptible an area is to the effects of a disaster, and it isn't always the type of hazard that determines how costly it is. The vulnerability to an area is also impacted by how significant the recovery costs are in comparison with the country's GDP. For example, the impacts of the 1995 Kobe earthquake in Japan added up to around 2.5% of their GDP, whilst the 2001 Cyclone Waka that hit Tonga cost the economy around 36% of national GDP (Kelman et al., 2011, p. 74). There are already good examples of participatory based approaches being used in the South Pacific for coastal management. In the last twenty years, over 12,000km² of coastal areas have come under a community-based resource management approach, involving 500 communities in 15 countries. The benefits of this approach are that local awareness, traditional knowledge and customary governance all strengthen the abilities of each community to look after their area (Govan, 2009, p. 16).

2.3.5 Community resilience indicators and citizen science

On reflecting on the two parts to the literature review, there are obvious connections between the themes from the literature on citizen science and the literature on community resilience. To highlight a few of these connections, I use several of the resilience indicators outlined in Becker et al. (2011) from their report titled 'Building community resilience to disasters: A practical guide for the emergency management sector.' These resilience indicators include community participation, articulating problems, action coping, community empowerment, and trust (Becker et al., 2011). They suggest that learning what drives resilience within a particular community can be used to create practical tools and narratives to work with that community and that "once you have an understanding of the resilience factors that are important in your community, how they interact, and to what level they currently exist, you can develop programmes that target the factors for that particular community" (Becker et al., 2011, p. 44).

From a community resilience perspective, Paton (2007a) describe participation as how much people take an active role in community life, and how they contribute to community goals. A person's participation may take on many forms, through donating time, money, or resources, and often relates to the action of volunteering. Volunteering can include engaging in local social, environmental, cultural, or political groups, and can range in activities from signing petitions to serving on local committees or groups. It can also include formal participation such as serving in public office or through government-mandated citizen participation.

The concept of community participation (Becker et al., 2011) is often at the heart of citizen science projects, many of which depend on some type of community interaction. This is different from sole individual participation in projects. Benefits of community participation in citizen science projects include that when a community has been engaged to participate, their knowledge of the project subject matter increases. There is also an opportunity to use citizen science to influence how community members articulate problems that impact themselves or their local geographic area. Projects that encourage citizens to participate in disaster risk management also increase their chances of success by providing solutions tailored to that particular community. Research suggests that local community members must be the ones to decide what they are willing to lose to hazard events, not be told by outside organisations, and that they can be given the tools to help manage their own environment and resources. Members of the community need to feel invited to be part of the solution and be equipped with the right type of information. Providing information only, and not the chance to participate, is not as effective (Pearce, 2003).

The concept of community empowerment, which is common in resilience literature, is also often discussed in reference to citizen science participation, especially with projects that aim to include a social change component. Empowerment is reflected in feelings by individuals that they can and do have an influence on what goes on in their community. Empowerment occurs through cooperative linkages between other individuals, the community and wider society. The empowerment process should be supported by external sources (e.g. emergency managers), rather than led by them (Becker et al., 2011).

Engaging in participatory processes can also build trust between citizens' agencies. The concept of trust is very relevant to the use of citizen science for increasing community resilience, as it influences how people relate to each other, both at individual and group levels, which can in turn affect adaptive capacity. Trust in official sources of information also plays a key role during disaster events,

and research has shown that protective measures are more likely to be adopted if people trust the sources of information (Paton, 2007a, 2007b; Becker et al., 2011).

Issues related to trust were investigated during the volcanic crisis in Montserrat where researchers found that trust was highest between friends and family members, and that this helped perpetuate the spread of misinformation on levels of volcanic risk (Haynes et al., 2008). The research also found that while scientists were viewed as highly trusted by government authorities, there was also some mistrust towards scientists and political leaders as a result of risk level uncertainty and perceptions of integrity (Haynes et al., 2008). This example highlights the importance of trust in disaster considerations, which has implications for disaster citizen science, and longer-term resilience. For example, mistrust in science and political leaders may influence how a citizen science project is run or engaged with across the duration of the project from development through to implementation.

And finally, action coping is defined by Becker et al., (2011, p. 12) in their report as dealing with problems “by undertaking action directly (rather than worrying)” and they described it as people’s ability to “solve problems in life by confronting and resolving them”. It is a form of problem-focused coping where actions are taken to address the cause of a problem directly, which in turn has been found to predict resilience (Becker et al., 2011). Action-coping can help people prepare for and respond to disasters and is strongly related to risk reduction behaviours (Becker et al., 2011). Action coping has been shown to influence the number and quality of action plans for disaster preparedness and is also linked with community participation (Becker et al., 2011).

These examples show how factors related to community resilience align with the citizen science space, and how they might contribute to affecting positive changes in resilience for community members. Chapter 3 outlines more of these aspects in detail, through the themes identified in the development of the disaster citizen science framework.

2.3.6 Ethics

A final important note regarding citizen science is related to ethics. Researchers need to be aware of the duty of care they have to the communities they work with and they must be cognisant of the ethical constraints and protocols surrounding citizen science engagement (Orchiston et al., 2016). Bowser and Shanley (2013) highlight the ethical barriers government agencies face when working with citizens, especially around privacy. Some government agencies in the United States of America, such as the Federal Communication Commission (FCC)’s and Agency for International Development,

are showing that it is still possible to be innovative in this space, within the bounds of policies and regulations (Bowser & Shanley, 2013).

Eitzel et al. (2017) suggest that projects which do not tell participants what the data they are collecting will be used for are not true citizen science projects. This transparency of approach is key to a project being conducted in an ethical manner. They believe that the “Ten principles of citizen science” developed by the European Citizen Science Association (ECSA) are a good grounding for including ethical practices within citizen science projects. But they also acknowledge that, just as ethics standards in research change over time, the principles highlighted by the ECSA may also have to change and adapt if they become outdated (Eitzel et al., 2017).

Riesch and Potter (2014) expand on this to suggest that citizen scientists should have some form of ownership rights over the data they help to collect. They also highlight the issue of giving credit to the citizen scientists within publications resulting from work they took part in. They acknowledge that this apportion of credit is dependent on the type of citizen science project, with some projects taking up a lot more of the citizen scientists’ time than others. There are also differences with giving ownership of data and results to citizen scientists that have been involved in project development and data analysis, as opposed to those who have provided data only (Riesch & Potter, 2014).

[2.4 Link to Chapter 3](#)

Chapter 2 outlined the research approach for the literature review, along with key literature related to community resilience and citizen science, with the aim of understanding the key components of citizen science in building disaster and climate resilience. Chapter 3 reorganises this literature in the form of a framework that can be used for developing and running future disaster and climate-related citizen science projects. Chapter 3 has been submitted to a journal, “Progress in Disaster Science,” with the intention that it will be published, and is the reason why it is in its current format.

3 Chapter 3 - Disaster citizen science framework development

3.1 Introduction

Chapter 3 uses information from the literature review to create a framework that can be used for developing and running future disaster and climate-related citizen science projects. This chapter brings together information from that review to identify the 1a) elements that make up an effective citizen science project; 1b) how projects can be designed to increase community resilience to disasters and the climate crisis; and 1c) how project leads can use reflexivity to set up or run an effective citizen science project. Chapter 3 has been submitted to 'Progress in Disaster Science' so is presented in this chapter in a journal paper format. There is some repetition in the following introduction to this chapter and the previous chapter (Chapter 2) due to the need to create a complete manuscript. The Disaster Citizen Science Project Development Framework (hereafter 'the Framework') described in the paper is included in full as Appendix One of this thesis.

3.2 Journal paper

Opportunities for citizen science to inform disaster and climate change spaces: Designing a Disaster Citizen Science Project Development Framework

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Abstract

Citizen science refers to projects where volunteers participate in scientific discovery, to assist in understanding a scientific phenomenon, which can ultimately help with making future decisions. A wide variety of citizen science projects exist, many of which have been undertaken in the environmental space, with some examples from disaster and climate change fields. The types of projects undertaken depend on the motivation of the scientists and/or citizens and range from extractive crowd sourcing to highly participatory projects. To better understand the nature of such projects and how to effectively develop new disaster or climate-related citizen science projects, we undertook a scoping literature review of

citizen science scholarship. We explored what citizen science is, how projects are designed and how they are used within the disaster and climate change research fields. We reviewed 160 papers and thematically analysed these for key themes. The themes were assembled into a Disaster Citizen Science Project Development Framework (the Framework). The Framework provides a tool for researchers to consider how they might include citizen science approaches more deliberately in their work.

Keywords

Citizen science, disaster, climate change

1.0 Introduction

Citizen science is a term which covers a wide range of different projects where volunteers participate in scientific discovery^[15]. There is a spectrum of citizen involvement within these projects, with some being led by professional researchers who encourage citizens to take part, whereas others are community led and may not include professional scientists. The projects can be complex and have multiple purposes. They can be a great way to both gather data and educate the public on areas of disaster preparedness and risk reduction, which are necessary in the disaster and climate change research fields to mitigate hazards and increase community resilience^[16]. A wide variety of different citizen science projects exist to suit academics and practitioners who are looking to include citizens as part of their work, ranging from extractive crowd sourcing to highly participatory projects.

With an increase in the use of citizen science as a methodology, this article aims to provide guidance on developing citizen science projects that build disaster and climate resilience. To do this we undertook a review of citizen science scholarship that explored what citizen science is, how projects are designed and how they are used within the disaster and climate change research fields. From this review, we propose a Disaster Citizen Science Project Development Framework (the Framework) as a way that researchers could include citizen science approaches more deliberately in their work. The Framework is used to highlight standard development considerations as well as disaster-specific project considerations, such as timing, predictability of occurrence, location, frequency, number of associated hazards, and focus area.

As is good scientific practice, we begin this work by first providing an overview of citizen science and disaster citizen science specifically. We then describe the method used to undertake the literature review and the process used to create our Framework. Each component of the Framework is elaborated upon and aligned with the literature so as to understand the reasoning and nature behind each individual component of the framework.

¹⁵ Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., & Shirk, J. (2009). Citizen science: a developing tool for expanding science knowledge and scientific literacy. *BioScience*, 59(11), 977-984.

¹⁶ Feng, S., Hossain, L., and Paton, D. (2018) Harnessing informal education for community resilience. *Disaster Prevention and Management: An International Journal*, 27(1), pp.43-59.

We conclude by deliberating upon the use of the Framework in practice to support future disaster and climate change citizen science research.

1.1 Citizen science overview

Citizen science is a broad term which encompasses a variety of different types of projects where the general public work with academic researchers to undertake scientific research. Citizen science has its roots in the physical sciences, especially biology and environmental science^[17] but has expanded to many others, including natural hazard, disaster and climate change research^[18]. Today there are millions of volunteers engaged in citizen science projects around the world in a variety of different fields. They are responsible for collecting, categorising, transcribing, and analysing data. These projects span the more traditional science topics such as conservation biology, archaeology, astronomy, ornithology, and population ecology^{[19],[20]}, as well as more recent additions such as ecological restoration, water monitoring, conservation, meteorology, public health, telecommunications, disaster response, and climate change^{[21],[22],[23],[24]}, and include specific projects such as species monitoring, star observations, storm identification and tracking illegal deforestation^{[25],[26]}.

The definition given to citizen science through the work of Rick Bonney and colleagues has now come to dominate the citizen science sphere and the term was added to the Oxford English Dictionary (OED) in 2014. The OED describes it as:

¹⁷ Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., & Shirk, J. (2009). Citizen science: a developing tool for expanding science knowledge and scientific literacy. *BioScience*, 59(11), 977-984.

¹⁸ Marchezini, V., Horita, F. E. A., Matsuo, P. M., Trajber, R., Trejo-Rangel, M. A., & Olivato, D. (2018). A review of studies on participatory early warning systems (P-EWS): Pathways to support citizen science initiatives. *Frontiers in Earth Science*, 6, 184.

¹⁹ Silvertown, J. (2009). A new dawn for citizen science. *Trends in ecology & evolution*, 24(9), 467-471.

²⁰ Haklay, M. 2014. Citizen Science: an overview. Powerpoint presentation. <https://www.slideshare.net/mukih/participatory-citizen-science>

²¹ Haklay, M. 2014. Citizen Science: an overview. Powerpoint presentation. <https://www.slideshare.net/mukih/participatory-citizen-science>

²² Silvertown, J. (2009). A new dawn for citizen science. *Trends in ecology & evolution*, 24(9), 467-471.

²³ Bowser, A., & Shanley, L. (2013). New visions in citizen science. *Woodrow Wilson International Center for Scholars, Washington, DC*.

²⁴ Bonney, R., Shirk, J. L., Phillips, T. B., Wiggins, A., Ballard, H. L., Miller-Rushing, A. J., & Parrish, J. K. (2014). Next steps for citizen science. *Science*, 343(6178), 1436-1437.

²⁵ Bonney, R., Shirk, J. L., Phillips, T. B., Wiggins, A., Ballard, H. L., Miller-Rushing, A. J., & Parrish, J. K. (2014). Next steps for citizen science. *Science*, 343(6178), 1436-1437.

²⁶ Haklay, M. 2014. Citizen Science: an overview. Powerpoint presentation. <https://www.slideshare.net/mukih/participatory-citizen-science>

“Scientific work undertaken by members of the general public, often in collaboration with or under the direction of professional scientists and scientific institutions”^[27]

There is a basic agreement within the literature that the term “citizen scientist” refers to ‘people who have contributed to a citizen science project and is synonymous with “participant,” “volunteer,” and “user”’^[28]. Most studies agree that the citizen scientists volunteer their time, usually unpaid, and collect or analyse data in some way^{[29][30][31][32][33]}. The amount of involvement the citizen scientist has in the development of the project, and the processing or analysing of the data collected, depends on the type of project, including its purpose. The motivations, design, and outputs of citizen science projects vary widely. Some projects are highly participatory, where the citizens are involved in the project design, data collection and analysis. In this way, the projects can be more labour, time, and resource intensive. Whereas other projects are designed and coordinated solely by the scientist and the citizens only contribute limited amounts of time and effort. All types of citizen science can be effective for producing new knowledge and creating scientific outputs^{[34][35][36]}.

There are multiple names for ‘citizen science’, including community science, participatory biodiversity assessment, community-based monitoring, and volunteer biological monitoring^[37]. These names represent the specificity of research domains, and highlight the

²⁷ Oxford English Dictionary (n.d.) ‘Citizen science’. Oxford University Press. <https://www.oed.com/>

²⁸ Straub, M. (2016). Giving Citizen Scientists a Chance: A Study of Volunteer-led Scientific Discovery. *Citizen Science: Theory and Practice*, 1(1).

²⁹ Tweddle, J. C., Robinson, L. D., Pocock, M. J. O., & Roy, H. E. (2012). *Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK*. NERC/Centre for Ecology & Hydrology.

³⁰ Peters, M. 2016. An Inventory of citizen science initiatives, resources and learning opportunities in New Zealand. A report prepared for the NZ Landcare Trust, Hamilton, New Zealand. p. 55

³¹ Straub, M. (2016). Giving Citizen Scientists a Chance: A Study of Volunteer-led Scientific Discovery. *Citizen Science: Theory and Practice*, 1(1).

³² Silvertown, J. (2009). A new dawn for citizen science. *Trends in ecology & evolution*, 24(9), 467-471.

³³ Haklay, M. 2014. Citizen Science: an overview. Powerpoint presentation. <https://www.slideshare.net/mukih/participatory-citizen-science>

³⁴ Bonney, R., Ballard, H., Jordan, R., McCallie, E., Phillips, T., Shirk, J., & Wilderman, C. C. (2009). Public Participation in Scientific Research: Defining the Field and Assessing Its Potential for Informal Science Education. A CAISE Inquiry Group Report. *Online Submission*.

³⁵ Shirk, J. L., Ballard, H. L., Wilderman, C. C., Phillips, T., Wiggins, A., Jordan, R., ... & Bonney, R. (2012). Public participation in scientific research: a framework for deliberate design. *Ecology and society*, 17(2).

³⁶ Haklay, M. (2013). Citizen science and volunteered geographic information: Overview and typology of participation. In *Crowdsourcing geographic knowledge* (pp. 105-122). Springer, Dordrecht.

³⁷ Shirk, J., Ballard, H., Wiggins, A., Phillips, T., Jordan, R., Wilderman, C., ... & Bonney, R. Public Participation in Scientific Research: Converging on Effective Design Strategies. POSTER

dominance of citizen science in the fields of environmental monitoring and biological sciences. However, this is changing as more scientific fields discover the benefits of including citizens within their research projects.

There are now many citizen science organisations internationally, including various citizen science associations, research centres and the well-established journal, 'Citizen Science: Theory and Practice', which are all dedicated to the promotion of citizen participation and engagement in science. Through the work of these citizen science organisations, guidelines and codes of conduct have been established to promote the need for effective, engaging and ethically sound citizen science projects^[38]. One area where citizen science projects have been slower to develop is in the emergency management, Disaster Risk Reduction (DRR), and Disaster Risk Management (DRM) fields which is discussed in the next section.

1.2 Disaster citizen science

We know that adapting to hazards will be an increasing burden on communities over the coming decades due to climate change and other development pressures ^[39]^[40]. The world and populations are heading into a decade of severe change, far greater than any temporary pandemic reshaping of our world. We need unprecedented shifts in our cultural and social norms if we are to have any chance of reducing the disaster-related impacts of the climate crisis. We need to reach out to people through both hearts and minds, and connect science and policy solutions with them in ways that inspire significant individual behaviour change alongside wider system change. Projects that promote community participation, including citizen science, have the power to be effective instruments to create those connections between science and action.

For the purposes of this paper, we are treating climate change as a disaster exacerbator and the use of the term disaster in the rest of this article is in reference to disaster events caused

³⁸ <https://ecsa.citizen-science.net/engage-us/10-principles-citizen-science>

³⁹ IPCC. (2013). - Stocker, T. F., Qin, D., Plattner, G. K., Tignor, M., Allen, S. K., Boschung, J., ... & Midgley, P. M. (2013). IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, 1535 pp.

⁴⁰ IPCC. (2014). - Field, C. B., Barros, V. R., Dokken, D. J., Mach, K. J., Mastrandrea, M. D., Bilir, T. E., ... & Girma, B. (2014). IPCC, 2014: Climate change 2014: Impacts, adaptation, and vulnerability. Part A: Global and sectoral aspects. Contribution of working group II to the fifth assessment report of the intergovernmental panel on climate change.

by both geological hazards and climate change exacerbated meteorological/hydrological events. We argue that citizen science, as one form of community participation in disaster research, is an effective tool for creating more disaster resilient citizens in the face of the current climate crisis. Citizen science has the power to create projects which shine light on practical yet inviting new visions of social transformation, whilst at the same time designing science which holds those in power accountable for continued inaction on the climate crisis.

Citizen science projects have been emerging within the disaster space for the last few decades. One reason for the slower uptake of citizen science in these domains may be the over reliance on positivist research approaches that are founded in particular knowledge about what is considered ‘valid’ data. This in turn produces concerns around data quality. Despite this initial uncertainty, citizen science is becoming increasingly popular, as noted by the wide range of projects highlighted in recent reviews on disaster citizen science projects^[41].

A wide range of citizen science projects aim to either build community resilience to disaster events or to help communities respond or recover when an event happens. These projects cover hazards such as tornadoes, earthquakes, volcanoes, floods and cyclones^[42]. Citizen science is used to collect data before, during, and after disaster events ^[43]. Projects take place at the local level, such as an initiative in Jamaica which focuses on training volunteers for reading river level gauges to help with gathering data for flood protection initiatives, or at a larger international scale, such as a project collecting data on rainfall and food prices to help the Famine Warnings Systems Network in ensuring food security ^[44]. Another example is a community-led tsunami research project based in Petone, Aotearoa New Zealand^[45] where a group of citizens surveyed their local community following a tsunami warning after the

⁴¹ Hicks, A., Barclay, J., Chilvers, J., Armijos, M. T., Oven, K., Simmons, P., & Haklay, M. (2020). Global mapping of citizen science projects for disaster risk reduction. *Citizen Science: Reducing Risk and Building Resilience to Natural Hazards*.

⁴² Marchezini, V., Horita, F. E. A., Matsuo, P. M., Trajber, R., Trejo-Rangel, M. A., & Olivato, D. (2018). A review of studies on participatory early warning systems (P-EWS): Pathways to support citizen science initiatives. *Frontiers in Earth Science*, 6, 184.

⁴³ Bonney, R., Shirk, J. L., Phillips, T. B., Wiggins, A., Ballard, H. L., Miller-Rushing, A. J., & Parrish, J. K. (2014). Next steps for citizen science. *Science*, 343(6178), 1436-1437.

⁴⁴ Bonney, R., Shirk, J. L., Phillips, T. B., Wiggins, A., Ballard, H. L., Miller-Rushing, A. J., & Parrish, J. K. (2014). Next steps for citizen science. *Science*, 343(6178), 1436-1437.

⁴⁵ Blake, D., Johnston, D., Leonard, G., McLaren, L., & Becker, J. (2018). A citizen science initiative to understand community response to the Kaikōura earthquake and tsunami warning in Petone and Eastbourne, Wellington, Aotearoa/New Zealand. *Bulletin of the Seismological Society of America*, 108(3B), 1807-1817.

nearby magnitude 7.8 Kaikōura earthquake in 2016. They investigated the types of actions taken by residents of the area in the hours following the tsunami warning, including evacuation procedures, in a hope to better understand responses and plan for future tsunami. Similar citizen science data collection activities have been undertaken for tsunami evacuation exercises in other parts of Aotearoa New Zealand, including Orewa and Hawke's Bay^[46]^[47].

Given the possible benefits of community participation in disaster science, we decided to investigate the attributes that make a successful citizen science project. To do this we conducted a thematic analysis of results from a scoping literature review on citizen science, as outlined in the next section.

2.0 Method

A scoping literature review^[48] was undertaken, and articles analysed, to understand the components of disaster citizen science and to provide recommendations on what might be involved in developing an effective disaster-based citizen science project. The initial literature search was focused on the research question 'what is the science behind citizen science?' and included the search terms; citizen science, types, fields, definition, data quality, participation, problems, benefits, and challenges. Between June 2017 and June 2018, 216 academic articles were found in Google Scholar and the abstracts were read to ascertain relevance to the topic. Of these 216 articles, 160 were chosen to be read in full and evaluated for their usefulness in helping understand different characteristics of citizen science projects. Evaluation was also focused on what project design aspects make up a citizen science project. For the evaluation, an inductive, qualitative research approach^[49]^[50] was applied to the articles using a thematic

⁴⁶ Doyle, E. E., Lambie, E., Orchiston, C., Becker, J. S., McLaren, L., Johnston, D., & Leonard, G. (2020). Citizen science as a catalyst for community resilience building: A two-phase tsunami case study. Massey University.

⁴⁷ Blake, D., Johnston, D., Leonard, G., McLaren, L., & Becker, J. (2018). A citizen science initiative to understand community response to the Kaikōura earthquake and tsunami warning in Petone and Eastbourne, Wellington, Aotearoa/New Zealand. *Bulletin of the Seismological Society of America*, 108(3B), 1807-1817.

⁴⁸ Grant, M. J., & Booth, A. (2009). A typology of reviews: an analysis of 14 review types and associated methodologies. *Health information & libraries journal*, 26(2), 91-108.

⁴⁹ Creswell, J. W. (2002). *Educational research: Planning, conducting, and evaluating quantitative* (pp. 146-166). Upper Saddle River, NJ: Prentice Hall.

⁵⁰ Garner, R., & Scott, G. M. (2013). *Doing qualitative research: designs, methods, and techniques*. Pearson Education.

analysis method ^{[51],[52],[53]}. Thematic analysis is qualitative research method which shows linkages, patterns, and connections within data^{[54],[55],[56]}. Thematic analysis was undertaken on the content of the 160 articles which identified 36 main themes and 221 sub-themes. The main themes were chosen as they were umbrella concepts for four or more sub-themes. The main themes are included in Table 1 below. One limitation of this review is that the literature search was restricted to English-language articles, and therefore may not represent the breadth of material available across different nations, languages, and cultural contexts, leading to some themes perhaps being missed.

Table 1 – Main themes that emerged from the citizen science literature review

Literature Review		
Main Themes		
Data quality	Outputs	Terminology
Roles	Outcomes	Relationships
Cost/Funding	Reciprocity	Partnership
Resources	Power dynamics	Collaboration
Evaluation	Trust	Local context
Methods	Empowerment	Engagement
Ethics	Participation	Diversity
Upskilling	Knowledge	Equity
Timeframe	Learning	Culture
Motivations	Project type	Democracy
Scale	Training	Activism
Project Design	Protocols	Tools

⁵¹ Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2), 77-101.

⁵² Doyle, EEH., Johnston, DM., Smith, R., & Paton, D. (2019). Communicating model uncertainty for natural hazards: A qualitative systematic thematic review. *International Journal of Disaster Risk Reduction*. 33, 449-476

⁵³ M.J. Grant, & A. Booth. (2009). A typology of reviews: an analysis of 14 review types and associated methodologies, *Health Info. Libr. J.* 26. 91–108, <https://doi.org/10.1111/j.1471-1842.2009.00848.x>.

⁵⁴ Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2), 77-101.

⁵⁵ Doyle, EEH., Johnston, DM., Smith, R., & Paton, D. (2019). Communicating model uncertainty for natural hazards: A qualitative systematic thematic review. *International Journal of Disaster Risk Reduction*. 33, 449-476

⁵⁶ M.J. Grant, & A. Booth. (2009). A typology of reviews: an analysis of 14 review types and associated methodologies, *Health Info. Libr. J.* 26. 91–108, <https://doi.org/10.1111/j.1471-1842.2009.00848.x>.

As a way to organise and display the results of the literature review, the main themes identified were compared with the structure of a basic logic model, where inputs, activities, outputs, and outcomes are all considered stages of a development process ^[57], such as that required for developing a citizen science project (Table 2). Under each of these stages, important aspects for consideration are highlighted, many of which align with the themes identified from the literature review in Table 1. As a way to test if a basic logic model format would be a good basis for a new Framework, 24 of the main themes were used to identify if there were enough themes to go across the different stages, as outlined in Table 2 below. Not all main theme were included in this test once it was obvious that there were themes spread across the different categories of the logic model.

Table 2 – Logic model ^[58] which themes identified from the literature review were compared against

Input	Activities	Output	Outcome
Purpose	Participation	Create knowledge	Learning
Resources	Roles	Data quality	Science for change
Finance	Engagement	Partnerships	Empowerment
Ethics	Collaboration	Publishing	Trust in science
Terminology	Local context		Upskilled citizens
Diversity	Reciprocity		
Knowledge	Diverse activities		
Motivation			

Using the logic model as an underlying structure, and the themes identified in Table 1 above, a potential new framework was then developed that outlines the stages and considerations involved in developing a disaster-based citizen science project. We have named this framework the Disaster Citizen Science Project Development Framework (the Framework) and henceforth outline its components in the following results section.

3.0 Results: Our Disaster Citizen Science Project Development Framework

The Framework will be useful for researchers who want to start a new citizen science project. It is intended to allow disaster researchers to ask questions of themselves and their colleagues at different stages of a project and analyse if citizen science is a good fit for their intended

⁵⁷ Knowlton, L. W., & Phillips, C. C. (2012). *The logic model guidebook: Better strategies for great results*. Sage.

⁵⁸ Knowlton, L. W., & Phillips, C. C. (2012). *The logic model guidebook: Better strategies for great results*. Sage.

purpose. Our Framework has been organised into the following sections: Motivations for the Project, Level of Citizen Participation, Disaster Specific Considerations, General Project Design Considerations, Project Outputs, Project Outcomes, and a section for wider critical considerations labelled Being Reflexive. The first sections are loosely based on the logic model format, while the 'Being Reflexive' section was added for critical analysis of the processes at each stage of a project. The Framework headings are depicted in Table 3 below.

Table 3 – Overview of the Disaster Citizen Science Project Development Model

Motivations for the project
Level of citizen participation
Disaster specific considerations
General project design considerations
Project outputs
Project outcomes
Being reflexive

The following sections will go through the Framework, providing a summary and examples related to each component. The first section outlines a few of the possible motivations behind developing and running a citizen science project.

3.1 Motivations for the Project

Due to the wide variety of citizen science project types, there is also a wide variety of purposes and motivations that sit behind their creation. It is good to be clear at the start of a project about the motivating factors influencing its development (Table 4).

Table 4 – Motivations for the project

MOTIVATIONS FOR THE PROJECT			
Gathering data, especially large or geographically diverse data sets	Process large data sets	Community engagement through educating people on a	Creating science data to change something in a community or environment

		particular issue or topic	
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The popularity of citizen science is in part due to both its ability to engage non-professional scientists in various types of scientific investigation, and for its ability to gather large amounts of data that would not be possible without the free labour given by volunteers ^[59]^[60]^[61]^[62]. We identified four different motivations that influence citizen science project design. These four types of motivations are not mutually exclusive, and projects can have multiple motivating factors.

The first two motivations of citizen science identified in our thematic analysis are for scientists to (1) gather large samples of data, or (2) process large data sets, using the help of the general public. While citizen science is a good way to gather and analyse data to inform science, this approach does not necessarily have a public education component built into the design of the project and may contain no public education efforts at all. Some scientists are primarily interested in the scientific outputs of a project, and citizens can be seen as a way to increase the capacity of the research team and to gather data from a wider variety of places ^[63]^[64]^[65]^[66]^[67].

A third motivation is that citizen science has been increasingly used as a community engagement method. Citizen science can allow members of the public to step away from an

⁵⁹ Bonney, R., Ballard, H., Jordan, R., McCallie, E., Phillips, T., Shirk, J., & Wilderman, C. C. (2009). Public Participation in Scientific Research: Defining the Field and Assessing Its Potential for Informal Science Education. A CAISE Inquiry Group Report. *Online Submission*.

⁶⁰ Dickinson, J. L., & Bonney, R. (2012). Introduction: Why citizen science. *Citizen science: public participation in environmental research*, 1-14

⁶¹ Becker-Klein, R., Peterman, K., & Stylinski, C. (2016). Embedded assessment as an essential method for understanding public engagement in citizen science. *Citizen Science: Theory and Practice*, 1(1).

⁶² Bowser, A., & Shanley, L. (2013). New visions in citizen science. *Woodrow Wilson International Center for Scholars, Washington, DC*.

⁶³ Riesch, H., & Potter, C. (2014). Citizen science as seen by scientists: Methodological, epistemological and ethical dimensions. *Public Understanding of Science*, 23(1), 107-120.

⁶⁴ Silvertown, J. (2009). A new dawn for citizen science. *Trends in ecology & evolution*, 24(9), 467-471.

⁶⁵ Tweddle, J. C., Robinson, L. D., Pocock, M. J. O., & Roy, H. E. (2012). *Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK*. NERC/Centre for Ecology & Hydrology.

⁶⁶ Bonney, R., Phillips, T. B., Ballard, H. L., & Enck, J. W. (2016). Can citizen science enhance public understanding of science?. *Public Understanding of Science*, 25(1), 2-16.

⁶⁷ Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., & Shirk, J. (2009). Citizen science: a developing tool for expanding science knowledge and scientific literacy. *BioScience*, 59(11), 977-984.

observer or recipient role, and become more of an active participant in scientific research [68]. It can give context and support to informal education and has the potential to significantly improve scientific literacy. It can also help to create diversity within formal science-based fields and lead to more diverse communities being included or centred in solving problems using participation in science[69][70][71]. The fourth motivating factor identified during the thematic review suggests that academics are now using their research to work towards social change, especially within disadvantaged communities[72]. The desire to place a more participatory approach to science at the heart of research objectives is highlighted in the work of Silvertown[73], who describes how an activist slogan from the 1970s, ‘science for the people’, has now morphed into the more inclusive aim of ‘science by the people.’

The thematic analysis results regarding project motivations highlight that there are at least three possible benefits from using citizen science in the disaster research field. Firstly, it is possible to collect large data sets from specific events, especially in geographically dispersed or hard to reach locations. Lack of relevant data has been highlighted by Orchiston et al.[74] as a key challenge faced by DRM communities, which affects the decision-making ability of disaster researchers and practitioners. The use of data submitted to local government and relevant agencies through community-based projects can counter this. Secondly, using citizen science as an approach to data collection can simultaneously be a way to educate communities around hazard impacts. Thirdly, it can enhance community resilience and preparedness, through community participation in data collection and/or analysis. Within

⁶⁸ Orchiston, C., Hudson-Doyle, E., Johnston, D.M., Becker, J.S., Crowley, K., Beatson, A., Lambie, E., Neely, D.P., Pepperell, B. (2016). Citizen Science in Disaster Risk Management Workshop : summary report. : GNS Science. *GNS Science miscellaneous series 90* iii, 35 p.

⁶⁹ Eitzel, M. V., Cappadonna, J. L., Santos-Lang, C., Duerr, R. E., Virapongse, A., West, S. E., ... & Metcalfe, A. N. (2017). Citizen Science Terminology Matters: Exploring Key Terms. *Citizen Science: Theory and Practice*, 2(1). 5-6

⁷⁰ Soleri, D., Long, J., Ramirez-Andreotta, M., Eitemiller, R., & Pandya, R. (2016). Finding pathways to more equitable and meaningful public-scientist partnerships. *Citizen Science: Theory and Practice*, 1(1).

⁷¹ Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., & Shirk, J. (2009). Citizen science: a developing tool for expanding science knowledge and scientific literacy. *BioScience*, 59(11), 977-984.

⁷² Baum, F., MacDougall, C., & Smith, D. (2006). Participatory action research. *Journal of Epidemiology & Community Health*, 60(10), 854-857.

⁷³ Silvertown, J. (2009). A new dawn for citizen science. *Trends in ecology & evolution*, 24(9), 467-471.

⁷⁴ Orchiston, C., Hudson-Doyle, E., Johnston, D.M., Becker, J.S., Crowley, K., Beatson, A., Lambie, E., Neely, D.P., Pepperell, B. (2016). Citizen Science in Disaster Risk Management Workshop : summary report. GNS Science. *GNS Science miscellaneous series 90* iii, 35 p.

these initiatives communities can assess their own vulnerabilities and capacities as well as the specific hazards they face.

The literature suggests participation in citizen science in the hazards space can lead to education and engagement in wider hazard related issues. For example, technically complex topics such as climate change within communities are challenging, therefore citizen science, as argued by Fatti and Vogel^[75], enables concrete examples that effectively focus conversations. Finally, citizen science can be used by communities to create change in their local area in response to potential or real disaster impacts. For some communities, participation in science has been a tool to highlight or resolve injustices. Community participation in science, including community-led science, can be effective in creating change on issues that harm residents in an area. Ottinger^[76] discusses the Bucket Brigade which is a series of citizen science initiatives whose members used simple air capturing techniques to prove that local factories were ignoring air quality regulations and used their data to prove that those illegal activities could do harm to the local community.

Being explicit about the motivating factors behind a project will help to determine if the project attempts to collect disaster impact related data, increase hazard awareness and education within communities, or have more specific community resilience building motivations.

3.2 Level of Citizen Participation

Traditionally many projects deemed to be citizen science were set up the same way, with observations being reported by volunteers on their environment, (e.g. the well-known Audubon Christmas Bird Count^[77]). However, our thematic analysis shows this is no longer the status quo and projects can vary significantly in appearance and purpose, though they still share the common aspect of involving participants in some form of scientific inquiry^[78]. Table

⁷⁵ Fatti, C. E., & Vogel, C. (2011). Is science enough? Examining ways of understanding, coping with and adapting to storm risks in Johannesburg. *Water SA*, 37(1), 57-65.

⁷⁶ Ottinger, G. (2010). Buckets of resistance: Standards and the effectiveness of citizen science. *Science, Technology, & Human Values*, 35(2), 244-270.

⁷⁷ Bowser, A., & Shanley, L. (2013). New visions in citizen science. *Woodrow Wilson International Center for Scholars*, Washington, DC.

⁷⁸ Becker-Klein, R., Peterman, K., & Stylinski, C. (2016). Embedded assessment as an essential method for understanding public engagement in citizen science. *Citizen Science: Theory and Practice*, 1(1).

5 shows a typology representing levels of citizen participation. The typology draws predominantly from Bonney et al.^[79] and Shirk et al. ^[80] who categorise citizen science into contributory projects, collaborative projects, and co-created projects^[81]; and Haklay^[82] who utilises the following categories of crowdsourcing, distributed intelligence, participatory, and extreme^[83].

The different project types have been categorised into numbers 1-6 as a way to show where common links are between the two types of project classifications, and to show that the lines are blurred between project types. For example, a co-created project is unlikely to be a researcher-led crowdsource project as the definition of ‘co-create’ means that the researcher and participants would be working, at least in part, on the project design, which would fit more in the participatory or extreme categories. Whereas, for a crowd-sourced project, Haklay^[84] has created this category to show where researchers are using data extracted from citizens without their participation in the project’s design.

We argue that there isn’t one ‘right’ type of project; instead, a project needs to be carefully designed to meet the needs of the researcher and participants. Contributory-type projects can be perfectly fine to meet data collection needs, and for citizens who desire lower levels of personal contribution, whereas co-creation projects are better for long-term relationship building and ongoing community engagement outcomes. Tweedle et al^[85] suggest that getting community/citizens involved and participating early in a project is key to a genuinely co-created project and that all groups involved need to be represented within the project team. They suggest that the types of participants sought will impact choices of training, data

⁷⁹ Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., & Shirk, J. (2009). Citizen science: a developing tool for expanding science knowledge and scientific literacy. *BioScience*, 59(11), 977-984.

⁸⁰ Shirk, J. L., Ballard, H. L., Wilderman, C. C., Phillips, T., Wiggins, A., Jordan, R., ... & Bonney, R. (2012). Public participation in scientific research: a framework for deliberate design. *Ecology and society*, 17(2).

⁸¹ Rickles, P., Haklay, M. E., Ellul, C., & Skarlatidou, A. (2017). Citizen science with GIS&T. *The geographic information science & technology body of knowledge*, (GS-24).

⁸² Haklay, M. (2013). Citizen science and volunteered geographic information: Overview and typology of participation. In *Crowdsourcing geographic knowledge* (pp. 105-122). Springer, Dordrecht.

⁸³ Haklay, M. (2013). Citizen science and volunteered geographic information: Overview and typology of participation. In *Crowdsourcing geographic knowledge* (pp. 105-122). Springer, Dordrecht.

⁸⁴ Haklay, M. (2013). Citizen science and volunteered geographic information: Overview and typology of participation. In *Crowdsourcing geographic knowledge* (pp. 105-122). Springer, Dordrecht.

⁸⁵ Tweedle, J. C., Robinson, L. D., Pocock, M. J. O., & Roy, H. E. (2012). *Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK*. NERC/Centre for Ecology & Hydrology.

collection, and research protocols, and therefore should be identified early in the project development process. They also mention that community members will have a better idea of what will appeal to their peers and that expertise of the citizens should be recognised and made use of.

Table 5 – Citizen science typology (adapted from Bonney et al.^[86], Shirk et al.^[87], and Haklay^[88]; and consistent with concepts in IAP2^[89])

	Crowdsource Citizens as sensors (active and/or passive)	Distributed Intelligence Citizens as basic interpreters	Participatory Citizens participate in problem definition and data collection	Extreme Collaborative science, problem definition, data collection and analysis
Contribute: Projects are designed by scientists and citizens contribute data	1	2		
Collaborate: Projects are designed by scientists and citizens contribute data, but may help in project		3	4	

⁸⁶ Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., & Shirk, J. (2009). Citizen science: a developing tool for expanding science knowledge and scientific literacy. *BioScience*, 59(11), 977-984.

⁸⁷ Shirk, J. L., Ballard, H. L., Wilderman, C. C., Phillips, T., Wiggins, A., Jordan, R., ... & Bonney, R. (2012). Public participation in scientific research: a framework for deliberate design. *Ecology and society*, 17(2).

⁸⁸ Haklay, M. (2013). Citizen science and volunteered geographic information: Overview and typology of participation. In *Crowdsourcing geographic knowledge* (pp. 105-122). Springer, Dordrecht.

⁸⁹ <https://www.iap2.org/mpage/Home>

design, analysis or dissemination				
Co-create: Projects are designed by scientists and citizens working together and at least some of the participants are actively involved through all/most of the scientific process			5	6

Even though we argue that different citizen science projects will fit different communities and that there is no ‘right’ type of project, those at the more participatory and collaborative end of the spectrum do have some distinct benefits. Participation in citizen science has been proven to increase knowledge and awareness^[90], both of which are known factors on increasing resilience in communities^[91]. Projects that encourage citizens to participate in disaster risk management may also increase the chance of success by providing solutions tailored to that particular community. Members of the community need to feel invited to be part of the solution and be equipped with the right type of information. Providing information only, and not the chance to participate, is not as effective^[92].

⁹⁰ Heilmann-Clausen, J., Bruun, H. H., Ejrnæs, R., Frøslev, T. G., Læssøe, T., & Petersen, J. H. (2019). How citizen science boosted primary knowledge on fungal biodiversity in Denmark. *Biological Conservation*, 237, 366-372.

⁹¹ Feng, S., Hossain, L., and Paton, D. (2018) Harnessing informal education for community resilience. *Disaster Prevention and Management: An International Journal*, 27(1), pp.43-59.

⁹² Pearce, L. (2003). Disaster management and community planning, and public participation: how to achieve sustainable hazard mitigation. *Natural hazards*, 28(2-3), 211-228.

3.3 Disaster Specific Design Considerations

As with any unique field of science (both physical and social), there are differences in the methods and types of data collected with hazard/community resilience research. The thematic analysis revealed a number of issues that need to be considered when deciding how citizen science projects could be developed, such as scale and location of disaster event, and purpose of the data collection/analysis. Some of the considerations include whether the project focuses on pre-, during, or post-hazard event data collection, or a mixture of these, and if the project deals with single events or multiple/cascading hazards. Other considerations include if it is practical to collect data for hazard events that are in spontaneous or random locations, or for events that are unpredictable or infrequent, versus projects that focus on events that occur in the same location each time and/or are frequent/predictable^[93] (Table 6).

Table 6 – Disaster specific considerations

DISASTER SPECIFIC CONSIDERATIONS				
Predictability of event location	Predictability of event timing	Specific project focus	Frequency of event occurrence	Number of different hazard events
- Predictable	- Predictable	- Preparation	- Daily	- Singular hazard
- Not predictable / random	- Not predictable / spontaneous	- Mitigation	- Weekly	- Multi-hazard
		- Monitoring	- Monthly	- Cascading hazards
		- Response	- Yearly	
		- Recovery	- Decadal	
		- Adaptation	- Longer	

3.4 General Project Design Considerations

General project design was a theme in the literature review that ended up encompassing or being connected to a wide range of other themes. The themes related to this section are

⁹³ <https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030>

summarised in General Project Design Considerations section of the Model, as outlined in Table 7 below.

Table 7 – General project considerations

GENERAL PROJECT DESIGN CONSIDERATIONS	
- Ethics	What does success look like for the project?
- Scale	What will the project cost and who is funding it? And for how long?
- Resources	What resources are needed to run the project?
- Finance (Cost / Funding)	Is the project offline, online or both?
- Training / Upskilling	What data is collected, how, and how often?
- Terminology	Will you validate the data? What are the quality controls needed?
- Technology	Does it need to be scientifically accurate data to be usable/useful?
- Reciprocity / Reward	Do you have the citizens needed to cover the geographical range or data volume of collection or analysis the project requires? If not, what is the plan to recruit more volunteers?
	Who owns the data collected?
	Who can access the collected data? Who can use the data? What for?
	Where and how is the data stored? Who pays for this storage?
	What skills are needed from citizens to join in?
	What makes your project attractive to groups or individuals to take part? Or what incentives do you provide for people to do so?
	Is the project giving citizens enough assistance and training?
	What ethical issues may arise from the project?
	How are you increasing the diversity of the citizens involved?

Researchers need to be aware of the duty of care they have to the communities they work in and must be cognisant of the ethical constraints and protocols surrounding citizen science

engagement^[94]. The main citizen science ethical issues focus on transparency, acknowledgement of participants work and data ownership^{[95][96]}, as well as the ability to continuously update ethical practices as the field develops^[97]. The “Ten principles of citizen science”^[98] (Table 8) developed by the European Citizen Science Association are a good grounding for including ethical practices within citizen science projects.

Table 8 – “Ten principles of citizen science” developed by the European Citizen Science Association^[99]

Citizen science projects actively involve citizens in scientific endeavour that generates new knowledge or understanding. Citizens may act as contributors, collaborators or as project leaders and have a meaningful role in the project.
Citizen science projects have a genuine science outcome. For example, answering a research question or informing conservation action, management decisions or environmental policy.
Both the professional scientists and the citizen scientists benefit from taking part. Benefits may include the publication of research outputs, learning opportunities, personal enjoyment, social benefits, satisfaction through contributing to scientific evidence, for example, to address local, national and international issues, and through that, the potential to influence policy.
Citizen scientists may, if they wish, participate in multiple stages of the scientific process. This may include developing the research question, designing the method, gathering and analysing data, and communicating the results.
Citizen scientists receive feedback from the project. For example, how their data are being used and what the research, policy or societal outcomes are.
Citizen science is considered a research approach like any other, with limitations and biases that should be considered and controlled for. However, unlike traditional research approaches, citizen science provides opportunity for greater public engagement and democratisation of science.

⁹⁴ Orchiston, C., Hudson-Doyle, E., Johnston, D.M., Becker, J.S., Crowley, K., Beatson, A., Lambie, E., Neely, D.P., Pepperell, B. (2016). Citizen Science in Disaster Risk Management Workshop: summary report. GNS Science. *GNS Science miscellaneous series 90* iii, 35 p.

⁹⁵ Eitzel, M. V., Cappadonna, J. L., Santos-Lang, C., Duerr, R. E., Virapongse, A., West, S. E., ... & Metcalfe, A. N. (2017). Citizen Science Terminology Matters: Exploring Key Terms. *Citizen Science: Theory and Practice*, 2(1).

⁹⁶ Riesch, H., & Potter, C. (2014). Citizen science as seen by scientists: Methodological, epistemological and ethical dimensions. *Public Understanding of Science*, 23(1), 107-120.

⁹⁷ Eitzel, M. V., Cappadonna, J. L., Santos-Lang, C., Duerr, R. E., Virapongse, A., West, S. E., ... & Metcalfe, A. N. (2017). Citizen Science Terminology Matters: Exploring Key Terms. *Citizen Science: Theory and Practice*, 2(1).

⁹⁸ Robinson L.D., Cawthray, J.L., West, S.E., Bonn, A., & Ansine, J. (2018). Ten principles of citizen science. In S. Hecker, M. Haklay, A. Bowser, Z. Makuch, J. Vogel, & A. Bonn. *Citizen Science: Innovation in Open Science, Society and Policy*. London, UCL Press. 1–23.

⁹⁹ Robinson L.D., Cawthray, J.L., West, S.E., Bonn, A., & Ansine, J. (2018). Ten principles of citizen science. In S. Hecker, M. Haklay, A. Bowser, Z. Makuch, J. Vogel, & A. Bonn. *Citizen Science: Innovation in Open Science, Society and Policy*. London, UCL Press. 1–23.

Citizen science project data and metadata are made publicly available and where possible, results are published in an open-access format. Data sharing may occur during or after the project, unless there are security or privacy concerns that prevent this.
Citizen scientists are acknowledged in project results and publications.
Citizen science programmes are evaluated for their scientific output, data quality, participant experience and wider societal or policy impact.
The leaders of citizen science projects take into consideration legal and ethical issues surrounding copyright, intellectual property, data-sharing agreements, confidentiality, attribution and the environmental impact of any activities.

The disaster research field is still to work out the unique ethical impacts that will affect how citizen science can be better and more ethically applied^[100]. The ethical ramifications of conducting citizen science in a disaster context need to be examined more, including post-disaster privacy issues, trauma, and monitoring if and when disaster hit communities begin to suffer from research fatigue, so that citizen science initiatives can adapt in response to these needs^[101].

Questions need to be asked by the project designer around whether the intended scale of the project is appropriate for the resources and capacity of the volunteers on the project, as well as the time, capacity, and resources available to the professional researcher to lead and monitor the project. Many articles mention the costs of conducting citizen science projects, as well as the financial benefits^[102]^[103]^[104]^[105]^[106]. There are often many start-up costs for projects that need to be considered, including websites or a smartphone app, publicity

¹⁰⁰ Orchiston, C., Hudson-Doyle, E., Johnston, D.M., Becker, J.S., Crowley, K., Beatson, A., Lambie, E., Neely, D.P., Pepperell, B. (2016). Citizen Science in Disaster Risk Management Workshop: summary report. GNS Science. *GNS Science miscellaneous series 90* iii, 35 p.

¹⁰¹ Patel, S. S., Webster, R. K., Greenberg, N., Weston, D., & Brooks, S. K. (2020). Research fatigue in COVID-19 pandemic and post-disaster research: causes, consequences and recommendations. *Disaster Prevention and Management: An International Journal*.

¹⁰² Shirk, J. L., Ballard, H. L., Wilderman, C. C., Phillips, T., Wiggins, A., Jordan, R., ... & Bonney, R. (2012). Public participation in scientific research: a framework for deliberate design. *Ecology and society*, 17(2).

¹⁰³ Tweddle, J. C., Robinson, L. D., Pocock, M. J. O., & Roy, H. E. (2012). *Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK*. NERC/Centre for Ecology & Hydrology.

¹⁰⁴ Silvertown, J. (2009). A new dawn for citizen science. *Trends in ecology & evolution*, 24(9), 467-471.

¹⁰⁵ Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., & Shirk, J. (2009). Citizen science: a developing tool for expanding science knowledge and scientific literacy. *BioScience*, 59(11), 977-984.

¹⁰⁶ Bonney, R., Phillips, T. B., Ballard, H. L., & Enck, J. W. (2016). Can citizen science enhance public understanding of science?. *Public Understanding of Science*, 25(1), 2-16.

materials, or resources for participants^[107]. There are also ongoing costs for the projects, often including paying staff to oversee or manage projects, as well as providing support for participants. The data collection process itself can also cost money^[108]. While the costs of citizen science need to be considered, many researchers also highlight the financial benefits of engaging volunteers in helping to collect and/or analyse data. Citizen science is a cost-effective way of researching over the long term, especially considering the amount of good quality data that citizen science projects are able to collect^[109].

There are a wide range of timeframes associated with citizen science, from annual or ongoing projects, through to one-off events^[110]. And just as there are different timeframes, there are also different scales of projects^[111]. There are some projects which are very restricted to a specific locality, such as a local stream or beach. Then there are projects which have a larger size, such as geographic extents covering volcanoes or forests. Moving up in size there are projects that span national or even international scales^[112].

Considerations also need to be factored in around the number and type of volunteers needed for a project. Different projects will need different numbers of participants to cover the geographical range or data volume of collection and/or analysis the project requires. Projects will require different training needs for the participants^[113]^[114]^[115], as well as different

¹⁰⁷ Tweddle, J. C., Robinson, L. D., Pocock, M. J. O., & Roy, H. E. (2012). *Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK*. NERC/Centre for Ecology & Hydrology.

¹⁰⁸ Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., & Shirk, J. (2009). Citizen science: a developing tool for expanding science knowledge and scientific literacy. *BioScience*, 59(11), 977-984.

¹⁰⁹ Bonney, R., Cooper, C. B., Dickinson, J., Kelling, S., Phillips, T., Rosenberg, K. V., & Shirk, J. (2009). Citizen science: a developing tool for expanding science knowledge and scientific literacy. *BioScience*, 59(11), 977-984.

¹¹⁰ Peters, M. 2016. An Inventory of citizen science initiatives, resources and learning opportunities in New Zealand. A report prepared for the NZ Landcare Trust, Hamilton, New Zealand. p. 55

¹¹¹ Peters, M. 2016. An Inventory of citizen science initiatives, resources and learning opportunities in New Zealand. A report prepared for the NZ Landcare Trust, Hamilton, New Zealand. p. 55

¹¹² Peters, M. 2016. An Inventory of citizen science initiatives, resources and learning opportunities in New Zealand. A report prepared for the NZ Landcare Trust, Hamilton, New Zealand. p. 55

¹¹³ Straub, M. (2016). Giving Citizen Scientists a Chance: A Study of Volunteer-led Scientific Discovery. *Citizen Science: Theory and Practice*, 1(1).

¹¹⁴ Hennon, C. C., Knapp, K. R., Schreck III, C. J., Stevens, S. E., Kossin, J. P., Thorne, P. W., ... & Striegl, M. (2015). Cyclone center: can citizen scientists improve tropical cyclone intensity records?. *Bulletin of the American Meteorological Society*, 96(4), 591-607.

¹¹⁵ Bowser, A., & Shanley, L. (2013). New visions in citizen science. *Woodrow Wilson International Center for Scholars, Washington, DC*.

resources to complete the study^{[116][117][118][119]}, and differing technology needs ^{[120][121][122][123][124]}.

It is important to give back to volunteers who give up their time to contribute to citizen science projects^[125]. This 'giving back' could be wide-ranging, depending on capacity, timeframe and budget. A simple 'thank you for participating' note may be enough for some types of projects, such as online projects where participants may not be a regular to the site and may not participate for long. Providing rapid feedback can also be a great way to motivate participants to continue engaging with the project. Scientists can also take their interpretation of citizen data back to the citizens as a form of validation or member checking. Another method includes showing on a map where all contributed data has come from. This gives the participants a sense that they are contributing to the greater whole of the project and allows them to be part of the wider project community. This sense of connection can also be achieved by sharing the project's results with the participants. One way of doing this is through regular newsletter updates or through giving them access to the data. Running competitions are fun ways to retain volunteers and promote repeat participation^[126]. It can be possible to create a smaller pilot project initially to test out the scope and scale of the project, as well as identify the training, assistance and resources that need to be provided to the participants. Systems for monitoring volunteer needs within a project can be designed and evaluations set up.

¹¹⁶ Bowser, A., & Shanley, L. (2013). New visions in citizen science. *Woodrow Wilson International Center for Scholars, Washington, DC.*

¹¹⁷ Bonney, R., Phillips, T. B., Ballard, H. L., & Enck, J. W. (2016). Can citizen science enhance public understanding of science?. *Public Understanding of Science*, 25(1), 2-16.

¹¹⁸ Bowser, A., & Shanley, L. (2013). New visions in citizen science. *Woodrow Wilson International Center for Scholars, Washington, DC.*

¹¹⁹ Silvertown, J. (2009). A new dawn for citizen science. *Trends in ecology & evolution*, 24(9), 467-471.

¹²⁰ Peters, M. 2016. An Inventory of citizen science initiatives, resources and learning opportunities in New Zealand. A report prepared for the NZ Landcare Trust, Hamilton, New Zealand. p. 55

¹²¹ Haklay, M. 2014. Citizen Science: an overview. PowerPoint presentation. <https://www.slideshare.net/mukih/participatory-citizen-science>

¹²² Bowser, A., & Shanley, L. (2013). New visions in citizen science. *Woodrow Wilson International Center for Scholars, Washington, DC.*

¹²³ Bonney, R., Shirk, J. L., Phillips, T. B., Wiggins, A., Ballard, H. L., Miller-Rushing, A. J., & Parrish, J. K. (2014). Next steps for citizen science. *Science*, 343(6178), 1436-1437.

¹²⁴ Silvertown, J. (2009). A new dawn for citizen science. *Trends in ecology & evolution*, 24(9), 467-471.

¹²⁵ Tweddle, J. C., Robinson, L. D., Pocock, M. J. O., & Roy, H. E. (2012). *Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK*. NERC/Centre for Ecology & Hydrology.

¹²⁶ Tweddle, J. C., Robinson, L. D., Pocock, M. J. O., & Roy, H. E. (2012). *Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK*. NERC/Centre for Ecology & Hydrology.

3.5 Project Outputs and Outcomes

The themes from this section are listed in the box below in Table 9. For this paper we define project *outputs* as results from the project which revolve around the scientific study conducted, whereas we are defining project *outcomes* as the impacts on either the participants, the academic researchers, or the significance of the project in the wider academic or community context.

Table 9 – Project outputs and outcomes

PROJECT OUTPUTS	
Considerations...	Questions to ask...
- Data quality - Data quantity - Publishing rights - Public engagement with findings - Access to data	Were the results of rigorous scientific standard? What are your criteria for scientific accuracy or legitimacy? Are you going to publish the findings in academic journals? Are you intending to acknowledge the participants for their work?
PROJECT OUTCOMES	
Considerations...	Questions to ask...
- Empowerment of citizens - Science for change - Creating/developing community specific knowledge - Activism - Democratising science	Has the project given citizens agency to affect outcomes of issues in their community? Has it drawn attention to a particular issue? What knowledge has the project generated in citizens and has this knowledge then been shared with others?

One of the main critiques of citizen science is the uncertainty around the quality of data collected by volunteers^{[127][128]}. Citizen science is not accepted by all people in the scientific community as a valid method, and some argue that volunteers can't produce data of

¹²⁷ Tweddle, J. C., Robinson, L. D., Pocock, M. J. O., & Roy, H. E. (2012). *Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK*. NERC/Centre for Ecology & Hydrology.

¹²⁸ Shirk, J. L., Ballard, H. L., Wilderman, C. C., Phillips, T., Wiggins, A., Jordan, R., ... & Bonney, R. (2012). Public participation in scientific research: a framework for deliberate design. *Ecology and society*, 17(2).

research-grade quality. There is an assumption that volunteers (non-professional scientists) introduce bias into the research^{[129][130][131]}. Validation can be as simple as checking that the postcode a data set is being attributed to is correct and within the bounds of the study. Verification can include asking participants to submit photos to compare with their numerical data or asking participants to check the data of others in the project^[132]. These methods can work well for quantitative research, but not as well for more qualitative research, where ‘authenticity’ is used as a measure for quality and reliability^[133]. As citizen science branches out more into the social sciences where mixed methods or qualitative research is common, the issue of what constitutes ‘quality’ data may become divisive. There have been multiple studies that aim to test the validity of findings from citizen collected/analysed data^{[134][135][136]}. The citizen science platform Zooniverse, for example, demonstrated through empirical analysis that classifications of galaxies were done as accurately by volunteers as by professional scientists^[137]. Similar research was conducted on the Blitz water monitoring study which showed that the volunteer-read data was similar enough to the lab-analysed data to conclude that the approach to citizen-collected data can be scientifically valid for water quality assessment^[138]. Some states within the USA accept data collected by volunteers for their assessments under the Clean Water Act, and note that data used for these types of regulatory purposes needs to meet strict quality standards^[139].

¹²⁹ Bowser, A., & Shanley, L. (2013). New visions in citizen science. *Woodrow Wilson International Center for Scholars, Washington, DC*.

¹³⁰ Bonney, R., Shirk, J. L., Phillips, T. B., Wiggins, A., Ballard, H. L., Miller-Rushing, A. J., & Parrish, J. K. (2014). Next steps for citizen science. *Science*, 343(6178), 1436-1437.

¹³¹ Soleri, D., Long, J., Ramirez-Andreotta, M., Eitemiller, R., & Pandya, R. (2016). Finding pathways to more equitable and meaningful public-scientist partnerships. *Citizen Science: Theory and Practice*, 1(1).

¹³² Tweddle, J. C., Robinson, L. D., Pocock, M. J. O., & Roy, H. E. (2012). *Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK*. NERC/Centre for Ecology & Hydrology.

¹³³ Kearney, J., Wood, L., & Zuber-Skerritt, O. (2013). Community–university partnerships: Using participatory action learning and action research (PALAR). *Gateways: International Journal of Community Research and Engagement*, 6(1), 113-30.

¹³⁴ Tregidgo, D. J., West, S. E., & Ashmore, M. R. (2013). Can citizen science produce good science? Testing the OPAL Air Survey methodology, using lichens as indicators of nitrogenous pollution. *Environmental pollution*, 182, 448-451.

¹³⁵ Nov, O., Arazy, O., & Anderson, D. (2014). Scientists@ Home: what drives the quantity and quality of online citizen science participation?. *PloS one*, 9(4).

¹³⁶ Gommerman, L., & Monroe, M. C. (2012). Lessons learned from evaluations of citizen science programs. *Gainesville, FL: School of Forest Resources and Conservation, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida*.

¹³⁷ Bowser, A., & Shanley, L. (2013). New visions in citizen science. *Woodrow Wilson International Center for Scholars, Washington, DC*.

¹³⁸ Muenich, R., Peel, S., Bowling, L., Haas, M., Turco, R., Frankenberger, J., & Chaubey, I. (2016). The Wabash Sampling Blitz: A study on the effectiveness of citizen science. *Citizen Science: Theory and Practice*, 1(1).

¹³⁹ Bowser, A., & Shanley, L. (2013). New visions in citizen science. *Woodrow Wilson International Center for Scholars, Washington, DC*.

Lewandowski et al.^[140] analysed the public perceptions around citizen science and found that confidence in citizen science project findings were higher in studies where professional scientists and volunteers collaborated on all aspects of the research. They propose that co-created citizen science projects could be used in cases where there is concern about public confidence in a project. They found that respondents placed more confidence on findings derived from a hypothetical citizen science project when it had involvement from professional scientists, rather than only volunteer (non-professional) citizen scientists. However, they also found that 24% of respondents in the same study were more confident if citizen scientists had been involved instead of only professional scientists. They discuss that some people place higher levels of trust in local knowledge than in information from professional scientists^[141]. Building relationships with citizen participants can be key to a project's ongoing success, sustainability, and learning outcomes, due to the trust and team building process that occurs^[142]. Co-created, community driven citizen science projects offer great promise for engagement with underserved communities^[143].

3.6 Being Reflexive

The final section of the Model is the 'Being Reflexive' section. In developing a citizen science project an initial plan is made for the project development and implementation, but a reflexive review process should occur at multiple points along the project journey. The reflexivity and reflection on method allows for changes in process or direction to be made, based on findings or feedback.

The 'Being Reflexive' section contains six overarching themes: inclusive participation, developing trust, creating partnerships, being context specific, monitoring power dynamics, and valuing different types of knowledge. We settled on these six themes for the Being Reflexive section due to their dominance in the literature, the centrality of the concepts in

¹⁴⁰ Lewandowski, E., Caldwell, W., Elmquist, D., & Oberhauser, K. (2017). Public Perceptions of Citizen Science. *Citizen Science: Theory and Practice*, 2(1).

¹⁴¹ Lewandowski, E., Caldwell, W., Elmquist, D., & Oberhauser, K. (2017). Public Perceptions of Citizen Science. *Citizen Science: Theory and Practice*, 2(1).

¹⁴² Kearney, J., Wood, L., & Zuber-Skerritt, O. (2013). Community–university partnerships: Using participatory action learning and action research (PALAR). *Gateways: International Journal of Community Research and Engagement*, 6(1), 113-30.

¹⁴³ Soleri, D., Long, J., Ramirez-Andreotta, M., Eitemiller, R., & Pandya, R. (2016). Finding pathways to more equitable and meaningful public-scientist partnerships. *Citizen Science: Theory and Practice*, 1(1).

project development and because excluding them can exacerbate prior inequities. These themes are listed in Table 10 below with suggested questions to reflect on for each. As all of these themes are complex, nuanced, and interconnected with other themes, we suggest researchers explore these concepts more before beginning a citizen science project. Because only high-level summaries of the six themes in the table can be included in this article, one sub-theme, power dynamics of language and terminology, has been expanded upon to help show this nuance (as underlined in Table 10 below).

Table 10 – Themes related to ‘Being Reflexive’

BEING REFLEXIVE FOR SOCIALLY JUST PROJECTS	Throughout the project, consider the following six key issues in each stage...
Inclusive participation	Seeking out diverse participation. Project designed for people of different backgrounds, needs, skills, resources, and experiences. Accessible projects.
Developing trust	Designing projects to build trust in science, in fellow participants, in the citizen science process through participation in the project.
Creating partnerships	Build genuine relationships with relevant partners e.g. indigenous nations, government agencies, academics & community groups.
Being context specific	Knowing how the project fits into the socio-cultural context of the area involved. Using locally specific/relevant language & content.
Monitoring power dynamics	Being actively conscious of your power as a paid researcher when engaging with unpaid volunteers. Creating realistic expectations. Monitoring racial, gender, age, <u>language, terminology</u> , and develop the ability to identify and acknowledge biases you and others bring to the project.
Valuing different types of knowledge	Accepting local and indigenous forms of knowledge and knowledge generation & sharing practices are legitimate. Consider giving them value within the project where appropriate. But also monitor possible cultural appropriation.

3.7 Power dynamics of language and terminology

How citizen science is defined can impact on who is involved and how. It can also impact whose knowledge is included or considered valid. The term 'citizen' is contested and in itself can be exclusionary, just as the term 'public' can't be used to generalise an entire population. It is the same with the term 'science' as there are many different ways of collecting information that might fall outside the bounds of traditional science terminology, or could be described as including citizen analysis, investigation, monitoring, or research^[144].

Lewandowski et al.^[145] suggest that 'citizen science' might not be a well-recognised term within the general public and other alternatives may be more effective for communicating around citizen science projects. However, they also state that the term 'citizen science' is becoming more prevalent and that researchers may benefit from using the term when publishing or communicating their research findings in other ways. One of the reasons they give for its prevalence is the formation of membership organizations such as the Citizen Science Association, the Australian Citizen Science Association, and the European Citizen Science Association, as well as the journal mentioned previously in this paper (*Citizen Science: Theory and Practice*). They state that these organisations have helped to debate and formalise the terminology within citizen science^[146].

Tweddle et al.^[147] discuss that accessible language needs to be used within citizen science projects, and that technical or academic language (including acronyms) are often not understood by the general public. Projects can be more inclusive if the language is accessible.

There is also the issue of inequalities and unbalanced power dynamics that different terms can create. Eitzel et al.^[148] describe how participation by citizen scientists can be changed by

¹⁴⁴ Eitzel, M. V., Cappadonna, J. L., Santos-Lang, C., Duerr, R. E., Virapongse, A., West, S. E., ... & Metcalfe, A. N. (2017). Citizen Science Terminology Matters: Exploring Key Terms. *Citizen Science: Theory and Practice*, 2(1).

¹⁴⁵ Lewandowski, E., Caldwell, W., Elmquist, D., & Oberhauser, K. (2017). Public Perceptions of Citizen Science. *Citizen Science: Theory and Practice*, 2(1).

¹⁴⁶ Lewandowski, E., Caldwell, W., Elmquist, D., & Oberhauser, K. (2017). Public Perceptions of Citizen Science. *Citizen Science: Theory and Practice*, 2(1).

¹⁴⁷ Tweddle, J. C., Robinson, L. D., Pocock, M. J. O., & Roy, H. E. (2012). *Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK*. NERC/Centre for Ecology & Hydrology.

¹⁴⁸ Eitzel, M. V., Cappadonna, J. L., Santos-Lang, C., Duerr, R. E., Virapongse, A., West, S. E., ... & Metcalfe, A. N. (2017). Citizen Science Terminology Matters: Exploring Key Terms. *Citizen Science: Theory and Practice*, 2(1).

the terminology used as it can change the way they are treated within a project or how they feel about their participation. An example of this is from the citizen science project OPAL, where their management of the programme avoided the term 'volunteer' when referring to citizen scientists to make it clear that they weren't just using the group for free labour^[149]. For some projects, citizen scientists are consulted about how the terminology affects them and ask what they would prefer to be called. Eitzel et al.^[150] give an example of farmers in Colombia who conduct their own experiments on their land. The farmers may investigate how to do land use practices differently than what typical scientific research would advocate for, but they would not claim the term 'citizen science' to describe what they do.

Communication styles of the citizen scientists should be valued and not diminished. Straub^[151] highlights how some citizen science projects keep the exact language used in their answers, including spelling, context and grammar. They suggest that the user's understanding of the subject shows through in their unedited answers, as well as their personality and the level of formality used. Terminology has the power to shape the creation of knowledge, influence what is researched and by whom^[152]^[153]^[154]. This is often true with the translation of indigenous concepts to English, without properly assessing if the term reflects the concepts. Scientific terminology may miss subtleties during the translation, and therefore miss out on a wealth of knowledge that are expressed through the indigenous concepts^[155]. Racial inequalities and colonisation can be continued through choices of language used to refer to people, activities, and objects. An example of this is shown in Eitzel et al.^[156] where they describe how the Standing Rock Sioux, who were fighting against fossil fuel infrastructure

¹⁴⁹ Riesch, H., & Potter, C. (2014). Citizen science as seen by scientists: Methodological, epistemological and ethical dimensions. *Public Understanding of Science*, 23(1), 107-120.

¹⁵⁰ Eitzel, M. V., Cappadonna, J. L., Santos-Lang, C., Duerr, R. E., Virapongse, A., West, S. E., ... & Metcalfe, A. N. (2017). Citizen Science Terminology Matters: Exploring Key Terms. *Citizen Science: Theory and Practice*, 2(1).

¹⁵¹ Straub, M. (2016). Giving Citizen Scientists a Chance: A Study of Volunteer-led Scientific Discovery. *Citizen Science: Theory and Practice*, 1(1).

¹⁵² Ng, S. H., & Deng, F. (2017). Language and power. In *Oxford Research Encyclopedia of Communication*.

¹⁵³ Woodend, J., Fedoruk, L., Beek, A., Roy, S., Xu, X., Groen, J., & Li, X. (2019). The Privileging of English Language Use in Academia: Critical Reflections from an International Doctoral Seminar. *Emerging Trends in Education*, 2(3).

¹⁵⁴ Alogali, A. (2018). World Englishes: Changing the Paradigm of Linguistic Diversity in Global Academia. *Research in Social Sciences and Technology*, 3(1), 54-73.

¹⁵⁵ Johnson, M. (1992). Research on traditional environmental knowledge: its development and its role. In *Lore: capturing traditional environmental knowledge*. IDRC, Ottawa, ON, CA.

¹⁵⁶ Eitzel, M. V., Cappadonna, J. L., Santos-Lang, C., Duerr, R. E., Virapongse, A., West, S. E., ... & Metcalfe, A. N. (2017). Citizen Science Terminology Matters: Exploring Key Terms. *Citizen Science: Theory and Practice*, 2(1).

being built across their land, consider themselves a nation, whereas local officials consulting on the Dakota Access pipeline referred to them as ‘stakeholders’. They did not consider themselves ‘stakeholders’ so they did not attend the ‘stakeholder meetings’. Within any community engagement practice, the choice of terminology is important and can define the outcome of a project. It is especially true of citizen science, as knowledge development is impacted by which terms are used to define the project parameters and shape the related power dynamics.

Some researchers include crowdsourcing data as part of the citizen scientist definition, others exclude it. Tweddle et al.^[157] use the term ‘citizen scientist’ for those participating in a wide range of projects, including ‘crowdsourcing, long-term monitoring schemes and environmental surveys’. However, the interpretation of the term ‘citizen’ is becoming increasingly divisive with the current refugee issues globally. The term citizen can range from ‘membership in a group by virtue of participation in its social body, to strictly legal interpretations associated with specific territories’, and it is the latter definition that can throw up complexities when working with refugee communities^{[158][159][160][161]}. Legal interpretation can be restrictive of who is considered a ‘citizen’ in a particular country and can create exclusion issues.

4.0 Discussion and concluding remarks

A literature review was conducted on the attributes that make up a citizen science project. A thematic analysis of this literature was undertaken on the content of the 160 articles which identified 36 main themes and 221 sub-themes. As a way to organise and display the results of the literature analysis, the main themes identified were compared with a logic model^[162] and then adapted into a framework for disaster citizen science project design. The resulting

¹⁵⁷ Tweddle, J. C., Robinson, L. D., Pocock, M. J. O., & Roy, H. E. (2012). *Guide to citizen science: developing, implementing and evaluating citizen science to study biodiversity and the environment in the UK*. NERC/Centre for Ecology & Hydrology.

¹⁵⁸ Bonney, R., Ballard, H., Jordan, R., McCallie, E., Phillips, T., Shirk, J., & Wilderman, C. C. (2009). Public Participation in Scientific Research: Defining the Field and Assessing Its Potential for Informal Science Education. A CAISE Inquiry Group Report. *Online Submission*.

¹⁵⁹ Irwin, A. (1995). Citizen science: a study of people, expertise, and sustainable development.

¹⁶⁰ Riesch, H., & Potter, C. (2014). Citizen science as seen by scientists: Methodological, epistemological and ethical dimensions. *Public Understanding of Science*, 23(1), 107-120.

¹⁶¹ Soleri, D., Long, J., Ramirez-Andreotta, M., Eitemiller, R., & Pandya, R. (2016). Finding pathways to more equitable and meaningful public-scientist partnerships. *Citizen Science: Theory and Practice*, 1(1).

¹⁶² Knowlton, L. W., & Phillips, C. C. (2012). *The logic model guidebook: Better strategies for great results*. Sage.

Framework is aimed at researchers who want to start a new citizen science project and is split into seven sections; Motivations for the Project, Level of Citizen Participation, Disaster Specific Considerations, General Project Design Considerations, Project Outputs, Project Outcomes, and a section for wider critical considerations labelled 'Being Reflexive.'

The Framework acknowledges that there are different motivations behind citizen science projects – both for scientists and citizens – which include gathering data, processing datasets, engagement, and creating science for change projects. People's motivations should guide the type of citizen science project developed. There is no 'right' project, only a project that is right for each motivation and context. Motivations and project specifics will also guide the level of input citizen scientists have on a project which can range from less input via contributions only (e.g. crowdsourced data) through to the co-creation of projects (e.g. extreme citizen science).

While the exact level of citizen contribution will depend on the motivations and context, the review did highlight that more participatory projects do have particular benefits, from raising awareness of issues, through to the development of solutions to address those issues. Thus, community preparedness and resilience can be increased through the power of participation in science. However, to do this, projects need the right design components and considerations. The Framework highlights many of these important project design considerations, including disaster-specific considerations and other aspects such as ethics, scale, resources, finance, training, use of appropriate language/terminology, technology, and consideration of reciprocity or reward. The Framework also highlights the importance of thinking about outputs and outcomes in advance, and being reflexive the whole way through the project development and implementation phases to ensure the project is fit for purpose, and tweaks are made as necessary.

Given the role that citizen science can play in building community resilience, more work could be done to design citizen science projects with the explicit goal of developing more resilient communities. For example, projects could both collect data on local hazard potential or impacts, and at the same time could educate communities to increase their preparedness and awareness for future disaster events. An example is the Aotearoa New Zealand project

GeoNet Felt Reports which has a citizen data collection application (app)^[163]. The GeoNet app allows citizens to interact with and contribute to earthquake shaking data measurement. The app is very popular amongst citizens after earthquake events, attracting thousands of geo-located citizen contributions after larger events^[164]. There are similar earthquake related projects elsewhere in the world, including participatory earthquake early warning systems^[165]. Other examples of more participatory or co-created projects have been presented in this paper, for example those which have focused on undertaking citizen science to understand and address environmental issues^[166].

Future research could explore how community resilience might be more explicitly embedded into citizen science projects to help people better understand changes in the environment and increase resilience to these changes. This is particularly relevant given our changing climate, the increasing number of climate-related disaster events, and the impact these are having on the environment and people. Citizen science, particularly in the participatory space provides an opportunity to collect data to help understand and develop solutions to act upon phenomena impacting us all. Additionally, given that citizen science can be reflected in a range of motivations and types of projects, there is opportunity to think more broadly about what types of projects might be most effective. Collecting crowdsourced climate data or undertaking participatory projects at local levels may be one approach, but at the other end of the spectrum there may be opportunities for citizens to contribute via policy and legislative mechanisms. Contributions at this highest level via citizen-led science could be an effective and untapped avenue for instigating solutions and change, and should be the focus of further investigation.

3.3 Link to Part 2: Chapter 4

¹⁶³ <https://www.geonet.org.nz/>

¹⁶⁴ Little, C. L., McBride, S., & Balfour, N. (2016). GeoNet's Felt Rapid': Collecting What Is Needed, When You Need It, No More, No Less. Rapid, Volumous Data For Response Versus Detailed, Precise Data For Research. *AGU FM, 2016*, PA53A-2277.

¹⁶⁵ Marchezini, V., Horita, F. E. A., Matsuo, P. M., Trajber, R., Trejo-Rangel, M. A., & Olivato, D. (2018). A review of studies on participatory early warning systems (P-EWS): Pathways to support citizen science initiatives. *Frontiers in Earth Science, 6*, 184.

¹⁶⁶ Eitzel, M. V., Cappadonna, J. L., Santos-Lang, C., Duerr, R. E., Virapongse, A., West, S. E., ... & Metcalfe, A. N. (2017). Citizen Science Terminology Matters: Exploring Key Terms. *Citizen Science: Theory and Practice, 2*(1).

Having considered what community resilience and citizen science consist of, how these might be related, and how they might be applied into a practical framework for developing citizen science projects, I now move into Part Two of the thesis. Part Two focuses on my involvement in the Zero Carbon Act campaign in Aotearoa New Zealand, an example of a citizen-led science and policy project and to explore how citizen contributions at high level policy can impact change. I will focus on the story of self – an autoethnographic account of analysing activism and academia to understand the role of citizen science and community resilience within such a context.

4 Part two: Chapter 4 – The Zero Carbon Act Case Study

4.1 Introduction

Following an extensive literature review focusing on citizen science, community resilience, and the development of a framework that supports effective citizen science projects, the next step was to find a case study where the aspects identified in Part One could be investigated further. After an initial search for a case study community, the connection was made that my own community (youth climate change activists) were already involved in a citizen-led science and policy project around climate change. This became the case study for my PhD.

The project was called the Zero Carbon Act campaign, and I was the National Convenor for the duration of the campaign (2016 - 2019). For this project, myself and our small team of volunteers

from the youth climate group Generation Zero developed a blueprint for a Zero Carbon Act, a climate law, which was adopted by government and passed unopposed into law by the New Zealand Parliament in November 2019.

Part two of the thesis therefore comprises an autoethnographic exploration of my participation in helping set up and run the Zero Carbon Act campaign for new climate change law in Aotearoa New Zealand and reflects on how such a campaign links with citizen science and community resilience in the context of increasing natural hazard risk due to climate change.

The autoethnographic case study chapter is split into the following parts:

- Choosing a citizen science project to investigate,
- Research questions,
- Zero Carbon Act campaign overview,
- Supporting theories and concepts,
- Methodology,
- Methods.

4.2 Choosing a study project

Citizen science provides the opportunity to understand the lived experience of climate change impacts over time, harnessing the power of differing ways of capturing and producing knowledge: sharing stories, photos, images, anecdotes, songs, history, and art. The PhD literature review, thematic analysis and Framework development had given me a useful knowledge base to work from when picking a project to study more in depth for the second half of the research.

As mentioned in Chapter 1, the 2019 American Citizen Science conference in Raleigh, North Carolina, with its strong focus on environmental justice, provided an opportunity to reflect upon how I might approach my PhD research.

Initially, ideas for future research work came flooding into my brain while at the conference – including setting up a community science organisation with a focus on climate and environmental justice that centred Te Tiriti o Waitangi at its core. I could potentially start a new project that identified and tracked climate change impacts, for example through community climate archives, a climate time capsule, capturing living histories, or through sensor inventories. Alternatively, I could

create a civic resilience platform to create community by sharing experiences, or develop ways to report climate impacts, e.g., coastal change in your area via a story map.

However, I wanted my PhD to highlight existing work that is inspirational, and seek new ways to approach old problems, boosting creativity and engagement, reaching people through their hearts and minds, and connecting issues with them in ways that resonate. Creative projects have the ability to light the path to show new futures, and hold governments accountable for inaction. Some key questions for me included: How are communities already finding ways to participate in a climate change space which could lead to increased resilience, particularly when this space is often confusing, scary, and disempowering? How can communities take back agency and a seat at the decision-making table through citizen-led science?

At the conference I recognised my own experiences and our Zero Carbon Act journey in the environmental activism stories and research case studies presented there; and so, I found where I could fit more authentically within the citizen science field. The intersection of the two worlds I'd been trying so hard to keep apart was exactly where my PhD was suited to be. It was where I felt I could add value using my knowledge and experience. Combining my worldview with the academic system I was trying to fit into was no longer scary. There was joy at finding people who had already publicly made connections between the worlds I was straddling (environment, hazards, activism, academia, citizen science) and examples of how they could be connected and taken seriously within academia. I had been connecting them in other ways (e.g. the ZCA campaign) without even realising it.

If I focus on the Zero Carbon Act case study, I will need to be okay with the outcomes not being 'as great' as I hope and the timeframe being longer than the time I have. I will need to extend the PhD by at least a year. So, if I decide to do this, I need to accept that and the challenges that come with that. Do I see this as a sacrifice? Do I see it as a necessity? Do I see it as being beneficial to my career? Do I see it as career limiting? Does it matter to me if it is career limiting? Do I see it as an essential part of how I want to research? What does this approach/method mean to me? Why? These are the questions I need to answer over the next few weeks as I reassess my PhD topic, these are the questions that will shape the new

direction. I then need to try figure out what I don't know, and play catch up – fast (PhD Diary – 17/03/19).

I had been busy trying to find the 'right' external community to research, but I hadn't considered my own because of my personal hang-ups around the activist/academia intersection. I hadn't wanted to admit to my activism within academia for fear of future repercussions and I hadn't wanted to use my community as I'd considered them (and myself) not fit for study because of the bias associated with campaigning for solutions or being against particular ideas, policies, and industries. However, upon reflection, it seemed a perfect opportunity to explore the ZCA campaign as a citizen-led science and policy project, and consider the implications for community resilience. The project could be categorised as citizen- or community-led, sitting at the highly participatory or 'extreme' end of citizen science. It involved using already collected raw climate science data by scientists, which was collated and analysed by Generation Zero, to create something new (i.e. the ZCA legislation drafting notes and public communications) from that data. This type of project is similar in nature to other citizen science projects that focus on using previously collected data, for example, in relation to astronomy where citizens have used previously collected astronomical data to identify new constellations or galaxies, such as Galaxy Zoo¹⁶⁷.

4.3 Research questions

The following research question was used to focus the research for this half of the thesis to explore an example of the lived experience of citizen science.

Part Two: Zero Carbon Act autoethnographic study

2a) What lessons can an autoethnographic analysis of the Zero Carbon Act campaign contribute to future community-led climate change projects, as well as wider disaster and climate change citizen science practice?

The following section will outline the Zero Carbon Act campaign – who it was, what it did, and what my role was.

¹⁶⁷ <https://www.zooniverse.org/projects/zookeeper/galaxy-zoo/>

4.4 The Zero Carbon Act campaign

The Zero Carbon Act was a name given to a proposed climate change law for Aotearoa New Zealand that was developed to hold current and future governments to a plan for reducing the country's emissions. The Zero Carbon Act framework was created by myself and a small group of young people at Generation Zero (with help from policy experts and lawyers) who decided we didn't have time to keep waiting for politicians to take meaningful action on climate change. The public campaign was driven for four years by our core team and in collaboration with a coalition of NGOs including WWF New Zealand, Forest & Bird, Oxfam, World Vision, Quakers, the Anglican Church, and many more. Towards the end of 2017 the Zero Carbon Act law idea was picked up by the new coalition government, and the Ministry for the Environment consulted nationwide on the idea of a Zero Carbon Bill during mid-2018. The Bill was tabled in Parliament as the Climate Change Response (Zero Carbon) Bill in May 2019 and passed into law in November of that same year.

As mentioned in the introduction section of this thesis, I volunteered as the National Convenor of the Zero Carbon Act campaign for its duration. I coordinated a team of 10 core volunteers, and a wider pool of around 100 people. During 2016-2019 I spent around 15-20 hours unpaid each week keeping the campaign moving. When I started as the campaign's National Convenor I couldn't think of a better use of my time than helping to set up the legal infrastructure to force government action on climate change and, on a personal level, to give any future children I have a fighting chance at what I would consider to be a 'normal' life.

This chapter focuses on the Zero Carbon Act campaign by Generation Zero and others (2016-2019), rather than the New Zealand government's official Zero Carbon Bill process (2017-2019). First, I give a brief overview of Generation Zero as an organisation before explaining why we thought a climate law was needed and so decided to do this particular campaign. I then give an overview of the Zero Carbon Act campaign including the team culture and how we worked, as well as the result of the campaign and how the government's Bill differed from our own.

4.4.1 Generation Zero

Generation Zero¹⁶⁸ is a volunteer youth climate change organisation based out of 4-5 urban centres in Aotearoa New Zealand, depending on the numbers and locations of the volunteers at any one

¹⁶⁸ <https://www.generationzero.org/>

time. Generation Zero was formed in 2011 in response to young New Zealanders returning from two successive climate change negotiations (COPs) in Copenhagen (2009) and Lima (2010). These young people decided that climate action needed to be increased back home in Aotearoa New Zealand as the international processes appeared to be stalled at best, and completely ineffective at worst. The group was named Generation Zero (abbreviations Gen Zero, Gen Z, and GZ) to highlight that their/our generation is the last that can act to get emissions to zero to stop the worst of climate change. The organisation 'vision' changes every couple of years to match the views and priorities of the current members, as well as the changing climate movement. Non-partisan ways of working have always been one of the key organisation values.

4.4.1.1 Vision of Gen Zero

The Gen Zero Vision as of January 2021:

Generation Zero is a youth-led climate action organisation. We mobilise New Zealanders to engage with decision-making and campaign for intergenerational climate justice. We campaign for smarter transport, liveable cities and independence from fossil fuels by lobbying government, business and other actors to advance climate change action. It's time for New Zealand to step up. ¹⁶⁹

Gen Zero was established as a youth-led organisation, with many members being university students and with some campuses having student club Gen Zero groups. Its members are not exclusively young people, but the majority would be young or 'youth adjacent' (<35 years old). Alongside students, young professionals are involved, many of whom joined while at university and have carried on their involvement once they graduated and moved on to paid employment. There have been occasional paid roles, more commonly part time administration roles, over the ten-year history of Gen Zero, but most of the membership are volunteers. Groups are usually based in Aotearoa New Zealand cities: Auckland, Wellington, Christchurch, Dunedin, and sometimes Hamilton. Regional group numbers can range anywhere from 2 to 30 people depending on time of year as volunteer capacity changes e.g. university exams or business end-of-year busy periods. Group numbers often change with the peaks and troughs of campaigns or pieces of work.

4.4.1.2 Membership

¹⁶⁹ Found on the Generation Zero website, January 2021. <https://www.generationzero.org/>

It is useful to note the types of people involved in Gen Zero to understand motivations, reasons, and mechanisms for being involved in the citizen science of the Zero Carbon Act Campaign.

‘Membership’ or ‘volunteers’ are used synonymously to describe people who participate in Gen Zero.

As previously mentioned, Gen Zero is mainly regionally based, which means that the main form of contact between members is weekly regional meetings. For the occasional nation-wide campaign, such as the Zero Carbon Act campaign and Fix-Our-Future campaign¹⁷⁰, meetings are held online. There are a few inter-regional meetings for such campaigns, perhaps two-three times per year, and often there is one ‘all of organisation’ meeting once a year, called Summerfest. Summerfest usually brings around 50 Gen Zero members together in one place for a long weekend of planning, re-connecting, meeting new members, organisational development, training, and fun.

Iterations of Gen Zero differ from year to year, even from month to month, depending on the direction of membership at the time, their levels of experience, their backgrounds and interests, and what is happening in their area/city in terms of climate policy (or lack thereof!). A statistically representative sampling of Gen Zero members was conducted in mid-2014 by Dodson and Papoutsaki (2017) to survey members and ask about demographics. It found that Gen Zero is homogenous in its demographics and political leanings. Findings from the survey state that Gen Zero is too white and upper class to be effective and inclusive in the climate movement, as follows:

To put it bluntly, they are 99% young privileged white hipsters who hang out with people too similar with themselves for anyone who's not part of that world to feel comfortable joining.

A more diverse range of people would mean changing significant parts of how the org functions socially, and right now that homogenousness is a strength. People make great sacrifices for their own clan. Like a cult in some ways (Dodson et al., 2015).

Similarly, Nairn et al., (2021) conducted a study of 6 youth activist groups in Aotearoa New Zealand, one of which included the Gen Zero Auckland team. Karen Nairn, one of the researchers on that team, described Gen Zero as mainly pākehā, mainly men, mainly from privileged backgrounds with no dependents and having a ‘time advantage’ for activism. That only the Auckland group was included in their study caused alarm to some in Gen Zero, myself included, due to the historical

¹⁷⁰ <https://www.scoop.co.nz/stories/PO1507/S00057/government-sets-climate-change-target-for-the-1.htm>

differences between the Auckland group and the rest of the Gen Zero regional groups. Often there have been different methods of working, different priorities, and framing used between the different regions. Gen Zero has also been the subject of Master's theses (Noronha, 2013; Moon, 2013) and was featured in a review of climate change action at the University of Auckland (Tokorangi, 2019).

4.4.1.3 Tactics and activities

It is important to consider the types of activities Gen Zero were involved with, so that the Zero Carbon Act campaign can be seen in context.

Gen Zero was initially known for 'stunt' tactics, especially in its first few years, which are now more common with groups such as Extinction Rebellion¹⁷¹ and 350 Aotearoa¹⁷². These usually took the form of public stunts aimed at creating a spectacle, gaining news coverage and drawing attention to a particular campaign or issue that Gen Zero was focused on at that time in that region/area. Examples of early tactics include a 'Funeral for business as usual' (funeral parades down main streets of cities); wearing underwear on trains to 'uncover' bad transport policy; and bake sales to 'fund the transition to a low carbon economy'.

The most common Gen Zero tactics or campaigning methods are submissions, petitions, open letters to government or print media, direct political or interest group lobbying, and op-eds (opinion pieces in news media) etc. Digital campaigning, which plays a large role in the Gen Zero campaigns, is a way young people are engaging politically (Dodson & Papoutsaki, 2017).

Early Generation Zero campaigns featured the well-worn vocabulary of global campaign and activist organisations, including flash-mobs, stunts and funeral processions (The Death of Business as Usual 2012) to draw attention to climate-change issues. Campaign and mobilisation tactics quickly shifted however, from these 'direct-action' tactics, to a digital and communicative focus, seeking to establish and represent core 'brand values' and organisational identity and purpose to online constituencies (Noronha, 2012). This shift was underpinned by knowledge and experience of campaigning tools and techniques imported

¹⁷¹ <https://rebellion.global/>

¹⁷² <https://350.org.nz/>

from international progressive campaigning networks, such as GetUp! and Organizing for America/Organising for Action (Dodson & Papoutsaki, 2017:199).

Consequently, moving into political spaces, where that of the Zero Carbon Act campaign is situated, was a natural progression for the Gen Zero group. The following section outlines reasoning for why we started the Zero Carbon Act campaign, from the scientific evidence that highlighted the climate crisis through to political inaction.

4.4.2 Why we decided a climate law was needed

Despite global agreements, including the Paris Agreement which had been signed two months prior to the start of the Zero Carbon Act campaign, Aotearoa New Zealand's greenhouse gas emissions were 24% higher in 2018, compared to 1990 levels¹⁷³. Successive New Zealand governments had been terrible at initiating concrete action that effectively reduced emissions or adapted to future climate change impacts. Robert McLachlan, Professor in Applied Mathematics at Massey University, stated in December 2020 that New Zealand as a country needed to face the fact that it has one of the worst climate change action records of industrial nations globally, with 12 out of 43 industrialized countries having seen net emissions increase between 1990 and 2018 (McLachlan, 2020). Aotearoa New Zealand was near the top of that group of climate change failures, and we thought that the climate change policies did not match up with its new ambition of the Paris Agreement.

4.4.2.1 ZCA campaign formation

In early 2016 in a café in Wellington, a small group of young people from Generation Zero Wellington, myself included, were trying to work out what to campaign on next in the city – things like sustainable transport, urban planning, and liveable cities. One group member said *“what we really need is a climate change law like they have in the UK, why don’t we just write one ourselves?!”* So we took the idea to our other Gen Zero teams nationally and the Zero Carbon Act campaign was born.

We had an initial meeting in April 2016 to gather interested members from around the country for three days of strategic planning. We had team members from Wellington, Hamilton, Christchurch,

¹⁷³ New Zealand’s greenhouse gas emissions, Statistics New Zealand.
<https://www.stats.govt.nz/indicators/new-zealands-greenhouse-gas-emissions>

and Dunedin. Generation Zero Auckland, which had a complicated relationship with the rest of the organisation at the time, did not want to take part in the campaign. Instead, we fortunately had a Wellington member moving up to Auckland at the time who started a separate ZCA team there. We planned for a five plus year campaign. We decided at that meeting to ‘launch’ our intent to draft the law at Parliament in June. This gave us a deadline to name the campaign, as well as develop the branding and the overarching public communications. We gave it the name Zero Carbon Act after lengthy discussions brainstorming all sorts of different name ideas for the campaign. During this initial stage we also conducted a power mapping analysis, where we mapped out who could help us, and equally, who could get in the way of our idea.

Our motivation was that the government did not have a suitable plan for climate change action, one that would actually start reducing emissions, so we decided to create one for them, as illustrated in the tongue and cheek meme image (Figure 4) from our team’s op-ed in The Spinoff when launching the campaign (McLaren, 2017). The Zero Carbon Act campaign was as much about selling a vision about Aotearoa New Zealand’s future as it was about policy mechanisms. It was intended to give us as a country something to measure progress against, and to use as a tool to hold current and future governments accountable to, and for, their climate promises, and to take them to court over their inaction.

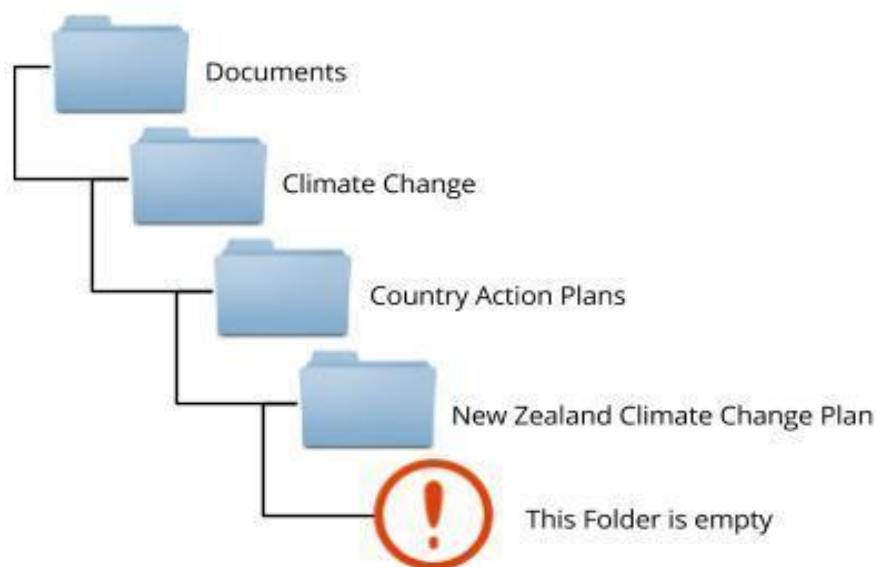


Figure 4 – Meme image from ZCA campaign launch Spinoff article highlighting the lack of political plan for approaching climate change action in Aotearoa New Zealand (McLaren, 2017).

We ‘launched’ our intent to draft the Zero Carbon Act on a cold windy morning outside Parliament in June 2016, in the form of a photo opportunity with a few team members and any available friends that were nearby at the time. We had purposefully not invited Members of Parliament (MPs) to be there, to save only one party turning up in support and it being branded a partisan campaign from the outset, but we did invite media and wider climate movement supporters. It was a very small crowd of around 15 people – a few of our team, a few friends, and flatmates. I read a speech, we took some photos, and that was it. It was very unceremonious, but it was enough for us to have a stake in the ground that we were going to write the draft law, and it was almost more of a message to our supporters as it was to Parliament and to the MPs.

We aimed to create a network of networks – both within climate change fields in New Zealand and internationally, including climate activists, policy experts, Non-Government Organisations (NGOs), and scientists. We also aimed to connect with people and groups outside of the climate system, including other types of social justice NGOs, church groups, sports clubs, and political groups, to broaden our ability to create public support for the idea. These connections proved invaluable when creating the movement for the Zero Carbon Act. By the end of 2016 we had formed two teams within our ZCA campaign which ran different aspects of the campaign. First, a policy team had begun drafting our blueprint for what we had by then labelled as a Zero Carbon Act. We created a policy reference group made up of policy experts, lawyers, and academics, who could guide our policy team on their journey. Our proposed law was similar to the UK’s Climate Change Act (Climate Change Act, 2008) in many ways, but it had to be tailored for the Aotearoa New Zealand context. Second, we had a community outreach team that did presentations up and down the country, wrote op-eds and blogs, and formed a group of allied NGOs who could share our idea with their networks. While our policy team was getting the technical details right, our community outreach team focused on socialising the new proposed law with anyone that would listen. These two teams are expanded upon in the following two sections.

4.4.2.2 Policy team

The policy work for the campaign behind the scenes was enormous. It was often the forgotten part of the story. But our team worked tirelessly for six months to bring the abstract idea for a climate law to the stage where we could launch it as a cabinet policy blueprint in front of Parliament, to a much bigger crowd than our initial launch. Our policy team compared and contrasted a wide range of climate science and policy documents, emissions pathways, mitigation techniques, the social acceptability of different policy options, and new and projected science outputs. We reached out to

a number of groups and climate change experts in 2016 to gather data and background information on the topics of climate science through to policy. We talked to different community groups up and down the country about our idea for a climate law and asked what they'd want it to look like and include. We looked at policies from almost a dozen countries as part of our research. Our most detailed research focused on climate laws from three places that had similar Parliament or legal systems: the United Kingdom (Climate Change Act, 2008), Ireland (Climate Action and Low Carbon Development Act, 2015), and the state of Victoria in Australia (Climate Change Act, 2017).

4.4.2.3 Community outreach and education team

The community outreach team aimed to get people excited about the 'why' behind the idea of a Zero Carbon Act. We were trying to sell a vision of a safe, liveable future, delivered within the next few decades. We wanted to focus on using a just transition pathway (Just Transition Alliance, 2024) to make sure that we didn't leave the more vulnerable or impacted communities behind, especially structurally oppressed communities, including frontline and indigenous communities. We also wanted to consider those communities whose livelihoods will be impacted by changes to a low carbon economy, including farming and mining. We ran countless community events and collected thousands of petition signatures asking for Parliament to create and pass a Zero Carbon Act. Our volunteers became skilled in media relations, public presenting, event coordination, and communications. We partnered with environmental and development NGOs including WWF New Zealand, Forest and Bird, Oxfam New Zealand, ActionStation, and World Vision, as well as many other groups.

We aimed to capture the climate narrative back from the oppositional lobby groups and set a new narrative around the Zero Carbon Act. We were not aiming for mass mobilisation; instead it was a strategic campaign, using a national core team, local teams, and spontaneous volunteers, to run tactics aimed at getting cross-party support for the law idea. We were pleased to find that people were then organising their own ZCA related events. We didn't want to own the idea of the law; we wanted people to get in behind it. However, we did want to make our position on it very clear which happened in a) our public communications, and b) our policy design. But we really wanted other groups to take the idea and run with it. An example of this was the Back the Act campaign that 15 International NGO groups set up as they couldn't officially back our ZCA campaign due to the activist nature of our organisation, but they made their own call for a ZCA type climate law.

We knew we would need good mobilisation of youth on university campuses to help add volunteers to the campaign. For this we needed to connect and engage with these networks, giving clear requests for what things they could do to help. We aimed to trust their abilities by giving them agency to do actions or campaign tactics their way, while supporting them and providing help when needed. Because we were considered ‘youth’, even though many of our core team and volunteers were aging out of that category, we did come up against those who were patronizing in their approach to us, including both scientists and MPs. But it also meant we were seen by many as relatively neutral and unthreatening.

We used a variety of different tactics during the campaign, many of which will be analysed in later Chapter Six of this thesis. Some of those tactics included training young people how to have conversations with both older people in their lives and Members of Parliament (MP) about the idea for a climate law (“Elbow Your Elders” and “Adopt an MP”), a petition to Parliament, open letters in the newspaper, giving climate change books to rural libraries, and a bike tour from Auckland to Wellington. We gained backing from businesses and youth political parties from across the political spectrum. On 12 October 2017, attendees at the Australia/New Zealand Climate Change & Business Conference in Auckland, including representatives from the business sector, NGOs, and central and local government, unanimously passed a resolution in support of the concepts outlined in our Zero Carbon Act proposal.

4.4.3 Links to citizen science

Our teams drove the project and we held the pen for the first 18 months of the campaign. We were using academics as sounding boards to start thinking and getting advice on contentious and complicated issues of science and policy. The project was very much citizen-led with academics being invited to take part in science for change, and we were upskilling ourselves and the wider campaign team members and other communities along the way.

As mentioned in the case study introduction, the citizen-led Zero Carbon Act campaign was similar in nature to other citizen science projects where citizens have made use of existing data to freshly interpret and understand that data and apply it in new ways that are useful. It can be argued that this project was akin to the process undertaken by scientists and other researchers when they review information for a scientific project. But the very fact that this scientific review effort was led

by citizens in this circumstance, makes the ZCA campaign inherently a citizen science project. As outlined in Chapters 2 and 3, citizen science projects can comprise many forms. Data was accessed, reviewed, and reanalysed by the Gen Zero team specifically to: (1) help understand climate issues and policy approaches, so that these could be applied into a new Zero Carbon Act; and (2) present to communities to garner support for a ZCA. Examples of how data was reanalysed and utilised are presented in Table 11 below.

Table 11 - Examples of how data was reanalysed and used as part of a citizen-led approach to developing a ZCA

Policy team	
Analysed scientific arguments for and against treating biogenic methane the same as other greenhouse gases (GHGs) in policy.	Embedded a 'split gas' approach within the drafting of the Zero Carbon Act as a way to a) highlight how different GHGs behave differently in the atmosphere (e.g. longevity) and b) to bring the agricultural sector to the metaphorical table to engage in the Zero Carbon Act discussions.
Document analysis of different countries' policies as part of our research into what the law could like and how it could work.	Identified specific policies that could be applied in an Aotearoa New Zealand context.
Analysed scientific arguments for choosing different climate change solutions and GHG reduction targets.	Used the scientific evidence to draft reduction targets for the proposed ZCA (zero net emissions of long-lived greenhouse gases by 2050 or sooner, and significant reductions on biogenic methane, in line with the IPCC's 1.5°C report).
Community outreach and education team	
Used scientific interpretation of climate impact data to summarise how climate change would impact different regions of Aotearoa New Zealand (such as temperature and sea level rise projections).	Presented to numerous community groups around the country, using this data interpretation to tell the story about the future our country faces with climate change and to garner support for the need for an Act.
Collected petition signatures	Used data from signatures to show level of support for the proposed law.

4.4.4 Policy launch

Our Zero Carbon Act was a framework, and we called it a ‘blueprint’. It outlined the need to have a target in law for Aotearoa New Zealand to reduce its emissions; a term target for 2050, and smaller targets that we will have to reach to make that happen (Table 12). It required adaptation plans and mitigation plans to set out what reductions need to be made in different sectors, what a work program would look like, and how it could be implemented. It also set up an independent climate commission, to oversee that process. When we created our Zero Carbon Act blueprint, we adapted it from the UK's Climate Change Act to be fit for the New Zealand context, which ensured including aspects such as:

- honouring Te Tiriti,
- acknowledging our place of privilege in the South Pacific amongst Island nations that are already feeling severe impacts of climate change,
- taking into account our high rates of agricultural emissions,
- acknowledging our need to act quickly and provide a just transition for those impacted by the changes needed.

Table 12 – Gen Zero summary information used to describe the Zero Carbon Act blueprint

What is the Zero Carbon Act?
The Zero Carbon Act is a legal framework based on the UK's Climate Change Act 2008. It requires governments to reduce New Zealand's emissions year-on-year and plan towards a long-term target: zero net emissions of long-lived greenhouse gases by 2050 or sooner, and significant reductions on biogenic methane, in line with the IPCC's 1.5°C report.
How does it work?
The Zero Carbon Act will require future governments to set a pathway of five year 'carbon budgets' on track to the zero carbon target and produce clear plans to meet these. It will establish an independent Climate Change Commission to provide expert advice on targets and policies and to monitor the Government's progress. The Act will also require the government to prepare a National Climate Risk Assessment and a National Adaptation plan to address these climate risks, which include sea level rise, droughts and extreme weather events.
How is it different from the UK's Act?

The Zero Carbon Act must honour Te Tiriti o Waitangi by giving effect to meaningful partnership with hapū and iwi, and by drawing upon Māori knowledge and values to inform our guardianship of the environment.

It must reflect our responsibility to our Pacific Island neighbours by making climate change aid transparent.

Our Act introduces a 'two baskets approach' for the different greenhouse gases where short-lived gases (such as methane) do not need to go to zero and will have separate targets under the Zero Carbon Act.

Another difference proposed by Generation Zero is that the targets in the Zero Carbon Act will apply to domestic emissions only (the 'firewall principle').

Our ZCA blueprint was launched in April 2017 outside parliament once again. This time many more people came, including the media, scientists, and politicians. By now we had an extensive list of supporting groups and individuals, including support from youth political parties from all sides of the house. We were shocked and excited when the Green Party of Aotearoa New Zealand announced that they would establish a Zero Carbon Act if they got into government, and even more amazed when the New Zealand Labour Party and New Zealand First Party signalled similar promises to create a climate law.

4.4.5 The ZCA passes into law

In late 2017, the new coalition government agreed to establish a Zero Carbon Act. They created an Interim Climate Change Committee to get started on the work that the Climate Change Commission would do after the law was passed. The Ministry for the Environment conducted a public consultation during 2018 and had over 15,000 public submissions during their two-month roadshow around the country.

At this point, our campaign had changed. We no longer had direct ownership over the draft law or a say on the outcome. We thought the name would change also, however, when the Green Party of Aotearoa New Zealand first publicly signalled their intent to create a climate law, they used the term 'Zero Carbon Act', so the name stuck. It now feels as though the 'zero carbon' narrative has been normalised in the public eye. For a significant portion of 2018, the government and opposition conducted talks about what the law should look like. The loss of power over our proposed law was exactly what we wanted to happen when we started the campaign. We needed it to be taken up by

the politicians who could bring it to life. But it took us a while to feel okay with giving up control over something we had all worked so tirelessly to create. We had lost the ability to shape the campaign narrative, as other people then held the pen and influenced the drafting process of the Bill, including some politicians and industry groups who misrepresented the purpose of the ZCA to meet their own goals.

We shifted our campaign to critiquing the government's Bill as it was drafted in early 2019.

Unfortunately, several groups and partnerships of groups formed who were opposed to the Bill, so we also attempted to develop countering narratives to address their oppositions. Many of those groups had pre-established relationships, networks, and money to get more public attention and lobbying opportunities with the MPs. They had connections in areas that we did not, such as rural parts of Aotearoa New Zealand, which meant that misinformation spread about the intent of the proposed law. As a mostly urban organisation, I found it initially frustrating that we didn't have the capacity to make inroads into connecting with rural communities, even though I was from a farm and was still connected to my rural community. There weren't enough of us. We had a small rural team of around 4-5 people, and this was not enough for proper engagement on a national scale. We were also spending more time focused on the policy implications of the draft law.

After the Bill was tabled in Parliament in May 2019, the Select Committee consultation had over 10,000 public submissions. There were a mixed range of submissions, but overall a positive response, which at the time was very encouraging. The law passed unopposed with cross-party support, aside from the one New Zealand Act Party MP in Parliament who did not turn up for the vote. The final vote was 119-0 in favour of the Zero Carbon Bill on November 7th 2019, and it was signed into law through Royal Assent by the Governor General on November 13th 2019 as the Climate Change Response (Zero Carbon) Act.

4.4.5.1 The ZCA: meeting our goal, or falling short?

While an important step in the right direction, initial analysis from the ZCA campaign team suggested the government's Act falls short in a number of ways. The two biggest issues are that (a) it is insufficiently committed to Te Tiriti o Waitangi, because it does not require climate change targets and policies to be made in partnership with hapū and iwi; and (b) the 2050 net zero target is not aligned with the Act's purpose of helping limit global warming to 1.5°C. To stay below 1.5°C, the leading climate science says that we must halve our carbon emissions by 2030, as well as achieve net

zero by 2050 (Allen et al., 2018). The Act does not force the government to take urgent action in this decade.

Under an equity approach the government's Zero Carbon Act also fell short. A group called the Climate Equity Reference Project attempted to create universally agreed criteria of fairness for reductions targets (CERP, n.d.). They stated that there should be a component of historical responsibility within determining emissions reductions targets. This can be broken down into historical emissions, as well as the ability of the country to act on climate change now from assessments of aspects like GDP. An Oxfam New Zealand briefing paper from September 2020 (Oxfam, 2020) highlights that New Zealand needs to increase ambition on reducing emissions on the basis of equity. It also states that climate finance for developing countries must play a critical part in the global effort to limit warming to 1.5°C, and that New Zealand has to significantly increase how much climate finance we are contributing to developing countries for this global effort. This climate finance could be a component of reaching a genuine fair share, emissions target for 2030 (Oxfam, 2020).

The first ever National Climate Change Risk Assessment for Aotearoa New Zealand was released by the Ministry for the Environment in May 2020 (MfE, 2020). The report delivers a comprehensive account of how Aotearoa New Zealand will be threatened by climate change and challenges the government to develop an adaptation response plan within the next few years. The National Climate Change Risk Assessment was initiated by the development of the Zero Carbon Act at the end of 2019, and a new one will be published every six years. The report found key risks to human society included exacerbation of existing inequalities and the potential for breakdowns of social cohesion and community well-being, more frequent extreme weather events, the impacts of sea level rise on coastal ecosystems, and the threat to native species from invasive species. It stated that marginalized people would be more at risk of the impacts of climate change (Daalder, 2020). The costs from climate change are going to be significant. We shouldn't just be looking at the costs of action, but also the growing costs of inaction. The cost to Aotearoa New Zealand of the Covid-19 global health emergency was significant, however this cost pales in comparison to the expected costs from climate change (Coughlan, 2020).

The previous section (4.4) aimed to give context around the Zero Carbon Act campaign before analysing specific parts of my participation in it within Chapters 5 – 8 of this thesis. While there were some wins gained from the citizen-led approach to passing the Zero Carbon Act, there is still work to

do and improvements to be made, to ensure that future communities are more resilient to climate change.

4.5 Supporting theories and concepts: Praxis and Vulnerability

Following on from my overview of the ZCA campaign, I will now outline the theories and concepts used in Part 2 of the thesis. In Part One of the thesis, critical pedagogy (Freire, 1970) was used as a lens to analyse citizen science during the literature review, as it provided a framework for considering underlying issues such as motivations, power dynamics, and bias, which are inherently present during the process of developing and undertaking citizen science projects. In addition to critical pedagogy, the following theory section outlines two other theories which underpin the analysis of the second part of the thesis. These two theories and concepts are a) 'praxis' as used by Paulo Freire (1996) and b) 'vulnerability' as researched by Prof Brené Brown (2013).

The theory section provides a definition of praxis and sets up how it can be used to analyse citizen science project development and participation. I then define vulnerability and show how it will be used in the discussion section to explore how including reflexivity in citizen science project design can feel personally vulnerable but that it is a necessary component when wanting to take justice-based approaches to disaster or climate change-related citizen science work. The section will also make clear that there are different layers of vulnerability that people can experience. Vulnerability in this sense relates to how a person can experience feelings of vulnerability. This is different to the use of the concept of vulnerability from the community resilience literature section (section 2.3.1), where vulnerability to hazards was discussed around the exposure and adaptive capacity risks a person or community would face from particular hazards. What can seem vulnerable for one person would be a non-descript daily experience for others. Some people are thus forced to be deeply vulnerable due to social or cultural circumstances, whereas others can choose it.

4.5.1 Praxis

The following section focuses on the alignment of values with social action to create 'praxis' (Freire, 1996; Mayo, 2020; Breunig, 2011). The origins of the concept of 'praxis' are traced back to the work of Marx (Rubinstein, 2013; Kitching, 1988) whose work created a profound shift in philosophical discourse by approaching being and knowledge (ontology and epistemology) as inseparable and therefore using a philosophy of praxis, whereby people can use theory and practice to transform social relations (Scatamburlo-D'Annibale et al., 2018).

As outlined in Chapter 2, Part One of this thesis focused on the critical pedagogy work of Paulo Freire – one of the most cited figures in educational thought – whom, alongside others such as Antonio Gramsci, incorporated and expanded upon Marx’s revolutionary formulation of praxis (Scatamburlo-D’Annibale et al., 2018). Praxis focuses on the human capacity to reflect on themselves and the world around them, to then use that information to alter their social, cultural, or ecological environment (Scatamburlo-D’Annibale et al., 2018). Praxis highlights the reciprocal and interconnected relationship between theory and practice, and ascertains that taking reflective action can transform a person’s world.

Freire’s work on education as a practice of freedom connected with his views on praxis transforming the world by personal reflection and acting (Freire, 1970). He based this upon an ontological argument that praxis was a condition of freedom and a defining feature of being human (Glass, 2001). Freire proposed “that human nature is expressed through intentional, reflective, meaningful activity situated within dynamic historical and cultural contexts that shape and set limits on that activity” (Glass, 2001, p. 16), and that people must critically reflect upon their reality by acting together upon their environment, to transform that environment through further action and critical reflection (Freire Institute, 2022).

In a vein not dissimilar to Freire’s focus on ‘freedom’, Mehta et al., (2021) discuss praxis as linked to values of justice, equity, and capability expansion, as well as a link to self-conscious social actions and an ongoing internal discussion between knowledge and practice:

Transformation as praxis is an embedded, reflexive and engaged process of change aimed towards transformation of the self and the wider social and political/institutional arrangements and is an attempt to reconfigure the dominant development trajectory. Thus, for any meaningful transformation to occur, we need to engage with change at the individual and collective (i.e. patches) as well as institutional levels. To study and be part of these processes provides important opportunities for transformative science (Mehta, 2021, p. 113).

Mehta et al (2021) link praxis with the concept of transformation, and highlight that transformation practice, in a climate sense, has yet to be fully developed to the scale and breadth needed:

Contemporary mainstream approaches in both adaptation and mitigation have tended to be only incremental in nature or even maladaptive...that transformation goes beyond marginal change, is non-linear and challenges the status quo of existing development structures. It requires innovation and a profound shift in the way we think and act, including our values, consumption patterns and conceptions of well-being, which are closely associated with understandings of culture, place and identity (Mehta, 2021, p. 111).

Praxis is a practical reflective activity which requires a level of personal vulnerability to analyse one's own place in the world. Smith (2011) in relating 'practice' to 'praxis' states in education, highlights the reflective aspect but also links it to back to qualities such as truth and respect for others:

We can now see the full quality of praxis. It is not simply action based on reflection. It is action which embodies certain qualities. These include a commitment to human well-being and the search for truth, and respect for others. It is the action of people who are free, who are able to act for themselves. Moreover, praxis is always risky (Smith, 2011).

According to Coburn and Gormally (2015), actioning justice projects, such as climate justice projects, requires people to reflect on situations and their position in them, analyse potential options for moving forward, and act on the basis of their reflections and the options available:

If social justice is about social and economic inequalities, as well as a belief in human rights and providing the capabilities, opportunities and resources to take action to address these inequalities, then there is a need for consciousness and the ability to act (Coburn & Gormally, 2015:77).

As well as climate and citizen science literature, this thesis discussion will also draw on work from the youth social work field to draw the connections between the outputs of community-led science for climate activism and the personal and group values of the participants. The social work field is one of the leading fields when it comes to discussions around embedding emancipatory praxis into their practice:

Emancipatory social work is directed at heightening awareness of external sources of oppression and/or privilege that hold the possibility of increasing self-esteem and courage to confront structural sources of marginalization, oppression and exclusion (Sewpaul et al., 2015).

Coburn and Gormally (2015) built on work by Ginwright and Cammarota (2002) and added to it from their own practice, creating guidance for how to foster praxis within young people, as outlined in Table 13 below. Such aspects were evident in Gen Zero where people's own reflections led to self-awareness, awareness of others, and the world around them, and a desire to alter their social, cultural and ecological environment, through the Zero Carbon Act campaign.

Table 13 – Fostering praxis within young people (Coburn and Gormally, 2015)

Level of awareness	Description
Self-awareness	Where issues relating to identity, race, class, gender and sexuality are identified. Although it may be more straightforward to work with individuals, an additional challenge is to get a community group to work collectively to discuss and identify these issues.
Social awareness	Where there is a focus on the misuse of power. This stage provides a framework to analyse community relations. However, we argue that social awareness is multifaceted and should be divided to create clearer analyses: - Firstly, internal social awareness – both within the community and with others from differing communities. - Secondly, strategic awareness – as key strategic relationships can impact on the day-to-day lives of young people and community groups. These can be both horizontal within communities and vertical within society, and include relations with, for example, police, politicians and educational and health services.
Global awareness	Where empathy for other oppressed people throughout the world is fostered. In many contexts the view of 'oppressed people' or those experiencing injustices is often divided between communities. There is often no clear-cut, universally accepted, global oppression, emphasizing the need for further negotiation and understanding.

As mentioned above, the reflective actions that are undertaken as part of praxis require a level of personal vulnerability to analyse one's own place in the world, and to consider the actions one might take. The next section discusses vulnerability in the context of reflexivity.

4.5.2 Vulnerability

4.5.2.1 Being vulnerable as an act of reflexivity

To understand the reflexive practice of vulnerability, the research of Prof Brené Brown is used throughout the case study analysis for this thesis. As discussed by Brown in her book 'Rising Strong' (Brown, 2015), vulnerability as a concept is nuanced and layered, and a person's ability to be vulnerable is highly determined by past experiences. Brown is a qualified social worker and academic who uses grounded theory approaches to develop theories based on lived experiences rather than existing academic theories. Her work focuses on emotions such as vulnerability, fear, shame, courage, and connection. She defines vulnerability as 'the emotion that we experience during times of uncertainty, risk, and emotional exposure' (Brown, 2018, p. 19). She highlights how the ability to be vulnerable can be an identifier of privilege, and that challenging systems and status quo behaviours is an act of vulnerability that is much riskier for some people than others due to their race, gender, disability, sexual orientation, etc. (Brown, 2015).

As pointed out by Burke and Brown (2021) everyone can experience vulnerabilities, but some people are more vulnerable than others due to a whole range of personal and structural reasons. There are other academics working on vulnerability research who were drawn on for this thesis, including Cole (2016) who states that some people are subjected to experiences that make them vulnerable in ways that other people aren't, and that vulnerabilities are often a matter of underlying social structures as much as an individual person's experiences.

While accepting the vulnerability we all share, uncovering its enabling aspects, and perhaps even cultivating "epistemic vulnerability," are worthy undertakings; the vulnerabilities that demand our urgent attention are those that deepen inequality and inflict harm (Cole, 2016, p. 266).

If focusing on 'urgent' vulnerabilities, for example, in research related to the climate crisis (which Cole (2016) suggests in the above quote 'deepen inequalities and inflict harm'), then the connection

needs to be made between current environmental harm and the concepts of social justice, equality, and equity (the latter two included deliberately separate, though the two are often used colloquially as synonyms). This thesis study used reflexive vulnerability to analyse both personal and campaign praxis using an autoethnographic methodology as outlined in the following research approach section.

4.6 Research approach

4.6.1 Research Paradigm: Critical Realism

As for Part One, Part Two of the research covered many fields of academia, including citizen science, disaster management, climate change science, climate change action and anthropology. Due to its transdisciplinary nature, a research approach was therefore needed for Part Two that coalesced methodological, ontological, and epistemological assumptions related to these different fields (Creswell, 2013; Pitard, 2017). It was also important that the research approach aligned with my personal beliefs, worldview, and values. As argued by Cromby and Nightingale (1999), epistemological and personal reflexivity is crucial when conducting such research. Pitard (2017) states that epistemological reflexivity requires researchers to consider how their epistemological position influences their research, and challenges assumptions on why particular research design aspects were chosen and how it might have been done differently. With all these aspects in mind, I chose critical realism for my research paradigm and autoethnography for my research methodology.

I decided to draw on a critical realism due to its ability to give transformative power to the researcher (Pitard, 2017 referring to the work of Giroux, 1988) which aligned with the social justice and activist components of the Zero Carbon Act campaign. Critical realism was put forward in the early 1990s as one way to consider and work with the complex relationships between power, structure, and agency, which are all aspects that influence the campaign (Pitard, 2017). The autoethnographic methodology was chosen as it enabled a deeper understanding of the intricacies involved in creating and running the Zero Carbon campaign from my position as a researcher and allows me to draw out lessons that could be applied to the wider citizen science field. Autoethnography allowed me to create, deliver, and analyse my own story. The following section outlines in more detail the nature and use of autoethnography, in the context of my research on the Zero Carbon Act campaign.

4.6.2 Research Methodology: Auto-ethnography

4.6.2.1 Overview of autoethnography

Autoethnography is a research method that uses personal experience (“auto”) to describe and interpret (“graphy”) cultural texts, experiences, beliefs, and practices (“ethno”) (Adams, Ellis and Jones, 2017, p. 1).

The term autoethnography first appeared within academia during the 1970s (Adams et al., 2017). Qualitative scholars continued to highlight the importance of personal narrative and storytelling through the 1980s, but it wasn’t until the 1990s when autoethnography became a common method for expressing cultural experiences through self-examination (Chang, 2016; Ellis et al., 2011). When using autoethnography it is important to connect its similarities and differences to related qualitative methodologies – ethnography and narrative. The following section will give a brief overview of these connections.

Ethnography, originating from the field of anthropology, is a social science research methodology used to understand people and how they live in the world (Genzuek, 2003; Gobo & Marciniak, 2011; Shagrir, 2017; O’Reilly, 2012; Sangasubana, 2011). Now used outside of its anthropology roots, ethnographic methods are included in education, psychology, social geography, health studies and sociology, as well as increasingly in the disaster management field (Revet, 2013). The researcher builds trust with the participants by immersing themselves in their participants’ world to gain insight into the people and their context (O’Reilly, 2012).

Similar to ethnography, where realities are attempted to be understood through observation fieldwork (Zickar & Carter, 2010; Mariampolski, 1999; Denzin, 1997; Stacey, 1988), autoethnography aims to explore and understand experiences through the lens of self (Jones, 2009; Hoholm & Araujo, 2011; Wall, 2006; Wall, 2008; Lincoln, 2006). While ethnography aims to separate the researcher from the research and participants, autoethnographic research deliberately centres the views and observations of the researcher. Autoethnography uses the lens of self to allow the researcher to analyse the intricacies of existence through their own values, interactions, worldview, and the study of culture and experience. In ethnography, the researcher takes on an observer role whose goal is to decipher the intricacies of their research participant(s) as they go about their daily lives. Whereas in autoethnography the researcher has to do this same data collection and analysis, except angled towards themselves.

Autoethnography as a field was, at least in part, born out of purposefully creating ethnographic alternatives through first-person, ethnographic storytelling (Bochner & Ellis, 2016). Ellis and Bochner (Ellis & Bochner, 1992; Bochner & Ellis, 1992) started drafting these types of stories in the early 1990s in reaction to the idea of radical empiricism by Jackson (1989, p. 4) who put out a challenge to researchers to treat their personal experiences as primary data by making themselves the subject of their own research within ethnographic enquiry. At the time they saw it as the blending of boundaries between the fields of humanities and social sciences (Bochner & Ellis, 2016), a boundary which today is almost non-existent. While traditionally ethnographic approaches were used to study communities as ‘the other’, often in places quite unfamiliar and exotic to the researcher, more modern interpretations allow for more local and familiar ‘field site’ such as the local playground, church, or hospital (O’Reilly, 2012). The same applies to an autoethnographic methodology.

Autoethnographic research is different from traditional ethnography (Reeves et al., 2008), though it shares many similarities with regard to research design. Autoethnography, for example, could be considered to sit at the “intersection of autobiography and ethnography” (Adams et al., 2017, p. 2). Autobiographical methods such as using memories, personal journals, and relevant news stories, can be combined with narrative storytelling techniques, and analysed to give the reader a sense of how the experience feels. Autoethnographers aim to share stories of themselves “in the process of figuring out what to do, how to live, and the meaning of their struggles” (Bochner & Ellis, 2006, p. 111, found in Adams et al., 2017, p. 1). In this way the nature of autoethnographic research is highly self-reflexive, in line with what I wanted to achieve in reflecting on the citizen-led approach to the Zero Carbon Act campaign (Allen & Piercy, 2005). The structure of an autoethnographic narrative analysis may vary widely, and the resulting outputs may range from formal scientific publications to literary texts, or even poetic-type outputs. Essentially there are few regulations on how to write out an autoethnographic narrative analysis, as it is the meaning of the story that is important, rather than conventions of scholarly production (McIlveen, 2008).

Given the importance of the story in autoethnography, it is important to consider other methodological approaches, such as narrative methodology. As narrative is a central concept within autoethnographic analysis, it is fitting to outline the connections between the two methodologies. Narrative methodology has the ability to both tell a story and to connect issues across time. It uses personal experiences, thoughts, feelings, and self-interpretation as genuinely valued information to be critiqued, analysed, and discussed (McIlveen, 2008). Narrative inquiry “involves telling stories, recounting – and accounting for – how individuals make sense of events and actions in their lives

with themselves as the agents of their lives” (McAlpine, 2016, p. 34). It centres the experiences of a person or group within the process of data collection, analysis, and write-up.

Both narrative inquiry and autoethnography acknowledge that a full story or a ‘truth’ will never be shared as there are too many nuances to each experience to capture everything. They also acknowledge that individuals will only share what they consider is relevant or what they feel comfortable with, whether it’s an anonymous survey or an in-depth interview (Riessman, 2008). Given those challenges, narrative inquiry attempts to keep “a story intact by theorising from the case rather than from component themes across cases” (Riessman, 2008, p. 53).

Hamilton et al. (2008) have highlighted the blurred lines between terms of narrative (story of self), self-study (examining self in action), and autoethnography (examining self in wider context). They sought to understand the differences between the types but also acknowledged that the three different methodologies all had overlapping characteristics as outlined by authors such as Geertz (2008) and Denzin & Lincoln (2011). Consequently, there is some overlap also in this thesis with the predominant use of autoethnography as a methodology, but also acknowledgement of the role that narrative inquiry offers in analysing the various stories told by myself, and others.

4.6.2.2 My autoethnographic influences

It is through my autoethnographic writing that I aim to “articulate insider knowledge of cultural experience” (Adams et al., 2017, p. 3), in this case seeking to analyse the cultural practices of the Zero Carbon Act campaign team, and how this sits within the wider climate movement. Like many autoethnographic researchers before me, I was initially drawn to, and captured by, the methodology through the work of Ellis (1995, 1999, 2004) and through the explanation of the method by Denzin and Lincoln (2011). Ellis was able to give academic insight while prioritising emotional nuance in her writing about spirituality and illness. She explicitly and unapologetically added her personal values into the research. The work of Denzin and Lincoln normalised the method within wider academic research methods.

It is through the work of these and other early pioneers and champions (Bochner, 1984; Couser, 1997; Denzin, 1989) of the method that I feel comfortable using autoethnography as a pillar for my PhD. I was also drawn to the work of Custer (2014) who discusses autoethnography as a transformative research method by highlighting seven lenses through which he saw autoethnography working. These seven lenses suggest that autoethnography: can change an

individual's perception of time, requires vulnerability, fosters empathy, embodies creativity and innovation, eliminates boundaries, honours subjectivity, and provides therapeutic benefits (Custer, 2014, p. 2-10). These initially gave me ideas for the different ways that autoethnography supports the production of knowledge about citizen science, both in terms of process (i.e., requires vulnerability, which is a focal point of the thesis as discussed earlier) and outcomes (e.g., provides therapeutic benefits, which could be aligned with aspects of citizen science that build community resilience).

4.6.2.3 Autoethnographic methods

Aligned with the critical realism paradigm and autoethnographic practices, my research took an inductive, qualitative research approach. Qualitative research is focused on the analysis of words and meanings situated in their wider context, rather than findings from objective experiments, and it rejects the idea of an objective or unbiased scientist (Silverman, 1998). Instead, qualitative research recognises that researchers “bring their subjectivity (their views, perspectives, frameworks for making sense of the world; their politics; their passions) into the research process” (Silverman, 2000, p. 8 found in Clarke & Braun, 2013). Qualitative research is usually made up of investigations with small sample sizes and in-depth analyses. It seeks to explore and understand people's views of the world and their experiences. Given this research focuses on my experiences of the Zero Carbon Act campaign, qualitative research provides a good fit.

Different methods can be used to undertake qualitative research. In an autoethnographic context, useful methods and tools might include self or participant observation and recording (e.g., diary-keeping, journaling, audio-visual capture), interviews, conversational engagement, focus groups, narrative analysis, artifact analysis, archival research (e.g. memoirs, photographs), field notes, thematic analysis, and storytelling (Adams et al., 2017; Chang, 2016). These methods and tools might be used by themselves, or together in a hybrid fashion to understand the topic being researched and to craft compelling narratives of the social and cultural nuances that provide insight into the topic. Some of the methods and tools can also be used as a means of triangulating information, to ensure the findings being reported are robust (Adams et al., 2017; Chang, 2016).

Analysis of qualitative research can be undertaken in different ways, but often thematic analysis is used as a way of identifying patterns in descriptive material to highlight important themes and reporting on these (Auerbach & Silverstein, 2003). Thematic analysis can be classified as inductive or deductive (Auerbach & Silverstein, 2003; Creswell, 2002). Inductive research aims to construct new

patterns and meanings from data to form generalisations and theories, while deductive research makes use of pre-identified concepts to see if these exist in the data (Auerbach & Silverstein, 2003; Creswell, 2002). Inductive research aims to not jump to conclusions without thorough investigation to the complexity of issues (Creswell, 2002). It can be harder to generalise data from an inductive approach due to its subjective nature. My autoethnographic research took an initial inductive approach to analysis (via analysis of personal diary entries), followed by a deductive approach where I took themes from the initial analysis of diary entries and considered whether these applied to interviews with Zero Carbon Act campaign participants, or other text-based documents.

4.6.2.4 Ethics in Autoethnography – self and interviews

There are ethical issues that arise from using autoethnography as an approach (Dauphinee, 2010), especially as I reflect on my participation in a group I had been involved with for many years (Ergun & Erdemir, 2010). These ethical issues are embedded within qualitative research, which always already involves complex ethical concerns, with no simple ‘one size fits all’ solution (Guillemin & Gillam, 2004; Diener & Crandall, 1978; Oliver, 2010; Israel & Hay, 2006; Mertens & Ginsberg, 2009; Christians, 2000).

For this project, I needed to gain consent to study how our group performed in our campaign, and how it related to wider issues with citizen science, while ensuring that the group members did not feel concerned about the representation of the campaign within the research. I needed to make sure my ethical processes protected the campaign group, myself, and my relationships with group members and members of the wider climate change activism community (Dauphinee, 2010).

Guillemin and Gillam (2004) provide a useful distinction between procedural ethics, where academics seek approval from an ethics committee in a pre-arranged university system, and ethics in practice (relational ethics) which is described as the ethical considerations of everyday research. They state that procedural ethics is often seen as a formality, a pitch to a committee to assure them that the researchers are competent and that their intended method has been well-considered and can be trusted, and will do no harm to participants, researchers, and institutions. However, Guillemin and Gillam (2004) highlight that ethics in practice may be numerous and are not seen as areas of concern by formal ethics processes as they fall outside the stipulations of the ethics committee review, such as a researcher determining in an interview how much detail to ask for about difficult situations an interviewee has been through. Both forms of ethics were important to this project and were realised by careful consideration around how I enacted the research (for

example, see the following section on data collection methods, including interviews) and by also procedurally going through the ethics process at Massey University.

4.6.2.5 Data collection methods and techniques of analysis

Two main methods of data collection were employed as part of the autoethnography: 1. Collection of textual artefacts, and 2. Interviews. The textual artefacts were a series of personal diary entries as the main data source. The interviews were with seven members of the Zero Carbon Act core team. Both types of data were analysed thematically as outlined in the following two sections.

Personal diary entries

The main data source used for the autoethnographic study was my personal diary entries spanning a timeframe of December 2015 – February 2020. A personal diary was kept as part of my climate activism in both online and offline form and all entries from this timeframe were analysed for their relevance to climate change or citizen science, and other relevant related issues (e.g., regarding activism, intersectionality, campaigning, and social justice, etc.).

I used two different types of diaries to collect and analyse data. Firstly, my personal diary was used to gather data from before the PhD process began. For example, notes I took during and after attending the Paris COP21 climate change conference in December 2015. Secondly, I had started a specific PhD diary in late 2016 as an outlet for processing thoughts, readings, and comparing ideas. I wanted it to also be a safe emotional outlet to process that emotional side of the PhD journey, knowing that the process of completing a PhD can be challenging for mental health. The PhD diary was kept up until February 2020, and it was written at any point I felt like during that time period. During the beginning of the PhD it was written more frequently to establish the habit, however, the average would be approximately one weekly entry over the course of active PhD stages. The diary was kept online using a word document template, which was split into three sections to prompt my ideas: a) thoughts, feelings, or concerns about research process, b) personal reflections, and c) any unresolved issues.

When the PhD diary was started it was not intended to be used for autoethnographic research purposes. However, once my PhD topic switched to using autoethnographic research methods in mid-2019, the subsequent diary entries were written with that purpose in mind. For example, the diary entry structure did not change with the change of topic (same template, same prompting questions), yet when writing the entries I was writing in a way that I knew the text would be useful

and could be more directly connected back to the ZCA study and research topic. My earlier diary entries, before the topic change, were more focused academically on citizen science and also on things happening in my life outside of the PhD like the ZCA campaign itself.

Through the research process I needed to be privately vulnerable in my exploration of thoughts, feelings or issues and seek to write about those experiences in a way that is accessible for a wider range of people, beyond the academic journal, and connect in such a way that the reader will compare my life with theirs. But to show those personal experiences, it was hard to know where to start in deeply evaluating myself and so I took guidance from the social identity wheel¹⁷⁴ to start unravelling different aspects of my positionality, and how I actively acknowledge or hide those aspects. I also used four questions posed by Pitard (2017, p. 10-15) from her article on positioning the researcher within autoethnography as prompts for diary analysis:

- “What do I believe underpins my knowledge of life?
- Where did I gain this belief?
- How does this belief influence the way I react to situations and people?
- How do the assumptions, which I have accumulated from my life experiences, affect my reflexivity in my research?”

A total of 141 diary entries were chosen to be thematically analysed for this study. These 141 diary entries were first read to see if there were any of the five theoretical constructs present that had been part of my Master’s dissertation. My Master’s thesis was titled ‘Educating for complexities: Using future focus education to approach the wicked problem of climate change’ (McLaren, 2013). It used the discourse of 21st century approaches to future-focussed education and examined its potential use in community education programmes, specifically youth led climate change education at Power Shift New Zealand/Pacific, hosted in Tāmaki Makaurau Auckland at the end of 2012¹⁷⁵.

Thematic analysis from that study resulted in five theoretical constructs: Complexity, Collaboration, Commitment, Connections, and Confidence (McLaren, 2013). The five theoretical constructs (which I started to then call ‘themes’) from my Masters work were initially explored in my 141 diary entries

¹⁷⁴ <https://sites.lsa.umich.edu/inclusive-teaching/sample-activities/social-identity-wheel/>

¹⁷⁵ The Power Shift New Zealand/Pacific 2012 event brought together over 700 people from around Aotearoa New Zealand and the wider South Pacific for a three-day conference in Tāmaki Makaurau Auckland on the topic of climate change made up of workshops, plenary speeches, open space forums, performances, and informal attendee lead interactions. A total of 160 questionnaires were filled out by conference attendees and these were thematically analysed.

as I already knew these themes were central to how I engage in climate change education, and I was interested to see if they might also apply to my participation in the Zero Carbon Act campaign.

The diary entries were initially coded and analysed using the pre-existing themes as codes and analysed deductively. I took large chunks of text and analysed them as a whole, e.g. paragraph by paragraph. The five themes of Complexity, Collaboration, Commitment, Connections, and Confidence were indeed present in the diary entry data, and therefore I decided to look for additional themes. For the next stage of analysis I looked for additional themes using inductive analysis taking a line-by-line approach for all 141 diary entries.

A total of fifteen additional themes were found through thematic analysis of the diary entries. Combining these 15 themes with the previous 5, a final total of 20 themes were identified and split into four overarching categories, listed below and shown in Table 14:

- Getting to know the issues,
- Personal conviction for climate action,
- Inspiring others to act,
- Creating safe (socially and culturally), effective, and connected movements.

Table 14 – List of themes found in the thematic analysis of diary entries

GETTING TO KNOW THE ISSUES

Complexity of issues	Certainty of science	Connections between underlying root causes	Curiosity for lifelong learning	Crisis and urgency framing
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PERSONAL CONVICTION FOR CLIMATE ACTION

Commitment to act	Confidence that the problem exists and motivates action	Courage to speak up and challenge unjust systems	Compassion for self and others	Competing personal identities	Coping with climate anxiety
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INSPIRING OTHERS TO ACT

Communication is key	Constructive messaging	Contextualise the issues	Captivating vision for the future
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CREATING SAFE (SOCIAL AND CULTURALLY), EFFECTIVE, AND CONNECTED MOVEMENTS

Collaborative ways of working	Collective action (movement building)	Community- based action	Culturally appropriate project and movement spaces	Consistent pressure from multiple sources
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Interviews

Seven targeted semi-structured interviews were also held with members of the Zero Carbon Act campaign core team. These interviews took place from 01/10/2019 to 30/09/2020. Interviews were conducted by the researcher and interviewees were asked a series of questions to collect rich and detailed information on core team members' experiences, feelings, beliefs, and opinions about the Zero Carbon Act campaign. Data was also gathered on how core team members viewed their engagement in the Zero Carbon Act campaign. Care was taken to help the interviewees feel able to be honest when describing their thoughts or lived experiences (Shagrir, 2017).

The interviews were semi-structured to enable the researcher flexibility in the order and structure of the questions asked, and to allow for other topics to be elaborated upon by the participant. Interviews took around 1-2 hours each and were held at a venue that suited participants (either online or offline) and outside of the participants' work hours to minimise the disruption to their work (unless otherwise specified by a participant). I was aware of the amount of volunteer hours these participants had already done within work hours on the Zero Carbon Act campaign and didn't want to burden them with more.

Each interview was recorded and transcribed, and the transcript was coded to highlight key themes. Codes were based on themes found in the thematic analysis of diary entries; therefore, they were somewhat deductive. However, new themes that emerged were also coded as per inductive approaches. Twelve out of the 20 themes from the thematic analysis of diary entries were also found in the analysis of interview transcripts. Those 12 are:

- **Connections** between underlying root causes,
- **Crisis** and urgency framing,
- **Commitment** to act,
- **Confidence** that the problem exists motivates action,
- **Courage** to speak up and challenge unjust systems,

- **Compassion** for self and others,
- **Coping** with climate anxiety,
- **Constructive** messaging,
- **Captivating** vision for the future,
- **Collaborative** ways of working,
- **Collective** action (movement building), and
- **Culturally-appropriate** project and movement spaces.

There were an additional six main themes that emerged in an inductive approach from these interviews, which were:

- Having fun,
- Making a tangible difference,
- Unknown futures,
- Disempowerment,
- Values-driven work,
- Personalising climate stories.

These additional six themes lead to a total of 26 themes found within the combined two data sets.

4.7 [Link to Chapter 5](#)

Having outlined the project that I chose to focus on, the research questions to be answered, the supporting theories and concepts underlying the research, and the methodologies and methods used to undertake the research I now present a discussion of the results (Chapters 5, 6, and 7). Due to restrictions of the PhD timeframe and word limits, Chapters 5 and 6 focus on just *two* of the 26 themes found in the thematic analysis (coping with climate anxiety and collective action) and highlight important aspects of these themes in relation to the citizen-led Zero Carbon Act campaign and citizen science in general.

Despite a focus on these two themes, it should also be noted, however, that other themes do appear throughout the discussion chapters. The discussion chapters are framed as a narrative covering the ‘Story of self’ (individual action), the ‘Story of us’ (collective action), and the ‘Story of now’ (strategy and planning). The results can help us understand what the important considerations or components of a citizen science project such as the Zero Carbon Act Campaign are, so that these might be applied to future projects.

5 Chapter 5 - Results and Discussion: The Story of Self

Chapter 5 begins by outlining the structure of the results and discussion sections for the autoethnographic research in terms of three narrative components (1) the 'Story of self' (individual action); (2) the 'Story of us' (collective action); and (3) the 'Story of now' (strategy and planning). The rest of Chapter 5 then outlines the results for the 'Story of self' in relation to the thematic area of '**Coping** with climate anxiety' and discusses linkages with citizen science and community resilience.

5.1 Introduction: Using the 'story of' framing

Ganz, one of the pioneers of movement-organising research, and a lecturer at Harvard University, developed the story framework tool (Figure 5) (Ganz, 2009). This tool is focused on narratives of individuals, the groups/movements they are part of, and the wider social context for these movements (Ganz, 2009). He describes narrative development as a process of learning which requires telling, reflecting, listening, and retelling. The framework comprises three key parts. First, the 'story of self' centres on the individual telling the story and aims to elicit what motivates them to do social justice work and share emotive stories that connect with their audience with the hopes of inspiring collective action. In addition to the 'story of self', the 'story of us' describes the values and experiences of the community involved in action, as well as theory of change and ways of working. Finally, the 'story of now' outlines what their view of success looks like and how collectively the group or movement aims to make this vision a reality. It outlines the wider social, political and economic context and why taking action is so important (Ganz, 2009).



Figure 5 – Story of Self, Story of Us, Story of Now framework (Ganz, 2009)

The use of this framework in framing the results for this thesis is relevant because it was utilised as part of the Zero Carbon Act Campaign. There were many other ways the results of the thesis could have been organised, however this one felt the most appropriate at the time. The story of self/us/now framework was used as a tool within Generation Zero to learn more about what motivated members to join. It was also used as a public communication technique when presenting to external groups on campaigns like the ZCA. In such presentations, I would always start with sharing my personal ‘climate story of self’ and the story of my community, as well as the wider story of the campaign (the ‘us’ and ‘now’ parts). The ‘self’ part allowed someone to share what connected them to the issue of climate change and how their personal values aligned with taking climate change action. It was often used as an origin story of sorts, where stories were shared about how an individual’s community was at risk from climate change impacts and how that motivated them to get involved with groups like Generation Zero or others in the climate change movement.

Ganz (2009) suggests a series of prompting questions to consider when investigating the stories of self, us, and now, which are summarised in Table 15.

Table 15 – Story of self, us, now – prompting questions (Ganz, 2009)

Story of...	Questions to consider
A story of self	Why were you called to motivate others to join you in this action? What stories can you share that will enable others to “get you”? How can you enable others to experience the values that move you not only to act, but to lead?
A story of us	To what values, experiences, or aspirations of your community will you appeal when you call on them to join you in action? What stories do you share that can express these values?
A story of now	What urgent challenge do you hope to inspire others to take action on? What is your vision of successful action? What choice will you call on members of your community to make if they are to meet this challenge successfully? How can they act together to achieve this outcome? And how can they begin now, at this moment?

5.2 Story of self

The story of self in climate activism, using the Ganz definition, is in essence the motivating factors of an individual acting on climate change. The mental health impacts of the climate crisis can be severe, and include emotional responses of climate grief, anxiety, fear, and guilt (Hayes et al., 2018; Palinkas & Wong, 2020; Gibson et al., 2020). Participation in climate activism can be a way of coping, to help navigate feelings of anxiety and grief about the climate crisis. As discussed in Chapter 3, citizen science motivations can include using science as a way of acting to change something in a community or environment, and in this case, action might serve a dual purpose of allaying anxiety and grief related to the climate crisis.

This research presents the idea that the motivation to act through participating in perceived climate solutions could be defined as ‘Action Coping’, a concept initially introduced in the literature review chapter when outlining the factors that shape community resilience (Chapter 2). Action coping has been shown to be helpful, by focussing on understanding and practically addressing a problem, rather than resorting to emotion-focussed coping (e.g. worrying) (Becker et al., 2011). It can be argued that citizen science activities such as the ZCA campaign are a form of action coping and therefore build personal and community resilience. In the following section, the theme of action

coping as motivation for climate action is analysed through personal experiences, as well as literature and interview responses from other ZCA campaign team members. The section discusses mental health issues arising from climate change and explores two concepts resulting from action coping identified in this research as a response to the climate crisis: creating hope through action; and action without healthy boundaries leads to burnout.

5.2.1 Disasters, climate change and mental health

Disaster events have negative mental health outcomes, both due to the event itself, and due to loss, disruption, and displacement after a disaster event (Fritze et al., 2008). Building on extensive studies around how individuals respond to environmental threats and stresses (Craps, 2020), psychologists are now focusing on climate change-specific stress and anxiety, sometimes referred to as 'eco-anxiety' (Mah et al., 2020). There is also growing literature on the impacts of the general threat of the climate crisis on mental health, including amongst young people (Cunsolo & Ellis, 2018). Cunsolo and Ellis (2018) have shown that environmental changes and climate related weather events have been linked to strong emotional responses including sadness, helplessness, stress, anger, distress, and fear. They have also shown the impacts of disasters on mood disorders such as anxiety, depression, and both pre- and post-traumatic stress.

Ogunbode et al. (2019) used 2013/2014 post-flooding survey data in the UK to show how the link between flooding experience and negative emotions is moderated by self-appraised coping ability. They also concluded that addressing emotional, physical, and financial stress of flood victims should connect the issue to climate change and include information on ways to reduce future climate risks (Ogunbode et al., 2019). While literature broadly characterises wellbeing as being negatively impacted by extreme weather events, some research suggests that motivation for personal action on the climate crisis can be stimulated by negative emotional responses to extreme weather (Ogunbode et al., 2019).

Because climate change is a deeply psychological issue, understanding the emotional barriers to action can help devise better guidelines for communication, advocacy, and policy (Clayton & Manning, 2018; Gregoire, 2016; Clayton et al., 2017). There are many millions of people now experiencing grief and/or anxiety around climate change. This global issue has become an increasingly common human response to the changes the world will experience from the climate crisis (Cunsolo & Ellis, 2018; Lertzman, 2015).

In addition, professionals who research climate science often experience “burnout, anxiety, grief, and depression, with some choosing to leave the area of research” (Cunsolo et al., 2020, p. 261 referencing Clayton, 2018). Cunsolo and Ellis (2018, p. 275) describe grief as “the internal physiological and emotional responses to loss” which can take many forms depending on cultural practices and individual mourning preferences around the world. They describe ecological grief, as a subset of the wider concept of grief, focusing on the decline of the natural world. They identified three types of climate grief:

- 1) Grief associated with physical ecological losses and attendant ways of life and culture
- 2) Grief associated with disruptions to environmental knowledge systems and resulting feelings of loss of identity
- 3) Grief associated with anticipated future losses of place, land, species, and culture (Cunsolo and Ellis (2018, p. 276-278).

Weaved in around the climate grief and anxiety is the notion of ‘bearing witness’. Cunsolo and Ellis (2018) discuss ‘bearing witness’ to the destruction of lands, plants, seas, and waterways is a way to remain deeply connected to the natural world and takes climate change out of the realm of an abstract scientific concept. They also claim that while the feeling of grief has been used to connect people to the reality of the climate crisis situation, the emotional side of climate change was slower to appear in the mainstream public narratives and has, until recently, been a grief that isn’t publicly acknowledged (Cunsolo and Ellis, 2018). Willox (2012) suggested this could be because of the ‘ungrievable’ aspects of non-human aspects of the natural world. The unequal allocation of ‘grievability’ in different societies decides what can and can’t be grieved (Butler, 2004; Willox, 2012).

One example of a non-human entity being publicly grieved was that of the Okjökull glacier atop Iceland's Ok volcano, where a ‘funeral’ or memorial ceremony was held to mourn the destruction of the glacier. The memorial event was attended by approximately 100 people from a wide variety of backgrounds including local politicians, farmers, scientists, and activists (Craps, 2020). The poem ‘How to grieve a glacier’ by Marybeth Holleman starts off with the lines "It's not something you can hold in your arms. / You can't rock with its image in a blanket / and keen away the nearing pain" (Holleman, 2018, p. 441) which eloquently sums up the difficulties in many Western worldviews of ‘mourning’ inanimate objects (Craps, 2020). For some people a glacier is mourned because it is a stunning natural feature worthy of existing purely in its own right. For other people it is more about

what the glacier represents – their livelihood, their place to escape to in the natural world around them, or a stark visual representation of the changing climate and what damage that is going to do for billions of people around the world for decades to come. For many it is all of the above, with different layers of grief building up as more and more of these climate icons are destroyed.

Changes from large-scale climatic events, such as mass coral bleaching or severe tropical cyclones, may also evoke strong feelings of sadness or loss about the destruction of non-human entities. Through surveys, Curnock et al. (2019) found an increase in feelings of sadness, disgust, anger, and fear associated with the changes occurring in the Great Barrier Reef (Australia) in 2017 compared to 2013, while experiences of joy, trust, and surprise remained unchanged between the two time frames. The surveys of tourists were conducted before (2013) and after (2017) significant coral bleaching episodes in the northern reef area, a well-known ‘climate icon’. The tourists showed attachment to the reef and felt associated grief from its destruction due to climate impacts, even though they did not have a direct place attachment to that area (it was not their home or work) (Curnock et al., 2019). The reef, while a tourism hotspot, is also associated with a sense of belonging, notions of identity, and other intangible values (Curnock et al., 2019) and its “loss is often given meaning through lived, embodied, and place-based experiences, and so is more felt than tangible” (Tschakert et al., 2017, p. 1).

These place-based connections (Inalhan, 2021) or people-nature connections (Kellert, 2012) are felt even more significantly within indigenous groups who have cultural ties to the land often going back thousands or tens of thousands of years. In 2012, some Inuit communities were already experiencing levels of pain when considering their future losses that were predicted to worsen in severity and impact due to the climate crisis (Wilcox, 2012). Strongly connected to pain of loss is the fear of losing culturally significant areas and ways of life. Fear has been linked to both inaction and motivation in a climate change context. The counterbalance of hope has been identified in the literature as a deciding factor between inaction and action/motivation. The ability of fear to stymie action is limited when humans hope, and fear is sometimes used to urge others into climate change mitigating action (Kleres & Wettergren, 2017). Head (2016) describe denial as having the potential to be a starting point which people can use to move towards a hope that is centred in action. This deeper connection to the issue through fear is often connected to the dual climate activist themes of hope and action.

Brown's description of the "myth of a certain future" (Brown, 2015, p. 146) resonates with me in terms of almost the feeling of mourning a future untouched by climate change.

Grief seems to create losses within us that reach beyond our awareness – we feel as if we're missing something that was invisible and unknown to us while we had it, but is now painfully gone (Brown, 2015, p. 146).

There is an assumption in this view that there would be a more certain future without the complexities of climate impacts, however this sense of loss would also be relative to a person's worldview. There may be different types of 'loss' experienced, such as economic prosperity (losing a potentially profitable future), or cultural prosperity and preservation (retaining culturally significant sites and traditions). Whatever the motivations behind the sense of grief or loss, understanding the mental health implications of the climate crisis is an important step when analysing youth climate mobilisation. One mobilisation technique used within the youth climate movement to address such anxiety, grief or loss is 'taking action', and that will be the focus of the following section. From my personal experience, responding to the climate crisis by taking action can feel motivating and give a sense of purpose to the negative emotions associated with impending climate impacts.

5.2.2 Action coping

Active or action coping (referred to as 'action coping' subsequently) has been around as a concept since the early 2000s when behavioural scientists started looking at action coping as a possible treatment for avoidance disorders (LeDoux & Gorman, 2001). Taking action in the climate crisis is a coping strategy for many. There are both pros and cons to action coping depending upon the type of action coping taken, how it is done, what self-care was involved in the process, how stressful the action is, and if it is done in conjunction with others or in isolation.

Action coping, as briefly outlined in Chapter Two, is defined by Becker et al., (2011, p. 12) in their report on community resilience as dealing with problems "by undertaking action directly (rather than worrying)" and they described it as people's ability to "solve problems in life by confronting and resolving them". It is a form of problem-focused coping where actions are taken to address the cause of a problem directly, which in turn has been found to predict resilience (Becker et al., 2011).

‘Problem-focused’ coping is contrasted in literature with ‘emotion-focused’ coping which is when people act to alleviate negative emotions caused by a particular problem (Duval & Mulilis, 1999). The relief from the emotions is the driver in this case, rather than the need to solve the problem (Fortes-Ferreira et al., 2006). Action-coping can help people prepare for and respond to adverse life-events, such as disasters, and is strongly related to risk reduction behaviours (Becker et al., 2011). Action coping has been shown to influence the number and quality of action plans for disaster preparedness and is also linked with community participation (Becker et al., 2011). Paton (2006) suggested that active problem solving should be used as part of community participation and empowerment strategies for developing action coping behaviours. While action coping is seen as problem-focused coping rather than emotion-focused coping, it still has the potential to alleviate the symptoms of ecological grief and anxiety through “work to reduce the underlying threat and through social prescribing of activities that support and enhance environmental, physical, and mental health” (Cunsolo et al., 2020, p. 262).

5.2.3 Creating hope through action

It is hard to have hope that we can win this fight, but it’s scarier not to have it (Personal diary entry, January 2016)¹⁷⁶.

In the context of climate change, the type of ‘action’ counted within the action coping concept would expand past emergency preparedness concepts such as storing emergency supplies and knowing your neighbours, and instead also include community resilience-building initiatives such as citizen assemblies, community-led science projects, and activism. Action coping is the glue that joins community resilience and citizen science in a climate activism context. It’s the reason why the two are connected in the Zero Carbon Act. It’s the reason why the Zero Carbon Act is an example of building community resilience, and it is also the way ‘Just Transition’ (Just Transition Alliance, 2024) comes into community resilience and the ZCA campaign.

Participation in climate activism was undoubtedly a coping mechanism for the climate grief and anxiety that was beginning to build up within me. The climate crisis had taken over my world – it was in my social media newsfeed, it was my work, it was talked about within my friendship circles. I felt like there were two options – either get increasingly depressed, or get moving to create change.

¹⁷⁶ This diary entry was written on the trip back to Aotearoa New Zealand after co-leading the New Zealand Youth Delegation to the UNFCCC climate conference, Paris 2015

There has been a pattern of action coping examples since I connected with the concept of climate change in 2010. I wanted to take action because I was learning what was happening to the planet and how it would eventually impact my communities. I wanted to help stop it. There were many iterations of what I thought that help looked like.

I helped start the ZCA campaign as a form of action coping; to create a solution to the climate crisis for Aotearoa New Zealand. I had hoped we could do something major as a team. I also joined the ZCA as a way to get over the inability to do as much as we'd have liked to at the COP21 in Paris. Action coping tackles the mental health aspects of the climate crisis, such as climate grief by focusing on action that can be taken to alleviate the issue. It can create spaces for discussions around climate grief and climate solutions.

As an activist, I have rarely experienced lethargy, or the sense that it is too late to halt, even reverse, the damage to our climate. One thing my activism has never centred around is a growing sense that it is too late to do anything about climate change (Hayward et al., 2020). Hayward et al (2020) state that an experience of external locus of control or it being 'too late' can reduce efforts to undertake mutual obligations for mitigation efforts and responsibility for past injustices. Posing climate action as a time-bound practice may make people question if it is worth taking any action at all (Hayward et al., 2020). I do, however, relate to the findings of BBC research on youth views on the climate crisis. The BBC surveyed 2000 young people (8-16yrs) in March 2020 and found that 73% were worried about the state of the planet and 41% didn't trust adults to fix the challenges presented by climate change (Cunsolo et al., 2020).

I too share the view that many 'adults' cannot be trusted to fix the planet, even though I spent my decade as a youth activist as a legal adult (over 18 years old). My distrust stems from witnessing first hand a decade's worth of inaction by those in positions of power (policy makers and politicians) that could have fast-tracked climate action. Transforming how societies function on a global scale is no small task, and the costs of inaction are growing greater each year in terms of human life, environmental destruction, and financial instabilities (Ekberg et al., 2022; Bosetti et al., 2009). The multitude of reasons politicians and industry has for inaction have been exacerbated by intentional misinformation campaigns from the fossil fuel industry (Lopez & Share, 2020). Many young people are starting from that place of distrust, as identified by Hayward et al (2020) as they begin to navigate the world of climate change action. Troublingly the survey also found 19% of the young people have previously had a bad dream about climate change (Cunsolo et al., 2020). As someone

who has suffered from similar climate dreams for years, I also worry about the impact dread-filled climate change narratives are having on the mental health of young people.

Over the last few years, I've become increasingly concerned about what will happen to the next generation of climate activists. We are seeing increasing rates of young people reaching out for climate change-related mental health issues. As someone who has worked in this space for over ten years, I have felt first-hand how depressing and soul destroying this work can be and I've seen that pressure in my fellow ZCA campaign team members. The following excerpt is from an interview I had with a ZCA team member. Here they discuss the rollercoaster of emotions as a climate change activist:

Being a climate change activist gives you the highest highs and the lowest lows that you will ever encounter as a human being. The lowest lows because you realise the world is somewhat of a shitty place and needs improving, and the highest highs because you have the ability to make that change. My life would be definitely easier, and potentially happier, if I wasn't a climate change activist and I wasn't thinking about the imminent threat of species extinction and harm to billions of people around the world.... there is a lot of loaded emotions wrapped up in the change you're trying to make [sic] (Interview participant quote).

Excerpts from my PhD diary also reflect that range of emotions triggered by climate change, but also the hope and desire to do something about it in a way that highlights action coping as a mechanism for and addressing climate change challenges.

The grief felt over the climate crisis is at times overwhelming. And I can't un-learn enough to turn it off. Learning has been the problem here; the more I've learnt about climate change, the scarier it is and the more unhappy I am. But through my activism I want to inflict the same thing knowingly and purposefully onto others, in the hope that we can change the global system in time to save humanity. Is there guilt in that? No. Not really at all, more an anger that people still don't know and that they aren't sharing in this burden. Or worse, that they know and don't care/can't connect it to their own lives or want to do something about

it. That is worse. Knowing that people know about the perils of climate change too, but won't do something to change it. Maybe they don't have hope so give up on it. Maybe they simply don't know what to do or feel like they have no agency over the process - very possible. I've always had a sense that I can do something. I've always had hope that we can change the situation. I've not always had the confidence to do something. That did not come naturally. But I've slowly gained it through the climate work as there are simply bigger things at stake than my nerves, my shyness. My brain trying to convince me that I can't play a role, but I knew deep down I needed to because I had privilege and knowledge to help in this situation [sic] (PhD diary – 05/03/18).

I really worry for the burden we are putting on the next generation to be able to cope with this all-consuming global problem. I raised the issue of youth mental health being impacted by the climate crisis with Prime Minister Dame Jacinda Ardern after a meeting with her in 2018. When thanking Generation Zero for creating and pushing for the ZCA during the Bill's first reading, she highlighted the feeling of anxiety that climate change was causing young people, and the need for action at higher levels.

Prime Minister Jacinda Ardern made a speech during the first reading of the bill, a rare move. She said there was huge anxiety amongst young people who were seeing the effects of climate change before their eyes. "We have to feel the anxiety that young people feel when they see the very real consequences of climate change around them," Ardern said. "Our job is to give them hope, not just in words but in action, and we also have to give certainty. This cannot be a three-year plan; it has to be a 30-year plan, which is why we have in this House sought to build consensus" (Cooke, 2019).

I think action coping can be reframed as, or at least connected to, what the previous head of the UNFCCC, Christiana Figueres, calls "Stubborn optimism" to keep acting (Figueres & Rivett-Carnac, 2021). I interpret this as the refusal to give up hope in the face of increasingly dire climate change predictions and unbudging layers of entrenched political apathy or inaction. I think this framing puts the power back in the metaphorical hands of the activist.

Climate change induced warming could stop relatively quickly, within a decade, if emissions were reduced to zero (IPCC, 2021). So, we know there is a reason to hope. However, an individual's response and efficacy may be undermined by a lack of hope which can lead to inaction to solve the problem (Marlon et al., 2019). The following quote by Nairn (2019), sums up the significance of hope in the context of climate change, as a foundation from which action might be derived:

Hope takes on particular significance at this historical moment, which is defined by the prospect of a climate-altered future (Nairn, 2019, p. 1).

Kleres and Wettergren (2017) argue that fear can be a motivator for action instead of an inhibitor as often argued in climate change discussions. They state that having hope can manage a person's fear and inspires action, especially useful in situations where the perceived chance of success is not high (Kleres & Wettergren, 2017). I remember hearing a presentation about climate change several years ago and the main theme of the talk was how we no longer should have hope that humans can solve the climate crisis, but we should continue to act anyway. I physically felt the disempowerment from that talk. It hit me like a punch to the gut. At that moment it felt like any power I thought I had to influence the outcome of climate change was stripped away. I doubted our impact, the point of all our work, how to fight the system if everything is that dire, and that it was stacked against us. For hours I had waves of grief, like nothing I had experienced or felt before. There was a really big feeling of deep embarrassment. Embarrassment that we had thought we could make a difference, that I could have naively hoped that our law would change New Zealand's climate pathway.

Curnock et al., (2019) suggest feelings of hope, protection and custodianship are necessary for both individual actions and collective response to climate change. These feelings can be connected back to the concept of 'bearing witness', where people see iconic places they feel attachment to threatened by climate changes and they have painful emotions associated with these impacts (Curnock et al., (2019). It is also summarised by the following Marlon et al. quote:

Hope and doubt are both significant predictors of political behaviors (e.g., donating to an organization) and support for greenhouse gas mitigation policies (e.g., regulate carbon dioxide as a pollutant). Specifically, "constructive" forms of hope and doubt positively predict engagement, yet, "false" hope (e.g., wishful thinking) and "fatalistic" doubt (e.g.,

beliefs that there is nothing humans can do) appear to have negative effects on engagement (Marlon et al. 2019, p. 2).

This connection between painful emotions and hope was often referred to in interviews with Zero Carbon Act team members. The following interview quote highlights how several emotions might exist together, such as hope and despair, and that these emotions were all necessary in motivating action coping:

Hope and despair, they definitely exist in unison. I kind of think everyone who's involved in climate action, I know, I think has a lot of despair. And like, really, really worries about the world and climate change and what the impacts are going to be. But at the same time, they really want to do something to help and have hope that things could be better. Hope and despair, they definitely exist in unison, they exist together. Hmm... It's kind of like having both the carrot and the stick for action [sic] (Interview participant quote).

Lifting the burden many young people are feeling around the climate crisis can be done by collectivising both hope and despair (Nairn, 2019). It also requires collective motivation which may be increased through the use of hope narratives, depending on whether it is used in a problem-focused coping way, rather than an emotional coping way (van Zomeren et al., 2019). Problem solving action may be a key way that hope is useful as a collective motivator, as highlighted in the following interview excerpt:

[In 2013] GZ had already been like, quite successful by then, especially in Auckland. They'd actually legit changed things in a way that I hadn't seen young activist groups or any activist groups really being able to achieve like that. For me, you just jump up and down at protests and like nothing happens. But stuff had actually legitimately changed from a small group of young people doing stuff. Which I think probably contributed to the hope side of things because I could see that I could actually see how it was making a difference [sic] (Interview participant quote).

Climate activists from the Global North have been referred to as 'hope brokers' due to the traditional tendency to stay away from narratives of guilt, shame, and fear (Kleres & Wettergren, 2017). Research has shown that hope leads to increased participation in climate action through exposure to efficacy information, in some cases even amongst conservative populations (Feldman & Hart, 2016).

For most people, especially in developed countries, it's very difficult to accept that we are facing, you know, existential threats and there's only one thing that you can do with it is useful. And that's actually try. Even if you don't know that you're going to win, even if you don't know how it's going to turn out. If you simply try to change that trajectory. That can make the difference between feeling okay, [...] and feeling total despair that floods into every part of your body and your life. So engaging people in climate action also gives them opportunities to be a part of the solution which also gives them opportunities to not be in despair, which I think can only be a good thing. And even if we don't win, hopefully we've reduced suffering for people along the way [sic] (Interview participant quote).

Kleres and Wettergren (2017) showed in their research that the emotional pairing of fear and hope is a general representation of Global North motivation for climate activism, whereas a combination of fear, guilt, and anger are more common in the Global South. They found Global North climate activists treated guilt and anger as motivating emotions for action more cautiously than Global South activists, and emphasized hope narratives. The Global South climate activists interviewed in their study were less hopeful and more acutely frightened and angry than the Global North activists, and they also ascribed guilt to Global North countries. Kleres & Wettergren (2017) state that, in general, this could indicate a more politicised approach to climate change activism in Global South countries than Global North countries. It is unsurprising people are angry – surrounded by inequity and broken systems full of injustice – so I would also propose that anger is a prevalent emotion for many structurally oppressed communities in the Global North too. It comes back to power and who is responsible for the environmental, social, and cultural harms that are at the root causes of the climate crisis.

Climate activism has been shown to use more pessimistic narratives compared to other social movements, with an increase in apocalyptic messaging becoming even more common after the birth

of certain climate activism groups, such as Extinction Rebellion and Fridays for Future, in 2019. Cassegård and Thörn (2018) suggest that disillusionment in the ability of government institutions to solve the crisis has been part of this narrative shift, and that fear of future catastrophes has become a more important mobilising tool than creating visions of a better future. There has been a two-fold push back on this apocalyptic future narrative, both from environmental groups promoting hope/positive-futures narratives, and from a predominantly Global South lens for which the apocalypse has in many ways already arrived. They refer to this as “post-apocalyptic environmentalism” where “communities are destroyed and populations displaced because of environmental destruction, is neither nourished by a strong sense of hope, nor of a future disaster, but a sense that the catastrophe is already ongoing” (Cassegård and Thörn, 2018, p. 1). As summarised by Marlon et al (2019, p. 2), “hope is not always good and doubt is not always bad; the combination of constructive hope and doubt may actually be motivating, whereas false hope and fatalistic doubt may lead to avoidance, distancing, and inaction.” Nairn (2019) showed that participants in her study of young climate change activists were not dissuaded from action by ‘end of world’ narratives, but instead were motivated to try to change the outcomes through personal action. Her research also suggested that some climate activists saw a sense of despair could be useful in countering ‘blind optimism’ (Nairn, 2019), which in my experience can also be disruptive when solutions are not developed with an intersectional approach.

As a campaign team we stayed away from the apocalyptical framings, common with many new or emerging climate groups at the time, because such framings can “hold the risk of eco-anxiety induced defeatism, burnout or withdrawal” (Nissen et al., 2021, p. 319). Instead, our narratives focused on solutions and bringing all of Aotearoa New Zealand together to act on climate change, which were more aligned with elements of action coping. Taking a hope and solutions-based framing to the campaign might be a reason why we were able to bring people together across the political spectrum, in a way that a more negative framing may have led towards a blame approach which could have exacerbated the political division existing around climate change issues at the time. During our ZCA campaign team meetings, conversations around climate justice often felt emotionally ‘heavy’ and the feeling of overwhelm was normal within the group. Burnout is a common and often accepted part of youth climate change activism, which will be described in more detail in the following section.

5.2.4 Action without healthy boundaries leading to burnout

Taking action on climate change is not always a positive experience. Lertzman (2015) suggests that we should help others to channel strong emotional responses to climate change into creative and constructive expressions. However, she purposely did not use the word 'action' and suggests that the way people are currently constantly pushing each other to act might not be as helpful as intended. Instead, she suggests that we need to find what action means for each individual person and that we should be reminding everyone, especially young people, that the burden of action is not all on their shoulders and that we're in this together as a species.

Maxey (1999) took a holistic and reflexive view of looking after the self whilst undertaking activism, describing it as doing as much as she could from where she was at, which can vary depending on how a person is feeling emotionally, physically, spiritually, etc. (Maxey, 1999). Sometimes the responsibility that comes with climate activism can feel like too much of a burden to bear. I really relate to the following quote from the research of Pezzullo (2016):

We have walked the streets chanting with signs and endured the mundane bureaucratic labor of social change by attending more and more meetings. We have compromised and felt disappointment often. We have re-messaged, re-framed, and re-articulated our intentions again and again (Pezzullo, 2016, p. 804).

Action without healthy boundaries is connected to the risk of activist burnout, and burnout, like all things social, is influenced by intersectional privileges. There are differing layers of burnout, with many young climate activists also experiencing burnout from existing under, and fighting against, structural oppression. Individuals with different levels of privilege will experience burnout to differing degrees: with people of colour, indigenous people, disabled people, and people of non-conforming gender experiencing discrimination and barriers which can contribute additional layers of burnout (Burke & Brown, 2021). For some young activists, they have all the layers of discrimination added to them on top of the burnout already expected from participating in the climate movement.

In her book *Rising Strong*, Brown (2015) highlights the need to self-monitor expectations of action taken and how emotionally involved someone is in actions that may fail or turn out differently to expected. Managing expectations in campaign disappointments that, for the most part, are so far beyond a person's control is important as Brown suggests "disappointment may be like paper cuts, but if those cuts are deep enough or if there are enough of them, they can leave us seriously

wounded” (Brown, 2015, p. 142). In youth climate activism there are many disappointments - at the inaction of governments, at the greenwashing of business leaders, at international science and policy processes which can feel painfully slow and complicated. As a climate movement there needs to be honest discussions around confronting expectations of action. It doesn't mean not being ambitious or calling for more/better action, but rather ensuring processes that protect the mental health of participants in those actions.

Capitalist expectations of 'work ethic' also play a significant role in how these movements are run, and how normalised or expected burnout is. Burnout is a common occurrence among staff in NGO organisations (Lopes Cardozo, 2012). Nairn's research on young activists highlighted that participants in that study spoke of burnout as an individual problem due a person's failings at finding balance in the ways they were working or by being too hopeful (Nairn, 2019). She suggests that the issues of burnout and despair need to be looked at through a broader, collective lens connected to climate change denial.

Self-care is a big part of the internal narratives within youth climate activist culture (Lertzman, 2015) but this is often easier in theory than in practice. Many organisations within the wider climate movement are becoming more explicit about asking people to take care of themselves, as they have seen activists in the space 'burn out' over the last decade (Gorski, 2019; Wettlaufer, 2015; Chen & Gorski, 2015). Lertzman (2015) highlights the story of the climate activist, Xiye Bastida, who ended up in hospital after organising strikes and actions for her local high school. Often the ideas to take better care to prevent burnout focus on the individual, such as relax, take breaks, meditate, and exercise. Within the ZCA campaign team we also tried to do some of those care activities as a group. For example, during one of our all of campaign team two-day meetings in Wellington we spent the first day as a work day and the second day as a gentle hiking day with the intent being to get the team out in nature and to connect as humans away from the talk of the campaign. Burnout is a well-known and often talked about problem within the wider youth climate change movement, as articulated by the following two interview participants who refer to issues such as constant workloads and emotional burnout:

I kind of just feel like I have to constantly be giving as much as I possibly can to the cause because it's just so, so urgent and so crucial, you know, so there's definitely an element of that. Not a healthy thing, but a thing I'm learning [sic] (Interview participant quote).

I've been really empowered by the work that I've done. It has given me skills and confidence and a real self-belief that I can make a difference. And I like to think that the people I've worked with feel the same way. But I know unfortunately that climate change and the climate change movement can be very disempowering for people. And they come away feeling fearful and anxious of what's happening. Or the movement itself has been disempowering because the person hasn't been listened to, they haven't been able to utilise their skills and energy, and they have left feeling underwhelmed or that they weren't valued or in some cases burnt out [sic] (Interview participant quote).

For me, burnout was the manifestation of grief combined with too much action coping. A few days before the ZCA went through its final reading in Parliament I was burnt out and unable to participate in climate spaces that I'd normally join in with, as outlined in the following diary entry:

I've followed or attended every COP [UN climate talks] since 2009. This year I just can't. I've maxed out on my climate f#cks to give. And can't bring myself to follow any of it [sic] (PhD Diary – 05/12/2019).

So, for me, action coping has not always been a positive thing. Climate change messaging bombarding my brain that it was so 'urgent to tackle' meant that I wasn't giving myself time to breathe. There was a huge time commitment and care labour component with the ZCA, something I'd advise anyone considering starting a community-led project to be wary of beforehand and consider their other time commitments. Feeling an expectation by new volunteers and external groups to be an expert on all things climate was tough and impossible, especially as I could only bring knowledge I had from my own worldview. The expansion in the climate change space was moving so fast and being much more crowded by different actors and stakeholders even in the short four-year timeframe of the ZCA campaign.

There was stress and burnout from other things that go along with activism including being "trolled" online and worries about surveillance. Participation in social movements can be good for young people's agency but at the same time it can also have negative effects, including through 'experiences of surveillance or repression' (Starr et al., 2008: found in Nissen et al., 2021, p. 319). Climate activists in Aotearoa New Zealand, including school students, were under surveillance by

their own government or fossil fuel industry groups due to their participation in climate activism (Hager, 2021). The ability to be taken seriously as a professional was a consideration for some young people joining climate movements. Anecdotally, it still presents challenges and young people are advised to play down their experience working on climate campaigns when applying for government jobs.

5.3 Summary and Link to Chapter 6

The 'Story of self' has focused on understanding the concept of action coping in relation to the ZCA campaign citizen science project. It is clear that action coping was a key component to an effective ZCA and was relevant to me personally as well. This chapter has highlighted the important influences that trigger action coping within the climate and ZCA context. Emotions such as hope and fear were found to promote action coping, but were very context-dependent. For example, hope of a better outcome was an important driver of action coping, however 'false hope' as discussed above could be a demotivator. Additionally, emotions could exist simultaneously adding to a complex mix of triggers for action. There was a risk of burnout though taking action, however, whether it be from physical workload or mental load, and so it was noted that healthy boundaries were important for effective action coping. The action coping style (e.g. in this context, communication, and engagement) needed to be adjusted depending on who I was speaking with, and my relationship with these people in terms of my multiple identities.

Given action coping has been identified as important in developing resilience, it is important to understand the nuances in how it works, so that these can be accounted for in future. Given citizen science is often based around concepts of 'action', this is particularly relevant in the citizen science project development and implementation space.

Now that I have outlined the key components that arose in relation to the 'Story of self' and action coping, I now move to the next part of the story – the 'Story of us'. This section is focussed on the theme of **collective action** as identified during the thematic analysis. It considers the role of narratives and stories in building connections and inspiring collective action during the ZCA campaign.

6 Chapter 6 – Results and Discussion: The Story of Us

While the previous chapter was focused on the ‘Story of self’, this chapter will focus on the shared knowledge, values, and experiences through the ZCA campaign – the ‘Story of us’, that connected and inspired action in the form of collective action, which in itself could be considered a form of ‘action coping’. It focuses on the theme of **collective action** identified during the thematic analysis, and the role that narratives and stories play in building this.

6.1 The power of connection and collective action

The following section focuses on the power of connection and collective action in campaigning or political movements. Brown (2015, p. 182) describes connection as “the energy that exists between people when they feel seen, heard, and valued; when they can give and receive without judgement; and when they derive sustenance and strength from the relationship”. She states that the basis for connection is both giving and receiving. In the climate justice context, taking climate action can be seen as an act of love, compassion, and empathy towards the destruction of the planet and for those impacted first and worst by the crisis.

The most powerful tool of compassion, empathy is an emotional skill that allows us to respond to others in a meaningful, caring way. Empathy is the ability to understand what someone is experiencing and to reflect back that understanding... Empathy is the antidote to shame, and it is the heart of connection (Brown, 2015, p. 155-156).

Individualistic capitalist-driven consumer culture promotes self-reliance as the ultimate success, and therefore shames people needing help as weakness. That self-reliance is now so ingrained in many Western cultures that many cultural norms that were common only decades ago have been shunned or forgotten. Brown suggests that our fear of being seen as weak causes a lot of internal shame which makes us less likely to compassionately connect with others, specifically “how can we be truly comfortable and generous in the face of someone’s need when we’re repelled by our own” (Brown, 2015, p.179). This chapter proposes that community-based connection, alongside shared values and narratives, is a key antidote to the systemic issues driving climate change. One way to help form and maintain those community connections while fighting for a liveable climate is movement-building, something that has been used in campaigns large and small around the world for decades.

Marshall Ganz (2011) provides a framework to turn those connections, or relationships, into action as a way of movement building. Ganz (2017) describes an organising framework which has relationships at one end and action at the other. He puts story, strategy, and structure in the middle as ways to turn those relationships into the power for potential action. He describes story as the ‘why’ behind the action, the strategy as the ‘how’, and the structure as ‘what’ has to happen to make it all work. I have turned that framework into a graphic (Figure 6).



Figure 6 – Relationships to Action pathway based on the work of Ganz (2017)

Due to the time constraints of the PhD process, the following section only critiques aspects of the first of these three middle concepts, story. Future research could explore the other two elements, strategy and structure. The section explores how the use of story can turn relationships into action. The ZCA campaign intentionally developed a shared vision for a world with more climate action and less climate impacts, and gave a possible solution for people to rally behind – the draft law. The following section looks at how stories were used to create that shared vision and narrative during the ZCA campaign and investigates how stories can create both power and empowerment through shared connections and values.

6.2 Using stories to create a shared vision and narrative

Ganz highlights the power of using stories to develop and shape shared public vision and narratives for change. He also highlights the importance of emotion also as part of the process, in the following quote, “because stories speak the language of emotion, the language of the heart...they teach us not only how we ought to act, but can inspire us with the courage to act” (Ganz, 2009, p. 3). He states that public narratives allow communities to respond to challenges with courage, with hope, empathy, and self-advocacy as opposed to reacting to them in fear, isolation, and self-doubt. Humans know and experience the world through both facts and emotions (head and heart). Ganz

(2009) believes it is important to appreciate that emotion has its own language just as cognition has its own language, and both can be influenced through shaping dominant public narratives.

6.2.1 Narrative and the power of stories

An aim of the ZCA campaign was to use storytelling to motivate collective action through sharing values and vision. Narratives have the power to shape public opinion around solutions to, and risks from, climate change, as well as influence behaviour to act (Han & Ahn, 2020). Dr. Renée Lertzman (2015), a pioneer at the intersection of psychology and climate change for more than 20 years, states that stories are the vehicles for deep change and that the most optimal way for humans to process information is through stories. In her Project InsideOut, Lertzman (2015) uses compassionate truth-telling as a tool to help share eco-grief or eco-anxiety in a way that is real, messy, and authentic, and which aims to inspire new ideas and action through increased emotional intelligence. She states that telling stories of how we are feeling allows us to show up as more resilient and emotionally intelligent. It also allows people to shift their personal internal narrative around climate anxiety from why they are feeling this way to what they can do about it and who they can do it with. Thus, also linking the utility of stories to action coping as discussed in Chapter 5.

The power of story and narratives can shape a new vision for the future. In this way stories and narrative can be useful in the climate change context to help people understand the issues that need addressing, and to connect with any initiatives that will achieve a future vision. Among these initiatives is climate law and policy, which provides a basis and mandate for climate mitigation and adaptation. Such policy is in a transitional space, with policies developing and evolving over time to address climate change issues. However, some governments are struggling to develop and implement such policies. With climate change there is also a need to connect all communities to the development of policy responses. These responses will need all the imagination, vision, flexibility, and diversity of thought possible to counter prevailing systems that are inherently unimaginative, often static and immovable, and are embedded in the ‘that’s just how we’ve always done things’ rhetoric.

Consequently, new conversations are needed to connect communities to the issues and help them realise why ‘the old way’ is no longer an option, and narrative and stories may assist this process. Additionally, it has been suggested that the lack of impetus by governments in addressing climate change can only be countered by more ‘extreme’ types of conversations that comprise an action component. For example, Ockwell et al. (2009) suggest that citizen activism, a form of collective

action, is the most effective way of implementing actions related to reducing emissions as singular conversations alone are not having any impact.

Han and Ahn (2020) state that climate change is experienced, interpreted, and socially constructed through different social settings and that narratives are one way that people make sense of the changing world. They highlight the power of story and narratives in that transition process, and suggest people's perceptions of climate change can vary on what they are told and whom they are told it by. One example they give is of the importance of stories to climate change activists:

Activists use stories to make sense of the reality surrounding them, motivate collective action by forging collective identity, recruit participants, rebound from strategic setbacks and obstacles, and affect institutional policymaking (Han & Ahn, 2020, p. 3).

Norgaard (2011) suggested cultural practices of everyday life produce inaction by the public. It takes cultural action, norms, and narratives to keep climate change at arm's length and pretend that it isn't an issue. Head (2016) proposes that some people use climate inaction as a way of protecting parts of their self-identity. They suggest that transitioning our current societies to the low-carbon alternative versions needed to ward off the worst climate impacts will take a lot of cultural work, and that as communities we will need to form new identities and practices while also grieving things that people will lose throughout the process. Thus, while stories and narratives can be helpful in helping people understand and respond to climate change, they are also part of the process for those not taking climate action.

6.3 Story of us

The following sections outline some of the considerations regarding narratives in the climate context, alongside reasons why storytelling can be a powerful tool for collective action, using examples from the data collected for this project.

6.3.1 The role of science and policy interpreters in setting the narrative

The data highlighted the role that scientists, policymakers and politicians play in setting the narrative about climate change, and what to do about it. It also highlighted the challenges of understanding and interpreting often uncertain or complicated, science information in ways that required particular skillsets. Additionally, the data highlighted that those people who had those skillsets, such as politicians, had control of the narrative.

How do politicians do this? For all the different laws they have to have an opinion on. It is such an inaccessible process. It's another language. One that usually has to be purchased through a university degree or three. A process that comes with an assumption of superiority, and one that is inherently powerful and makes the rules that others follow. One that is so limited that the rest of us need trusted translators [sic] (PhD Diary – 23/10/19).

Given the complexities and challenges of understanding climate information and what to do about it, such information required translation. Trusted translators and interpreters of science are key within the climate policy space, and are often a highly influential behind the scenes of projects and campaigns. In terms of the ZCA, as activists we had many people providing this role in the campaign, however they were often intentionally in the background due to conflicts of interest, having jobs that frowned upon staff participation in activism, or due to worry about how they'd be seen by peers if involved. Working in the system can be strategic and a key part of climate campaigning so we tried to balance having these people feel part of our campaign, and feeling that their work was valued, whilst keeping them anonymous. The role of such translators helped connect and engage people, as they used ways of communication that spoke to people's values that were more aligned with 'arts' than science.

What are all the important intricacies that science misses. Or maybe actually this is what connects arts and science. Science does have some really good ways of looking at different issues in different ways and figuring out the usual and unusual components on interactions. But we don't communicate it in the same way. It doesn't have the same poetry feel. Is that the fault of what science has been turned into through capitalism rather than the nature or limitations of science? Need to remember the importance of the arts in science connection and communication – the heart as well as the head [sic] (PhD Diary – 29/11/19).

As The Workshop¹⁷⁷ (an Aotearoa New Zealand-based research organisation) phrase it in their climate communications guide (Elliott & Berentson-Shaw, 2019), we simplified the information by selling the cake, not the ingredients. We aimed to highlight in our messaging how the law would

¹⁷⁷ <https://www.theworkshop.org.nz/>

make tangible changes in Aotearoa New Zealand's climate change response and how that would make positive changes to people's lives. This broader message, focussed on outcomes, was an easier story for people to understand, and embrace collectively as a vision.

6.3.2 Visioning and imagination through story

Macy and Johnstone (2012) talk to the power of imagination and visioning in their book 'Active hope: How to face the mess we're in without going crazy.' They describe dreams and visioning as "essential for navigating through life because they give us a direction to move in" (Macy & Johnstone, 2012, p. 163) and highlight Martin Luther King Jr's 'I have a dream' speech as a famous and powerful example of visioning being used to create a collective destination to aim for and strive to achieve. They suggest sharing a vision with others creates a sense of purpose and community and that "moving towards a destination that excites and inspires us energizes our journey, puts wind in our sails, and strengthens our determination to overcome obstacles" (Macy & Johnstone, 2012, p. 163). A compelling vision also creates an emotional connection that is important for buying into that vision (Macy & Johnstone, 2012).

We used visioning and storytelling as a major part of the ZCA campaign in an attempt to help communities imagine what a community transition to a low-carbon world could look like for them and what it might take to make that vision a reality. We started our campaign strategic planning with an exercise on what our 2050 vision was for Aotearoa New Zealand and how we saw the law playing into that vision. We built a shared vision, and the campaign was then constructed from that vision. The vision of what the law could do to build that future was more important in our narrative than what the law looked like. An excerpt from my PhD diary articulates some of the reasons why the creation of a shared vision was important.

Visioning as action gives hope to people. Creating and sharing a vision can unite a group around action. Feeling powerless, yet trying to create and feel hope through action creates a connection to like-minded people. Sell an alternative to the current social and environmental systems that are failing. People don't always like change, but visioning can attempt to make that change look more appealing to them. But we also need to share things that are also not that great – what is going to happen if we don't act and how people will be impacted. It is a hard balance to find [sic] (PhD Diary – 02/08/19).

My experience with the ZCA campaign has led me to believe that participating in creating a vision can be as important as the vision itself, where the act of participation can be powerful for connecting abstract concepts to action. I have memories from our first ZCA national meeting of drawing images on big sheets of paper in groups to attempt to create a collective vision for the year 2050, harnessing the power of imagination to reimagine our collective futures (Hopkins, 2019). We chose 2050 as at that time (following on from the 2015 Paris Agreement), most countries were still looking at the end of the 21st century for stabilising climate change. Aiming for 2050 felt really ambitious at the time, though now narratives around public ambition have changed and a mid-century date feels like too late (Harvey, 2023). I reflected on that visioning exercise in my PhD diary three years later:

I do not remember the actual vision or what we drew, but I do remember the feeling from participating in that activity. I remember the intense discussions with the group. The excitement and hope that came with being given free license to create the future, but also the fear that came with knowing how tricky, nuanced, complicated, and expensive it would be to transition to a world like in that vision, and wondering how we would convince people to get on board with it [sic] (PhD Diary – 02/08/19).

Basing a vision for the country on the views of 20 young, city-based, predominantly pākehā people with university level education was never going to make for a vision centred in climate justice. And yet the visions we explored during that process went on to form the backbone for the Zero Carbon Act campaign.

The Workshop state in their guide to talking about climate change that one should lead with a clear, positive vision before giving people a list problems or barriers (Elliott and Berentson-Shaw, 2019). Telling stories, through in-person events, mainstream media and social media became our main tool in imploring different community groups to sign onto that vision. We sold the vision of a climate law and what that could mean for Aotearoa New Zealand, rather than the law itself. We created the draft policy blueprint one year into the campaign, but leading up to that draft blueprint we sold the vision of what it could do, how we thought it would help our emissions reductions and adaptation planning, and why people should care.

As part of the vision, we specifically embedded the concept of ‘Just Transition’ in our ZCA campaign communications and policy development (McCauley & Heffron, 2018). ‘Just Transition’ refers to a set of principles, born out of the Union movement, which aims to promote the idea that healthy ecosystems, communities, and economies can thrive at the same time. “The process for achieving this vision should be a fair one that should not cost workers or community residents their health, environment, jobs, or economic assets” (Just Transition Alliance, 2024). It also promotes the idea that costs incurred to communities from transitioning to a different economic setting, such as switching to a zero-carbon economy, should be compensated (Just Transition Alliance, 2024). We used the Just Transition narrative within the ZCA campaign because it highlighted the inequities climate change action could perpetuate on communities in Aotearoa New Zealand, especially in areas where fossil fuel extraction is central to a region’s social and economic life. Stories are important in Just Transition work because it allows people to imagine a different world, one which they might be motivated to collectively work toward achieving. As I noted in my PhD Diary around Just Transition:

Visioning is so important when talking about a Just Transition. This is the whole point of the Just Transition concept – to show ways that we can do this work better, prioritise the need to put people at the heart of the climate change transition, not a profit-led or growth at any cost economy [sic] (PhD Diary – 10/5/19).

However, Just Transition work is often at risk of being captured by governments as an engagement tick-box exercise, rather than its original purpose of being focussed on workers’ rights. As highlighted by one interview participant, stories of individual or community transformations can help keep the Just Transition work centred on workers’ rights:

With just transition principles there are a lot of buzzwords that have been overused to the point of meaninglessness. Concepts like collaboration or even partnership in some contexts have become really loaded terms in a negative sense. I’ve seen really good examples of embedding just transition principles through stories people can relate to, rather than simply tick-boxing the word [sic] (Interview participant quote).

However, within storytelling we also need to listen as much as we talk. Again, in the context of Just Transition, the following quote highlights the need to listen to communities about their thoughts on

climate policies, to gain trust, and a willingness to collectively be a part of change. If not, the opportunities for collective action to make changes will be limited.

To me, Just Transition is about listening. It's a form of communication. Dr Jess Berentson-Shaw talks about communication through listening as being, you know, fundamentally the most important thing. I think that applies really well in communities where those in the position to make decisions about the direction of an industry or a community or whatever it is, you know, too often using the best research generated behind closed doors and sort of like a bit of a political negotiation, again, behind closed doors, to create a plan that's then presented as an idea for people to step into and to have buy in for. That hasn't proven to be a very good method of doing Just Transition where, you know, maybe it's because they're getting those policies wrong, because they're not listening to the community, or maybe it's just as simple as they're not building trust because they're not doing the listening. Maybe the policies are the perfect solution, but without the trust of the community and the willingness to be a part of that change, then it's not going to work and it's going to backfire and it's not going to be a Just Transition and everybody's going to be upset and worse off for it [sic] (Interview participant quote).

6.3.3 Cultural shifts through dominant narratives

Nissen et al. (2021) suggest there is potential for climate activism to shift social practice and culture, and contribute to collective action. For example, they highlight research which shows climate activism in young people can shape sustainability practices in their families (Nissen et al., 2021). Young climate activists are also collectively influencing popular culture, including fashion, literature and music (O'Brien et al., 2018). One of the interview participants from our campaign noted that songs, as a form of narrative, are missing in the Western climate movement, in comparison to other social movements past and present.

Something I find really strange is that the climate movement doesn't have a great song. Like the anti-Vietnam War movement has some really defining music. We are the largest protest

movement in history. But where's our iconic song? We need a more popular environment music culture [sic] (Interview participant quote).

Thinking and acting creatively, both as individuals and as groups, is an effective tool for coping with emotional responses to a crisis (Lertzman, 2015). Arts, science, policy, politics, and activism all need to be combined to solve the climate crisis. There are many climate-related artistic endeavours that can be used for action coping, such as painting, poetry, song writing, and having climate conversations (Lertzman, 2015). Organisations such as Track Zero¹⁷⁸ find engaging ways to promote the connection between climate scientists and artists to create climate communications through the use of artistic mediums including poetry, stage plays, film, sculpture, painting, and dance. Self-care for me turned into writing poetry to get the emotion of climate grief out. I was inspired by this piece of writing by Audre Lorde:

Poetry is not a luxury. It is a vital necessity of our existence. It forms the quality of the light within which we predicate our hopes and dreams toward survival and change, first made into language, then into idea, then into more tangible action. Poetry is the way we help give name to the nameless so it can be thought. The farthest horizons of our hopes and fears are cobbled by our poems, carved from the rock experiences of our daily lives (Lorde, 1985).

I was finding different ways of coping with the pressure of the ZCA campaign. As an antidote to climate anxiety, I found poetry as a creative expression. It helped me to relieve some of the stress associated with both the climate anxiety itself, and my other coping mechanisms, such as volunteer management of a climate campaign. One line from a spoken word style poem I wrote in 2019 highlights the complex feelings around the daunting task of fighting climate change whilst our lifestyles here in Aotearoa New Zealand are still rooted in the use of fossil fuels:

Our bid to desperately out-manoeuvre a foe so deeply ingrained in the system that to defeat it is also to destroy parts of ourselves [sic] (PhD Diary - 17/09/2019)

Brown shows in her book *Rising Strong* (2015, p. 7) that “creativity is the mechanism that allows learning to seep into our being and become practice”. While the poetry I was reading and writing

¹⁷⁸ Track Zero is an Aotearoa New Zealand based charity which aims to deliver creative platforms for the arts, science and others, to inspire transformative climate action - <https://trackzero.nz/>

connects with my action coping described in Chapter 5's, "Story of Self", such artistic narratives have the potential to be utilised collectively, to garner support for collective action to climate change.

6.3.4 Values based messaging

As a ZCA campaign team we wanted to harness people's passion for more ambitious government action on climate change. The following section outlines our strategy as it relates to collective action in the ZCA campaign.

With the climate crisis becoming more real in people's everyday lives, we needed a new authentic vision. A narrative for a future that let go of who we could have collectively been as a nation without climate change, and prioritised a just and equitable transition going forward. We needed to learn to have vulnerable conversations as a nation around our response to the climate crisis. That is not an easy task in the age of populism politics, three-year election cycles, polarisation culture, social media and internet 'fake news'. To combat these issues, scientific evidence about climate change alone was not enough to gain traction on solving climate change. We needed shared values and purpose to create collective action to move us as a society in the same direction for change. A quote from an interviewee sums up how stories enable connection and the sharing of values that can lead to action.

When people hear stories they can relate to about people working together, and getting stuff done, and being better off, I think that hits home a lot better than government documents that talk about strategic approach to partnership. Stories, if they're good stories, allow you to relate to, empathise with, or put yourself in the shoes of the characters that are being talked about. Whereas if you are reading a strategy document about partnership you've often got to do some mental gymnastics to apply that to your life [sic] (Interview participant quote).

We strategically used values-based campaigning as a way of leaning into, rather than away from, the complex and depressing realities of climate change. We used resources from The Workshop (Elliott & Berentson-Shaw, 2019) on implicit versus explicit motivations and ways of communicating, and we aimed to connect people to the solutions, rather than focus too much on the negatives. We also aimed to connect people to those who were already doing the work to show them that they weren't alone in wanting to make change (Elliott & Berentson-Shaw, 2019).

It is really difficult for people to, for some people, for most people maybe, to accept that we're facing existential threat. And a really natural response to that is to draw on your own personal experiences to explain why that can't possibly be true. And we all have experiences of a life that doesn't face the existential threat. I mean, we all maybe not all of us, but most of us do. And so, if we use that as evidence for the future, it's very difficult to see how that would be different. And so, it's natural that people become climate deniers, or climate sceptics or even just simply like, silent in the face of being able to act, you know, silences is deafening and it's actually what the majority of doing. That's one big problem [sic] (Interview participant quote).

We also knew that we needed to target people who were hesitant or confused about the issues, rather than people who were deniers. We spent time activating our volunteers who were enthusiastic about our idea and created communications to bring in people who did not hold strong views about climate change either way. It was for these people that the visioning and storytelling work was important as we could connect the abstract concept of climate change to their lives and show how a climate law would be in their community's best interests (Elliott & Berentson-Shaw, 2019). This is highlighted by the following interviewee quote:

The intrinsic value work was something that I got really into during the campaign. Telling stories, making it personal. Speaking to your own reasons why it's important. Why working on climate change is important, why what we're trying to do is important, and then, yeah, trying to like, find that common ground. Values based messaging was quite eye opening to me and seem to resonate really well with people [sic] (Interview participant quote).

6.3.5 Building trust with unlikely allies

Our ZCA campaign story, and the values that underpinned it, needs to be analysed in the wider Aotearoa New Zealand climate context in 2016 when we started. We 'framed' (Logemann et al., 2019) the ZCA campaign story for a particular political climate (i.e. parties in government, policies), so that the politicians would connect with it and support it. We designed our law under the

assumption that the New Zealand National Party¹⁷⁹ would be back into government at the 2017 election, and only a year prior they'd had climate deniers amongst their highest-ranking politicians. We also wanted all sectors embedded in the law, including the agriculture sector. Up until this point every climate policy had been fought by powerful agricultural and business industry lobby groups (Corlett, 2022). We treated biogenic methane differently in our draft law (the 'split gas' approach¹⁸⁰) as a way to change the narrative around agriculture emissions and bring them back to the policy negotiation table. This framing reflected a need to write the draft law for the current and anticipated future governments (Stefanou, 2016). We could have been designed the law differently if a Green Party-led government had been in power, who had been very supportive of climate change action for decades, but it might not have had the cross-party staying power to survive future government changes.

We have powerful people knowingly vested in the status quo. We have powerful people who actively tried and stop action happening. And that is true for politicians, and shareholders, and members of corporations. And they are the enemy of climate action [sic] (Interview participant quote).

Working within such an environment involves listening to viewpoints that might be counter to your own. There are few specific studies looking at the narratives or public facing communications of the Aotearoa New Zealand climate movement. One example is from Jonathan Oosterman (2018), Victoria University of Wellington, who sought to help fill the identified gap between those doing climate communications within the wider climate movement and those researching climate communications. His research highlights different theories of change within the people and organisations interviewed, and how they apply to movement communications. Oosterman (2018) focuses on different ways narratives can be 'framed' to analyse the balance of moral, social, and economic aspects of narrative. He uses George Lakoff's description of frames as "mental structures that shape the way we see the world" (Oosterman, 2018, p. 82). He describes how the narratives that climate movement participants tell the public are a process of public engagement, and that if they connect with the public, they can inspire new ways of feeling, thinking, and acting, which may emerge collectively.

¹⁷⁹ The National Party are one of Aotearoa New Zealand's main political parties; they lean centre right (conservative) on the political spectrum.

¹⁸⁰ <https://www.climatecommission.govt.nz/public/Advice-to-govt-docs/ICCC-technical-appendix-4-split-gas-policy-and-GHG-metrics.pdf>

Holding connections with people through interpersonal relationships is a key part of forming and maintaining collective action, but it isn't always an easy thing to do. It takes care to navigate these relationships in a way that is productive for shared positive experiences, both at a group and individual level (Brown, 2018). Forming connections with positive interactions and building trust with unlikely allies was a tactic used during the ZCA campaign. Trust was identified by Brown (2018) as a "slow-building, iterative, and layered process that happens over time" and that "we need to trust to be vulnerable, and we need to be vulnerable to trust." (Brown, 2018, p. 30). She states that trust is built in small, consistent moments of genuine connection, rather than highly visible actions or heroic deeds. It is developed using gestures of connection and includes paying attention and listening to what people have to say. Both building trust and being vulnerable involve risk. The following quote highlights the challenges of building trust in the ZCA context:

My preferred theory of change is to build bridges and create trust and bring people with you. And sometimes you have to make hard decisions about opposing an idea or a person or a group in order to bring more people with you... but for the most part, if you are trying to convince someone of something then bringing them on the journey is more effective than telling them you're wrong. In practice it is difficult because it's hard to change people's values. It's hard to change the stories they tell themselves. It is also hard because when you are pursuing a trust-based bridge building theory of change then there is a perception from others that you are working with the enemy sometimes, that you are not taking a hard enough line, and that from a personal perspective as well, sometimes you feel like you are being manipulative because you might find yourself, for example, pretending to agree with something someone said in order to build that trust and get them to change their mind down the track, which is totally manipulative, and that doesn't feel great. And that's when you better quite firmly believe in your vision of what a better world looks like, cause that's what you are trying to do [sic] (Interview participant quote).

During the ZCA campaign we had to start with trust-building with communities due to the history of the climate change debate. In the early decades of modern climate change science, trusting scientists was a risk, and a vulnerable thing for elected leaders to do, due to the injection of multi-

millions of dollars into anti-climate propaganda (Balková, 2020). Lertzman (2015) suggests that difficult yet compassionate conversations that get outside our own movement and comfort zones are critically necessary. The climate movement thus needs to be increasing capacity to hold such conversations.

Our Zero Carbon Act utilised the power of storytelling to connect with unlikely allies such as the youth wing of the New Zealand National Party (the ‘Young Nats’). Through a collaboration with the British High Commission, we ran a series of workshops with members of the different political party youth wings to allow for genuine dialogue around both climate change and the ZCA campaign ideas in a space that was viewed as neutral ground. We aimed to build trust across political lines (Quilter-Pinner, 2021) through finding common interests across the party youth wings and getting to know the members at an individual level. The collaboration resulted in all the youth wings publicly calling for a cross-party climate law before the 2017 central government elections (Generation Zero, 2017).

Convincing the Young Nats to support the climate law idea was a turning point in the campaign, and a moment when news media and other key stakeholders in the campaign, such as academics and MPs started to take the campaign more seriously. As the Young Nats wrote on their Facebook wall at the time, “The Young Nats are proud to support the Zero Carbon Act. Our membership overwhelmingly supports the ‘apolitical approach’ to climate change solutions being advocated by Generation Zero” (Generation Zero, 2017). It was an important tactical move because climate action was not a priority for the New Zealand National Party. Also, around the initial stages of the ZCA campaign the National Party still had some outspoken climate deniers amongst their top ranked MPs. For us it was necessary to build connections with members of their young wing to show those politicians that their young affiliates viewed the proposed law as something worthy of championing. Getting the youth political organisations from across different ends of the political spectrum to collectively back a cross-party climate law also meant we were able to show the public that the idea of a cross-party law was not incomprehensible.

6.3.6 The value of social connections and collective action

Teamwork and collective action provided distinct benefits to ZCA participants. Nairn (2019) has highlighted how young people in her study saw collective social action as a powerful tool and that hope was often experienced as a shared problem, whereas despair was experienced more as an individual problem. I experienced similar benefits from the process, particularly from an emotional

perspective. The ZCA campaign became a place and space I enjoyed working in because of the people around me, and the support they offered.

If we didn't have a good team, I think it would have been a lot harder, because for me it was the people that kept me going. Regular meetings help and I became friends with the team and that side of it I can't really describe. We became like a family. [sic] (PhD Diary – 27/07/2018).

Kleres and Wettergren (2017) suggest that social processes including the collective emotion management of social movements, function to sustain feelings of hope. They reference the work of McGeer (2004) who suggests that, within adult hope, peer-to-peer comforting is used to shield people from despair. For myself, the collective action part of the work not only gave me hope but it also gave me courage. Brown (2015) describes courage as contagious, where your ability to lean into difficult situations as a collective can inspire others to join. A person's ability to be vulnerable by owning and discussing feelings of grief, anxiety, worry or shame can lead others to do the same (Brown, 2015). Our ZCA campaign created a group culture where vulnerability was safe to be shared, and collective courage was able to be built.

Similar to my own motivations, several participant interviews highlighted that being part of a team was a major motivating factor for joining or continuing with climate activist groups in the first place.

My primary motivation has always been other people. And when I first when I first decided to become a member of an environmental group, it was because of other people that I wanted to be associated with. And I wanted to spend more time with. When I first started working more actively with Generation Zero, it was because I met some of the people that were part of the team and I really respected them. And I thought that the work that they were doing was great. And now I've been able to support people and help them make a real big difference in the world and feel empowered to be a part of the solution rather than just kind of a victim of the problem. Those are the things that keep me going and draw me further into this journey [sic] (Interview participant quote).

My original motivation to join was peer pressure, in a positive way. I wasn't pressured to join. But I met some people who I thought were inspirational and simply I wanted to be like them. And I suspect that sits behind a lot of things that human beings decide to do. The more I've learnt the more I see the factual urgency for doing this, but that wasn't the case at the start. But keeps me in this space is the fear of what will happen if we don't win this fight. Giving up is not an option [sic] (Interview participant quote).

Lertzman's advice for teens and young adults who worried about the future of the planet and are experiencing feelings of hopelessness and/or anxiety about their future is to find allies who they could use as a climate community and as sounding boards and safe friends for climate discussions and action (Lertzman, 2015). We often talked in the ZCA team about how we reach young people who aren't part of their school environment groups, or who are from communities where climate action isn't seen as a good thing to be a part of. I especially felt this coming from a small rural community where climate activists were often villainized. It made me feel worried for young people growing up in those environments and the conflicting information they would be receiving on climate change. This feeling was summed up by one interview participant who, when talking about students who weren't connected in with climate action initiatives, such as the School Strike 4 Climate (SS4C) movement, said:

It's the young people that are sheltered from the youth climate movement I really worry about...they may have in the back of their mind an understanding of the threat that we face, and they have less opportunity for action [sic] (Interview participant quote).

Social movements are spaces where people can use joint action to produce hope, which can in turn encourage more people to join in with the collective action. Hope in these group situations can be seen to mitigate the effects of collective and individual fear (Kleres & Wettergren, 2017).

What is needed are accessible and safe spaces to explore these difficult emotional reactions, the political will to ensure that important strategies and supports are funded, and the research required to strengthen and support approaches of healing and resilience (Cunsolo et al., 2020, p. 262).

Lertzman (2015) highlights the importance of listening and holding safe spaces for people to share their feelings around climate change. She suggests those working in the climate space should refrain from sharing positivity only, or doom and gloom only, and that it is okay for people to feel overwhelmed, as this is a natural response to the situation we are in.

For a few years it was quite a tiring thing. It didn't always feel tiring at the time when there were other people doing it with you, you were never alone. I've probably stayed in New Zealand because of it. I probably wouldn't have stayed here if not for this campaign [sic] (Interview participant quote).

Participation on such a large scale in climate actions can shift life course patterns that will impact an individual's family dynamics, workplace and career, as well as community life and friendships (Vestergren et al., 2017, found in Nissen et al., 2021).

We built our campaign on the shoulders of giants. There have been young people calling for action on climate change for decades, it's only recently that the world was ready to listen. I'm grateful to the young climate activists past and present, based here and overseas, who spend so much of their unpaid time doing this mahi. The work can be tireless, depressing, unseen and unacknowledged. And many are often doing this alongside work or study. But getting involved in climate activism can also give you a sense of community, togetherness, and a purpose unlike any other [sic] (PhD Diary – 16/04/19).

The ZCA team tried to develop an internal culture as a safe space for members to share their thoughts and feelings around climate change. Talking about how climate change increased the resilience of group members in responding to it, through a sense of connection to others, feeling a sense of belonging within the group, and learning more about self-care for climate activists.

6.3.7 Collaborative informal education

Educating people about the problem of climate change is not always enough to motivate them to take action (McLaren, 2013). However, education around climate change doesn't always have to be around climate science, it can also include educating communities about solutions to climate issues. Knowledge can still be powerful if it is providing information, tools, and ideas on how to make change and gain agency in the face of an often complicated and confusing global problem. There are

different narratives developing in education settings around learning, especially within less formal community education settings (Akomolafe & Jain, 2016). Freire (1970) highlighted education as a practice of freedom to transform the world by personal reflection and acting. The ZCA campaign is an example of informal education through upskilling of the core team and other volunteers in climate science, policy, and campaign theory, to then use those lessons to create climate action. We learnt together during the ZCA campaign through shared experience, peer-to-peer discussions, and peer-led workshops.

Informal Disaster Education, based on the work of Feng et al. (2018) highlights how the promotion of a more informal education approach can also be used to increase a community's resilience, as well as increase personal resilience in participants. Informal education can be described as unstructured, doesn't come with certification for completion, and often happens during daily activities that can be related to home or work life, including community groups, recreation or religious groups and other social networks (Feng et al., 2018).

Generation Zero as an organisation has a history of upskilling young climate activists, as well as communities involved in various campaigns. The Zero Carbon Act campaign was no exception to this. Informal education, mentioned as a community resilience enabler in Chapter 2, was a significant part of the campaign in two distinct ways: firstly, increasing the knowledge of our team members around climate science, policy, campaigning methods and community engagement practices; and secondly, increasing the knowledge of communities we worked with during the campaign around climate science and policy.

One way we tried to keep the ZCA team interested in the campaign was to upskill their level of climate change knowledge to help them navigate the language and concepts talked about in campaign planning meetings. We had feedback early on in the campaign that there seemed to be a high level of climate knowledge needed to join in with discussions. At the time we ran a series of climate policy and climate science '101' type talks which broke down the issues and connected team members to various aspects of our idea for a climate law.

Our policy team had, you know, like actual lawyers, who understand the words and what it means and were able to kind of teach us the translations between, you know, kind of law as it as it gets formulated, and, the principles around it right, like so you know, how precedents

are set, and what it all means and that stuff was super useful to learn [sic] (Interview participant quote).

Learning new things does not always lead to volunteer retention within citizen science projects (Peters, 2020). My experience with the ZCA has led me to believe that a volunteer needs to want to give time or skills or knowledge to a climate campaign for them to stick around, otherwise they may only join for a single tactic (demonstration, letter writing party, etc.) rather than join the ongoing campaign team. The education work undertaken by our core team and wider volunteers during the ZCA campaign expanded the worldviews of individuals, including exposure to justice-based narratives and issues. Even those who had more experience with climate change science or policy prior to the campaign learnt something along the way, especially around how multiple layers of marginalisation plays out within policy nuances.

I think my understanding around the policy nuances has changed. So, I think when I first got into it, you know, I was like, you have targets, and you have budgets. It's literally as simple as that. And then you have put policies in place to meet those. But the nuances around how that affects certain people, and how we should think of that, and how we should incorporate some principles into our policy space, I think was definitely an eye opener. So, I think, for a long time, the only equity issues that I kind of really underscore explicitly acknowledge, I guess, were around the treaty, and probably on our commitment to the Pacific. But I didn't consider and this is, you know, complete failing on my part that, like, the agricultural sector and other industrial sectors, did actually have some requirements in terms of equity and justice, right? Some big corporation owning a bunch of farms, maybe less so. But certainly family farms, people who work on the farms, workers in the fossil fuel sector, like, you can't just leave them out to dry. I think that interaction between the policy space and how to think of equity as a broad principle, rather than specific marginalized communities was a big eye opener. Because you know, you because you always have the tick box as a margin as communities, right? There's like three or four of them and go, Yeah, we got to work on those ones. But actually, marginalization can happen in all sorts of weird dimensions. So that interaction, I think, between what equity means and what the science

means, in terms of how you formulate specific policy and how you relate the science to the policy, I think, changed quite a bit with that particular piece of work. But otherwise, yeah, I mean, was more going into more detail for the sake of writing the policy [sic] (Interview participant quote).

The benefits for me personally, and I think this might be true for other people is that as we participate in this work and we become active in it, we do have to confront all those difficult things. And that's, it's an opportunity to learn a whole bunch of new things. So, I think totally differently now. And I think much more broadly about the world now, as a result of my activism through climate change, which is, you know, it can be quite a narrow lens, but it's certainly helping me to see much broader. So that's how it's helped me personally. And I think, you know, I get the feedback from other people that it's true for them as well [sic] (Interview participant quote).

Learning about citizenship and democratizing processes was a key outcome of the ZCA campaign. We learned a lot about the barriers to taking part in civic processes, including the barriers to policy formation.

I was under the impression that the sovereign parliament, like New Zealand has, you know, you could do things quickly, right. And maybe you can, if you have the will, I don't know, but the political inertia was not something I was prepared for going into it. I understood the social inertia, like campaigning to get them on board, but the process of negotiation and even how little scientific reality plays a part in actual policy development. That was a bit of a revelation [sic] (Interview participant quote).

Personally, I had little concept of how to get involved in civic participation before the campaign, aside from the well-known basic concepts such as voting or mass protest. Our campaign educated our volunteers on parliamentary processes and law development, and gave them new ways of understanding the concept of citizenship. We often received comments from people joining the

campaign about how 'brave' we were for trying to write a new law. It was seen by many as a very unusual thing to do.

6.3.8 Teaching others through community outreach

With climate change, I have found it so much easier to connect people to the issues through something that they can understand, something they can relate to, and that they can imagine or feel. So we tried to connect them to our vision for the campaign with something they value locally.

It's been phenomenal to see the number of people that participated in the ZCA discussions. So, let's just put some numbers to that. Let's just say that 15,000 maybe 20,000 people have some understanding of the policy platform of the Zero Carbon Act. In that they understand that New Zealand is moving in a direction, and as part of that our whole economy will be changing. And they are learning we have to have quite a long-term future lens on pretty much everything we do now. Yeah, even if they don't understand the details, I don't think that's really important. But those big concepts people are now learning. There are 20,000 plus people in New Zealand who are part of different communities and I think that's really powerful as then provides champions in, you know, represented in all or most communities, there are champions, which this leads to community conversations. I hope that we've seen it something that can be much larger and much more long term [sic]

(Interview participant quote).

The ZCA was a national campaign run through regional groups, and we tried to connect the climate law back to wider climate issues within the different regions. I don't know how well we did, but we tried. One tactic we used was to fundraise for books about climate change to donate to local libraries. But this tactic had varying levels of success depending on how well connected we were to the town/area we were donating to.

One partnership which developed in the last year of the campaign was with the newly formed School Strike 4 Climate (SS4C) organisers in 2019. SS4C was part of the global Fridays for Future movement instigated by Greta Thunberg and saw over a hundred thousand people take to the street

in protest around Aotearoa New Zealand during the first six months of their existence as an organisation. The partnership developed organically with friendships developing between members of both organisations, as well as through shared tactics in the lead up to the passing of the Zero Carbon Act. One such tactic was the 'Elbow Your Elders' tactic where we were asking young people to encourage older generations in their life to care and act on climate change. The tactic was based originally on similar tactics that had been run by youth climate groups overseas. We specifically engaged SS4C on this tactic because their claim to the label 'youth' was much stronger than for many of our ZCA campaign members, myself included, as well as seeing it as another way to form connections between the two groups. We launched the tactic at the second national climate strike day of that year.

"This is an opportunity for youth to talk to their elders about why climate change matters to them and ask them to advocate for more climate change action," Zero Carbon Act national campaign convener Lisa McLaren said in a statement. "Over the next few months we will send videos, make submissions, visit rest homes, take photos, have many cups of tea and stale cake, all with the aim of getting our elders to care and act on climate change," said Molly Doyle of School Strike 4 Climate (Stuff news, 2019).

The relationship with SS4C was valued by many members of the ZCA team, a lot of whom spent many hours to mentor members of their SS4C organising teams and help them develop policy points.

I was giving a talk at [redacted for anonymity] and there was a really young school striker there who said to the room that when they grew up they wanted to be a climate activists as well, like they were saying, they wanted to do it as a job because they assumed that I was doing it as a job. And I remember everyone in the room kind of chuckled because they knew that I was obviously not getting paid. So, I was like Oh my God, like they're looking up to us and going, you know, I can do that too [sic] (Interview participant quote).

We also tried and failed at times at different outreach techniques for the general public during the ZCA campaign. We tried a tactic called 'my zero carbon world', which was in 2016 before we had our policy blueprint. We asked people to send in photos through to our social media channels about what they visioned for their 2050 world. Most of the photos that went up online were from us. No

one engaged. A week into the tactic Donald Trump got elected as US president and the massive Kaikōura earthquake happened in Aotearoa New Zealand, which distracted the public on to other matters. So, we gave up. It was a giant failure because the campaign didn't have a movement behind us yet. If we did that a few years later it could have looked very different as it became more of a movement. It was a learning experience, however, as it was another reminder that if people can't imagine something, because it is so far out of their worldview or because they've never had the opportunity to try imagination or visioning-type exercises. We then switched to taking our current shared team vision and really personalise it for different types of groups and people. We learnt that how we campaigned needed to be redesigned to bring people along if we wanted to build a movement of collective action calling for a new climate law.

6.3.9 Shared learning on how to have uncomfortable discussions

In our ZCA campaign climate change discussions there were multiple layers of issues, from confusion and grief around our own role in the climate crisis and at the wider state of the world, through to learning about how to centre intersectional ways of addressing climate change. Having a space to discuss such issues collectively was a useful part of the process of undertaking climate action. The interview participant quote below exemplifies the complexity of climate issues, and articulates some of the difficult discussions that were had (e.g. regarding decolonization in this instance).

I think another big problem is that climate change is a symptom of intersecting issues. And it's really, really, really difficult to understand some of those issues, both because they're complex and they are many, but also because understanding them and confronting them means confronting things about ourselves that we don't want to believe to be true. I suppose that's particularly evident in the decolonization space where colonisers have to confront their privilege, as bestowed on them by colonization, and how that interplays with climate change. And that's like a never-ending journey. And it's very confronting. It's quite easy to be hurt by those conversations. And it's, you know there where we get given many opportunities to exit action. And some people take that. And the third major thing is that [sic] (Interview participant quote).

Holding such conversations were sometimes messy, complicated, and felt like they were going round in circles. We had many nuanced and in-depth discussions on how to unpack different cultural

aspects of solutions being proposed around the world to both mitigate and adapt to climate change. The research from Brown (2018) shows that people often rush into solutions before they've identified the true cause of the problem, including underlying root causes. Rushing into these solutions makes them ineffective which can be costly and demoralising as the issues will continue. Brown (2015) proposes that groups need to create a safer learning culture for these complex and often emotive discussions on complex issues. She describes those tricky conversations as a 'rumble' where participants must lean into vulnerability with curiosity and fearlessness.

As part of the ZCA campaign, we needed to create safe spaces for vulnerable dialogue which required constant work to maintain good team culture, including through open communication, mediating conflict, reconnecting with shared values and goals, and checking how and why power is shared. However, the idea of a 'safe space' is not the same for everyone, and what might be safe for one group or individual does not mean it is safe for another (Burke & Brown, 2021). It was hard to guarantee culturally competent spaces and approaches for all during the ZCA campaign, especially as many of us in the core team were learning about these issues as we went along.

In terms of difficult discussions, we struggled at times in the intersection or tension between values and action. As members of a national campaign team spread across different areas of the country with different life experiences and world views, we were not homogenous, and we did not all share the same values or have an idea of how our shared organisational values worked in practice. Putting our collective values into action, or praxis (Friere, 1970), was often harder in practice than theory, often because we didn't create the time to reflect on these while in the middle of busy campaign periods. Therefore, our campaigns and actions weren't always directly attributable and accountable to those values. We as a youth group were making these things up as we went along. We didn't have a well-known strategy to follow in Aotearoa New Zealand for having these conversations and we didn't always know who to turn to for someone that could role model this behaviour.

We often don't have access to or connections with the mentors needed as young pākehā on how to do this work differently. Not an excuse. Just a fact of where the movement started and developed [sic] (PhD diary – 21/06/19).

Unequal power relationships or interpersonal conflicts could have influenced whose vision or ideas were being purposed and how connected volunteers felt to the ZCA campaign (Nairn, 2019). For example, whose vision was centred in the work, why they had the skills or experience to decide what

is best for the country, which values they bring to the work, and what privilege they bring which shapes their worldview. Creating a sense of connection (Jordan, 2008) to each volunteer was important for volunteers to feel they had a place in the wider campaign team and that their ideas or opinions would be listened to.

I've certainly felt Gen Zero as an outsider prior to this campaign [the ZCA]. They were all fairly homogenous, which meant that they had a similar perspective, which kind of leads to building cliques. And once that happens, it's pretty hard to change. It's a bubble. During this campaign I didn't really feel that way [sic] (Interview participant quote).

Being vulnerable and open in the ways we learnt together took a lot of self and group reflection, as well as mental load and energy (Brown, 2018). We used 'check-ins'¹⁸¹ at the beginning of every meeting to gauge how people were feeling, what people were bringing to the meeting that day, for example, stressful home, school, or work situations, low or high energy, illness, worry or inspiration about particular aspects of the campaign. Allowing time for narratives to be shared amongst team members was an important part of the process of collective action (Ganz, 2009).

As the campaign developed, we pushed more for the inclusion of Te Tiriti o Waitangi in the law engagement and development as part of our commitment to integrating climate justice approaches into the work. During the governments consultation on the Zero Carbon Act, a Gen Zero spokesperson, Victor Komarovsky, said, "We ask that the Ministry of Environment officials honour this by drafting an ambitious bill, one that is comprehensive and fair, and continue to work with iwi and hapū to reflect our commitment to Te Tiriti o Waitangi" (Kupenga, 2018).

As a team we started learning more about how climate justice was deeply connected to other injustices such as environmental racism which can include creating damaging practices in communities of predominantly people of colour, indigenous people, and low-income people (Environmental Justice Network, 2002). Environmental damage can lead to physical harm to the people and their surroundings, including poisoning air and water, as well as desecration of spiritual sites and food harvesting areas. It is also responsible for loss of cultural knowledge and practices, being economically shut out of areas, and ineffective emergency planning and warnings

¹⁸¹ A check-in is a way of enquiring about how each member of a meeting is feeling at the start of that meeting. It can include basic questions such as 'how are you feeling today?', to more fun or creative questions such as 'if you were a season (e.g. summer, winter) today which one would you be'?

(Environmental Justice Network, 2002). Environmental racism was not something that the majority of people in our core team had lived experience in nor had to deal with in their daily lives. However, by confronting these big issues through educational encounters, team members made changes in their own lives, and the team had the potential to shift the boundaries of the ZCA campaign through changing our public narratives (Coburn & Gormally, 2015).

My involvement in the climate movement as a volunteer has shaped so much in my thinking, to the point where now I guess I live my life really differently. I have a different set of friends. I act on different values. I've changed work and countries because I think doing this is the most important thing that I could be doing right now. The youth climate movement has really shaped my life in every facet [sic] (Interview participant quote).

One major critique of the idea for a climate law based on the UK's Climate Change Act was that it was a form of 'recolonizing' (Harrison, 2012) (i.e. that an overseas law was being applied in a way similar to past colonisation processes).

For the first year or so we didn't know how to deal with the knowledge that the whole concept of bringing in a UK-style law was recolonising. We had this climate law idea and thought the idea had merit, and we didn't take the time to dig down deep enough at the very start to look more broadly at what that would mean for climate justice. Instead, we got in over our heads and had to learn some hard lessons along the way. So, although it doesn't excuse our process, we learnt lessons that mean it's likely the majority of the team would do it very differently if it was done over again [sic] (PhD diary – 21/06/19).

I think there were always good intentions to have like climate justice included in the Zero Carbon Act campaign. I think we probably had the same weaknesses that any other NGO climate group in New Zealand that's fairly mainstream. The kind of people who are in GZ, they can be very very privileged compared to the general New Zealand population, often because it's traditionally been a university-based activist group. A lot of us didn't have the lived experience that would have made the justice side of our campaign stronger. The justice

side of things didn't get as much attention as it really should have. There were attempts to be better, like with the Treaty workshops that were organized by the Zero Carbon Act campaign team. But I think a lot of us just didn't really know what we were doing. I feel like I learned lots of stuff this year. We had good intentions but that doesn't justify any harm done [sic] (Interview participant quote).

I think initially, like this is like 2015/2016. Now, we had kind of an understanding that we had been pretty lax in terms of climate justice in general, as an organization. So that meant that we were aware that we weren't doing enough, we just didn't know what to do about it, I think, or at least, you know, and it became lots of conversations without really anything happening. In terms of the campaign, I think, early on, we definitely didn't do enough. I think we also approached it in a really transactional way. Like, if we involve group x who have these boxes ticked, then we have achieved, you know, like, all like we sent it to the Iwi leaders forum, whatever, to get feedback. Like, that's not justice. Right? I think that was approach we took to that. And to be fair, because you know, that's the approach most people take, and I think we were kind of naive about it [sic] (Interview participant quote).

One way our ZCA campaign team tried to address these issues was to upskill the knowledge of ourselves and our volunteers in areas such as Te Tiriti o Waitangi (The Treaty of Waitangi). We commissioned a multi-day workshop with a well-known local Te Tiriti trainer to explore the history of Te Tiriti o Waitangi and He Whakaputanga¹⁸², and how those national foundational documents intersected with our youth climate campaigning work. The workshop was the result of many discussions (both internally to our team and with external people) around how we negotiate the issue of our proposed climate law being based on the UK's Climate Change Act and what that meant for potential recolonising through legislation.

¹⁸² Te Tiriti o Waitangi and He Whakaputanga are the founding documents of Aotearoa New Zealand, explained more in Chapter One of this thesis.

6.4 Summary and Link to Chapter 7

The 'Story of Us' has focussed on shared knowledge, values, and experiences through the ZCA campaign, that connected and inspired action in the form of collective action. Researchers have previously highlighted the power of connection, alongside shared values and narratives, in achieving collective action (Ganz, 2017; Brown, 2015; Lertzman, 2015; Elliott & Berentson-Shaw, 2019). Experiences from the ZCA have highlighted the importance of these aspects and the quotes illustrate how these manifested within that context.

To support collective action occurring, a number of factors were important for sharing knowledge. Education of team members internally was also important in building knowledge and motivation for action, alongside outreach with those external to the team, including volunteers and the public. Climate science and policy information could be quite difficult to interpret for those who were less informed or were not trained in understanding such issues. However, capacity building was useful for helping people engage in a conversation about climate change and action.

Additionally, the ZCA team acted as 'translators' of this information in ways that the public could understand. They played a role in organising information, so that people could see a bigger picture about what climate change meant and how this might be realised in terms of policy and other actions, rather than presenting such components separately. To achieve this, a narrative of a shared vision was created both internally within the team, and for volunteers and the public. This was then supported by communication efforts that included values-based messaging, which was more likely to inspire action than facts alone.

The building of trust featured heavily in sharing information and motivating collective action, including building trust with people that might not necessarily initially share the same vision. For example, building trust with young political party members (Young Nats) was an important first step to be able to discuss and develop a shared vision, and garner their support for a new ZCA.

Creating spaces to have more vulnerable or difficult conversations was also important, as difficult issues needed to be navigated before action could take place. These included issues related to differences in team members' values about climate action; how the ZCA might address justice issues, including those relevant to Te Tiriti o Waitangi; and more emotional issues related to climate anxiety. While personal climate anxiety was addressed through action coping as discussed in Chapter 4, it is evident that collective discussions were an important part of this process, as it was through

conversations with peers that people were able to share concerns, and collectively discuss ways forward.

While citizen science projects recognise that there are different motivations and levels of participation by citizens (see Chapter 3), there is much that can be learned from the ZCA process that can inform citizen science models. For the ZCA project it is clear that vision and values play a key role, and careful consideration needs to be given to how these are formed into both internal and external narratives in ways that motivate and harness collective action. While values are recognised as important amongst other disciplinary perspectives, these are often lightly treated in disaster citizen science practice and deserve more recognition in current models.

The next chapter rounds off by drawing on the insights gained from the ‘Story of self’ and the ‘Story of us’ to discuss my more strategic reflections and propose several frameworks for future justice-based climate action – framed as the ‘Story of now’.

7 Chapter 7 – Results and Discussion: The Story of Now

The following ‘Story of now’ chapter discusses my strategic reflections on the ZCA process and proposes several frameworks that might assist future climate action to centre climate justice approaches. As an example of learning new ways to align values with social action (praxis) (Freire, 1996), I use lessons from the previous two chapters and present them in ways that could be helpful for similar campaigns, campaigners, or wider climate related citizen-led projects. In his 2017 public address at the Collective Impact Convening, Ganz described ‘organising’ as turning communities into constituencies. He contrasts this with marketing products to customers or providing services to grateful clients. He highlights that the word ‘constituency’ comes from the Latin ‘cōnstāre’ which means to stand together, whereas the word ‘client’ comes from the word ‘inclīnāre’ which means to lean upon or to depend upon (Latin Dictionary, 2021). He makes the point that organising is not about creating dependency within a group of people, but instead that it is about enabling power. Empowerment is highlighted as a key principle in disaster citizen science efforts, as highlighted in Chapter 3, but the details of how people might be adequately empowered are rarely explored. The following chapter aims to provide context and content for groups to examine their own ideas and find ways to enable their own power.

7.1 Use of prompting questions to reflect on, and refine, your focus and approach

As part of his ‘story of now’ concept, Ganz (2017) poses a series of prompting questions that people can use to determine how they want to go forward with an idea for a campaign, project, or movement. These questions include:

- What urgent challenge do you hope to inspire others to take action on?
- What is your vision of successful action?
- What choice will you call on members of your community to make if they are to meet this challenge successfully?
- Wow can they act together to achieve this outcome, and how can they begin now, at this moment? (Ganz, 2017).

The following chapter is my attempt to answer two of these five questions based on auto-ethnographic analysis of my experiences from the ZCA campaign. Due to the time constraints of the PhD all five questions could not be examined so two were chosen that more closely related to the findings from the first two discussion chapters. These two questions are:

- 1) What urgent challenge do you hope to inspire others to take action on?

- 2) What choice will you call on members of your community to make if they are to meet this challenge successfully? (Ganz, 2017).

Brown (2015) states that asking for help is an act of courage and compassion and through this discussion chapter I hope to encourage future climate-focused groups to lean into the reflections and conversations that come with challenging their own ways of working. I also note that these prompts are only intended as a beginning offering for that journey, and recommend groups ask for help to explore ways to do things better. The act of reflection is recognised as an important component of citizen science projects generally as discussed in Chapter 3. One point of reflection relates to Gant's first question about urgent action. Namely, it is important to reflect on the concept of urgency and how much power it has over the actions people choose to take.

7.1.1 Question 1 – What urgent challenge do you hope to inspire others to take action on?

7.1.1.1 Take radical action on climate change without falling into the 'Urgency Trap'

Climate change is undoubtedly an urgent challenge that I would encourage others to act on. The IPCC has put the world on notice that we only have the next decade to act in ways which will keep global average temperature rises under 1.5°C (Allen et al., 2018). However, as outlined in the first two discussion chapters, not all solutions to climate change address the systemic inequalities that are at the root cause of the climate crisis. This section explores ways to avoid championing false solutions to climate change in the name of urgency.

During the ZCA campaign I had confusion about what defined 'real' or 'useful' solutions to climate change and why action wasn't happening quickly and ambitiously enough. I was still feeling this way after the passing of the Zero Carbon Bill legislation. An excerpt from my diary entry from that week is included below and it shows my internal dialogue about my worry that urgent action wasn't being taken and how I thought the law still wouldn't be enough to help Aotearoa New Zealand address the climate crisis in time.

I'm left feeling that the Zero Carbon Act is still not enough. Paris wasn't enough. That has been made very clear four years on. Aotearoa New Zealand's new climate law will likely not be enough either. Not after the politicians messed with it. It's a band aid, the ambulance at the bottom of the cliff. It's a start. But it is too late in the game to just be starting. We need the finale. We need the big finish. We need the fireworks and the crescendo. We don't just

need it, we deserve it. We deserve better than a continuation of the last decades of political inaction. Our most at risk communities and our future generations all deserve better going forward [sic] (PhD Diary – 13/11/19 2019. Written after a trip to Government House¹⁸³ to watch the Governor General sign the Climate Change Response (Zero Carbon) Act into law).

The following chapter aims to show how action coping, as explored in Chapter 5, ‘Story of self’, can also become action bias (Brown, 2015) when the action is taken to make the person feel better, rather than taking a pause to explore if the action is needed, is strategic, and isn’t going to cause harm or unintended consequences. Misdirected enthusiasm and un-strategic action can hurt others, especially those already structurally marginalised, and therefore the wider climate movement. The ‘urgency trap’ is a name I have given the concept of un-strategic, gut-led reactivity to learning about how bad the climate crisis really is. Action bias in this context is a stage that many people go through when they first learn about the seriousness of climate change issues and is explored in the following section.

7.1.1.2 When action coping is really action bias

Brown (2015) talks about recognising the power of emotion and not being afraid of leaning into the discomfort. She also highlights a concept called ‘over functioning’ – which she describes as going straight to action to avoid dealing with feeling in stressful situations (Brown, 2015, p. 171). She also describes the concept of ‘action bias’ (Brown, 2015) as people defaulting to action instead of strategizing about the problem first. Brown connects action bias to the concept of vulnerability, as pausing before launching into action can be an act of vulnerability – to discover what the underlying causes of a problem are instead of reaching for the easy, surface level solutions. Approaching problems through intersectional (Cho et al., 2013; Crenshaw, 2013; Kaijser & Kronsell, 2014) and wicked problem (Frame et al., 2023) lenses can help to discover those underlying root causes. Brown’s research suggests that this pause can be daunting for people to do but it can lead to better outcomes where solutions target the real causes and mean that the problem doesn’t need to be solved over and over again (Brown, 2015). This section outlines how there are similarities between the three concepts of ‘action coping’, ‘action bias’, and ‘over functioning’, and how a combination of these can lead to a person who is new to the climate action space falling into a mindset I am referring to as an ‘urgency trap’.

¹⁸³ <https://gg.govt.nz/government-house>

The challenge associated with action coping (Becker et al., 2011) or action bias (Brown, 2015) is when someone rushes to solve problems without consideration of the wider social, cultural, economic, class, environmental contexts. For the purposes of this thesis, I am calling this phenomenon the ‘urgency trap’, where we are not being intentionally reflexive or strategic in the process for developing climate action.

Working on climate change is chaotically complex, especially when trying to keep up with ever expanding scientific discoveries whilst navigating issues of justice and equity. We know indigenous, front line, disabled and other structurally oppressed communities are being hit first and worst by climate change, while often being excluded from the business-as-usual decision making and solution generating processes. Our work going forward needs to right this. We need to connect people, knowledge and places together if we are to hit the root causes of the climate crisis, not just keep putting more ambulances at the bottom of the cliff. Urgency does not mean we make decisions on the fate of our country based on fear. If we make knee jerk reaction solutions based on fear, then it will only entrench current inequities further and deepen the crisis. It doesn’t matter how many plans we draft, or targets will create. If we don’t hit the root causes of the crisis we will keep failing. The urgency is an opportunity to come together to make a plan. We need to come to the table as a country, acknowledge past wrongs and conflict, and commit to a journey going forward centred in climate justice and just transition principles, and we plan out this new critical, complex and chaotic journey together. As we shift into this new stage of human history, the time of the climate crisis, people and organisations need to use their power and influence to double down on their focus on connectivity and systems thinking, on empathy and righting root causes of inequities, and on inspiring hope to motivate our communities to take action on climate change [sic] (PhD Diary – 15/11/19).

My decade plus experience in different parts of the global climate movement has shown me that it is full of false solutions and misdirected enthusiasm which can hurt others or the wider movement,

and the climate movement in Aotearoa New Zealand is not immune. Not all action coping is created equal, and many attempts to 'solve' the climate crisis can do more harm than good. An action may technically count as climate action if it is reducing emissions, but that doesn't mean it is done in just and equitable ways. A risk with responses that are rushed due to fear of urgency, is that they are not thought through properly or their impacts on vulnerable groups are ignored under the guise of the situation being too urgent not to act. Preston and Carr (2020, found in Hayward et al., 2020), show that the suffering of already vulnerable communities could be exacerbated from a rush to geo-engineering solutions because of the narratives insisting that the world has run out of time to act.

I've been called a person who is too much 'in the system', because I worked on a policy thing. If your ultimate solution is rioting, or whatever, like, do you know what that feels like? And do you know how scary it can be? How willing are you to be at the end of a police baton, right? How willing are you to be tear-gassed or take a bullet in the leg? How willing are you to have people disappear in your life? If you are, that's fine, right? But if that's if that's the path you have to go down, I wouldn't go with you. Because I don't think violence is an answer, especially in a country like New Zealand where you can actually do some stuff without doing that. But, like, just kind of romanticizing of revolution without recognizing how bad it affects vulnerable people. I think it's just dumb [sic] (Interview participant quote).

Urgency shouldn't mean rushed and ineffective solutions which keep the status quo ways of working instead of branching more into climate justice or intersectional approaches. It is important to create the time to be self-reflexive when everything feels urgent. The urgency solutions are also often focused on individual actions a person can take to lower their environmental emissions, such as reducing personal carbon footprints, a concept devised by fossil fuel companies to shift the blame for climate change to individuals. The scale of change needed is too large to be solved by individual solutions alone, especially when considering that change is very hard for people and that 'will power' is often not effective (Kegan & Lahey, 2009). We need to understand the problem more deeply before we rush to solve it. So often people look for solutions that are considered easy, shown

to them by friends or family, or are promoted in the community, or popular in other areas or on the internet.

By the urgency trap, I do not mean that urgent action is not needed for reducing climate change impacts. Ganz (2011) states that inertia can be countered with urgency by capturing attention and making space for new action. He notes, however, that it is more about priority, commitment, and concentration of energy rather than time (Ganz, 2011). So, instead, I am proposing that the urgency trap concept is a reminder to reflect first, and then take intentional and well-considered actions that will create systemic change. I have brainstormed and listed several questions below that people joining the climate movement, or proposing solutions, could ask themselves:

- What happens in the world when this action is taken?
- What types of consequences will come from this action, and are there any potential unanticipated consequences we haven't thought about?
- How is this action connected to helping with other separate but connected crises, such as the global biodiversity crisis?
- What drives you to take this particular action? What makes you think it will be successful?
- How do you feel about taking this action? How do others around you feel?
- What feedback are you getting from others in the climate change space?
- What personal compromises are you going to have to make because of this action?
- What compromises will other people have to make?

We need societal transformation to solve climate change (Boik, 2020), but many ways of creating societal transformation will be negative for a lot of people. Climate change as an urgent issue is a dominant narrative within many climate activism groups in Aotearoa New Zealand. An individual in the wider climate movement reached out to me to describe taking a climate justice approach as 'indulgence' that we don't have time for. This narrow view of activism leads to many inter-movement issues. It would be worth investigating if these urgency narratives were more prevalent within groups of older climate activists as they may feel like there is even less time for them to make a difference in solving climate change. I expect that I'll spend my life working on these issues, but that hopefully means the next forty- or fifty-plus years. How people engage with the issue of climate change is connected with the concept of time and how time intersects with different worldviews or cultures (Nairn et al., 2021).

I keep coming back to the concept of time and to Karen Nairn's article around indigenous and western concepts of time and how that relates to narratives of urgency. I've done the work I've done over the last decade because of a sense of urgency that the world is being changed at a rate that is going to negatively impact billions of people for millennia to come. The scientific narrative is that the window for change is shrinking by the year. That we must act now and fast and ambitiously. That we have a chance to 'save' the situation but only if we are quick [sic] (PhD Diary – 03/04/22).

In their article, 'Living in and out of time: Youth-led activism in Aotearoa New Zealand', Nairn et al, (2021) showed the differences in how different cultures view and relate to 'time'. For many cultures around the world, time as a concept takes on a much more intergenerational meaning. For an environmental degradation context, such as climate change, there is a different relationship to the sense of urgency for those who have, for generations, suffered from a wide variety of negative cultural, environmental, social, and economic impacts. Colonisation is a key example here, where people have had their lands, language, and culture violently stolen away from them (Nairn et al., 2021). Climate change is another added layer of harm caused through this colonial legacy. For myself, who hadn't grown up with these racial structural marginalisation's as part of my DNA, an issue such as climate change felt like a sudden shock which threatened a carefully curated life plan and needed to be dealt with urgently so that things could go back to 'normal'. The urgency mindset played a huge role in me joining the ZCA campaign and staying in it for the whole four years it was active. I saw the potential climate law as a tangible way of forcing the government to undertake domestic emissions reductions.

7.1.1.3 Urgent climate action without justice-based approaches and context can be damaging

The following section includes PhD diary reflections from during the campaign around the complexity of issues at play and why urgent climate action without justice-based approaches and context can be damaging. I have left large parts of these excerpts as they are, to show the complexity involved. They illustrate the need for longer term strategic thinking about how climate action might impact Māori, and other cultural or marginalised groups, particularly if the action is poorly thought through, and undertaken with too much urgency.

Our climate movement is working in a historical context that we don't examine enough.

Environmentalism was created within a racist system, and my involvement is based on that

legacy. Colonisation has led to small group of people benefitting a lot from the system they created. I am still existing in a system that has been designed by upper class white men and built on the backs of those they oppressed. I did not have anything to do with the creation of the colonial system. And if I was born at that time I would unlikely have had any say in the development of that system anyway because I'm a woman. However, for generations my New Zealand born ancestors benefited from that system. And I now benefit from that system. It's hard to see when you are part of it. But it is important to look for it, to learn about it, to notice it when you explicitly take advantage of it. Issues such as racism and classism don't have to be a deliberate act or explicit behaviour. They come in many forms, including unconscious biases where our brains are programmed to notice patterns and adjust our behaviour to match. Racial biases are often based on stereotypes and over-representation of negative stereotypes portrayed in the media or by friends and family, rather than personal experiences. We overgeneralise based on these stereotypes and biases, many of which we don't even consciously know we are thinking. I have actively needed to train my brains to interrupt the subconscious generalisation and stereotyping, and to start analysing how people and situations in the media are presented to us. Too often, minority groups take on these stereotypes, even about themselves. There is much internalised racism and classism to be unlearned [sic] (PhD diary – 14/06/18).

Those interests I discussed above remain dominant in our social systems today. We have not seen real investment in dismantling and recreating the system, because it is in the interests of those with the most power and capacity to lead the change to maintain the status quo. Power reproduces itself, and 'white' and 'men' still dominate positions of power in businesses and government. They promote and champion people who look and act like them, people who relate to things they've been taught to value.

The causes and effects of environmental degradation are racialized, including through colonial legacies which were and still are exploitative and extractive. Colonisation led to land clearing, biodiversity reduction, traditional crops being decimated or transplanted which were not

suited to the new local conditions, mining and resource extraction shifting wealth to the colonial powers, and often unchecked pollution. Industrialisation in Europe was created on the back of this colonial extraction which led to worse mining and worse pollution. The extraction damage is usually left for the people who are living in these often-developing countries to clean up while the profits are funnelled into developed countries and corporations. Through years of this extraction and land degradation legacy, climate change will harm non-white, developing country groups sooner. And because of these centuries/decades of extraction without compensation they often do not have the same adaptive capacity to cope with the impacts. There have been young leaders from these developing countries calling for action on environmental harm and climate change for decades now. Thousands of young people, just like Greta Thunberg, but whom media and public attention did not give them the recognition and support they deserve. To her credit, Greta became aware, or was made aware, of this inequity early on in her public activism and has spent a lot of time trying to create public spaces for those other activists to tell their own stories [sic] (PhD diary – 15/12/19).

Policies don't have to be explicitly racist in a system where it is designed for a particular (white) group, as the default policies are racist by design due to how the laws were established (Agénor et al., 2021, Perez, 2021). Minorities can be racist against each other by wielding the oppression already held over that group by the dominant group (White & Langer, 1999). Inflaming these inter-oppressed group aggressions is a tactic used by those in power to distract from their hold on power.

7.1.2 Question 2 – what choice will you call on members of your community to make if they are to meet this challenge successfully?

7.1.2.1 Being reflexive to navigate intersectional approaches as one small antidote to injustice

The previous two discussion chapters (Chapters Five and Six) highlighted how our personal motivations, experience, and worldview affect how we approach campaigning and in turn can impact how others in the climate movement perceive you. According to Coburn and Gormally

(2015), actioning justice projects, such as climate justice projects, requires people to reflect on situations and their position in them, analyse potential options for moving forward, and act on the basis of their reflections and the options available. Aligning our actions with our collective/shared values, such as for a safe and just climate future, is one way to not create inappropriate solutions that have unintended consequences or cause harm. Mehta et al. (2021) discuss praxis as linked to values of justice, equity, and capability expansion, as well as a link to self-conscious social actions and an ongoing internal discussion between knowledge and practice. To centre our values in our actions, both as individuals and groups, we need to know what those values are and how to practically apply them to our work. As highlighted in Chapter 6, internal reflection or tricky interpersonal discussions can be one way to explore these values. Those tricky conversations and internal musings require a person to be vulnerable to making mistakes or acknowledging past wrongs and learning how to counter any shame that comes with those discussions. Some of these difficult internal thoughts entered my mind in the early hours of the morning, when considering how race made a difference in how I might have been listened to, in contrast with others.

My voice – it is not that it doesn't matter or I shouldn't have a say on climate action, but the point is that it already matters more to many people because of my white skin and I am listened to more because of that [sic] (PhD diary – 17/11/19, written on a Post-it note in bed at 3:30am).

As discussed previously, as part of those difficult conversations, justice is a core component of the climate crisis and should be considered. Thus, this comprises an important choice to make as part of Ganz's Question 2 – how might justice be incorporated successfully into climate action?

One way to incorporate justice within climate action can include taking more intersectional approaches. Intersectionality provides a framework where issues cannot be seen in isolation from each other, and where the culmination of different issues changes people's experiences of them. This framework is now used by numerous academic fields (Amorim-Maia et al., 2022) and at its core "aims to address the fact that the experiences and struggles of women of color have fallen between the cracks of both feminist and antiracist discourse" (Crenshaw, 1989, found in Amorim-Maia et al., 2022, p. 5). Intersectionality can be a framing for connecting big social challenges such as worker exploitation and cultural oppression. For example, it can be used to illuminate how capitalism has been based on the continued oppression of racial and gender minorities, including undervaluing and making invisible the contributions from those groups (Melamed, 2015, found in Amorim-Maia et al.,

2022, p. 3), and the systematic devaluation of female and non-white bodies and its assimilation into economic processes (Pulido, 2017 and Robinson, 2000, found in Amorim-Maia et al., 2022, p. 5).

In reference to climate change, Amorim-Maia et al. (2022, p. 4) highlight how studies have shown that the fields of resilience and climate adaptation can cause unjust and maladaptive practices which worsen social and environmental outcomes for marginalised groups through “overlooking historic and ongoing patterns of uneven and inequitable development.” As outlined in the Literature Review (Chapter Two) climate change is already having a disproportionate effect on racial and gender minorities, as well as low-income communities, which is negatively impacting the adaptive capacity of those communities to respond to climate change.

With well-documented multiple forms of climate injustice faced by people of color, low-income, and migrant communities in today’s cities (Anguelovski et al., 2019), together with increasing pressures posed by climate change on cities’ infrastructures and services, it is essential to apply an intersectional lens to urban climate studies to help uncover the interconnected and lasting systems of oppression and disadvantage that drive and sustain vulnerabilities in cities while depriving some groups of ecological benefits (Connolly and Anguelovski, 2021), so that adaptation strategies can be more boldly inclusive and just (Amorim-Maia et al., 2022, p. 4).

Any climate action is underlain by a set of complex intersecting issues, many of which are related to justice issues and contextually relevant historical background. During the Zero Carbon Act campaign, our core team spent a lot of time trying to understand these underlying complexities, most of all how developing a climate change law based on a UK model could be done in a way that wasn’t recolonising.

It was not just our group who was grappling with these big, complex conversations. There are expectations of, and within, many climate groups that they should be much more than climate action groups – that they also need to be experts in climate justice, decolonisation, and re-indigenisation concepts and practice, as well as take intersectional approaches to campaigning (Crenshaw, 2013; Kaijser & Kronsell, 2014). Many of us are expecting our young people to do better and be better at intersectional ways of working in the climate space than previous generations,

though we are not always sharing the lessons on how we attempted this, either well or poorly. Despite this, many young people are forging their own path with these difficult, inter-movement conversations.

An observation of the youth climate movement, and I think it's more apparent with School Strike than it is with Gen Zero, for example, but young people are often just better people than older people [laughs]. I don't know why that is, and some things they don't do as well, sure. But by and large, they display behaviours which I feel are better on average. And one of the things that they do really well is that they compromise and collaborate, and they put their values first. So, with that they put care and love and benevolence and kind of broad mindedness first. And for some reason, as we get older, it seems we kind of like, pick up baggage that makes it harder for us to do that. And I think that, you know, that sort of a nice little differentiation in my observation between school strike and Gen Zero, where we as slightly older young people have picked up a bit of this baggage that school strikers still haven't. So that's a power School Strike does have. Young people present an opportunity, a sort of a beacon of hope for much broader range of people to see the vision and to be able to dream up a future state that's different to the one that they live in [sic] (Interview participant quote).

The ability of young people to campaign in the ways outlined in the quote above means those of us who have been working in the climate space for a while are getting called out by younger activists coming through, when we fall short of their standards of ways of working together. The new generations of climate activists are rightly calling out those who have gone before when intersectional approaches to climate work aren't being used. Their grasp on intersectional campaigning for climate justice is significantly better than my own at their age. And they're not afraid to ruffle feathers in the movement and lay down challenges to others which can be a real strength. They seem to be more comfortable or committed to sitting in uncomfortable conversations through connections and deliberate group dynamics.

Over the years, and even from within the climate movement itself, ecofascists have used environmentalism to promote conservative, violent oppressive politics (Campion, 2023). They blame the Global South for environmental destruction through issues like migration and high population (Paz Moskowich-Spiegel, 2023). For example, it is an easy narrative to blame people for having ‘too many’ children versus the real cause of climate change where the developed world has colonised much of the developing world, stamping out cultural practices, stripping the countries of their resources, making them more vulnerable to social and environmental change. Race-neutral environmental protection measures do not exist (Mallory & Neal, 2021; Saito, 2009).

When we began our ZCA campaign, I assumed it would be a law where, because it was an overarching framework, rather than specific policy design, it would be race-neutral. I quickly learned through our work that no environmentalism is race-neutral because of the racist systems we are working within, and that climate campaigns needed to be actively anti-racist. Weren’t all white, but we mostly identified as pākehā and/or tauīwi and were mostly university educated. Many of the justice lens we put on the campaign were often added as we went rather than as the core part of the campaign design [sic] (PhD diary – 15/12/19).

Cultural competency (Sue, 2006) is needed so that decisions aren’t made in the name of acting urgently to solve the climate crisis. There is going to be a decade of greenwashing (de Freitas Netto et al., 2020) of business as usual in a new change of clothes. We are not always taught how to critically analyse situations, ideas, problems in a way that identifies those other impacts. Co-benefits (Karlsson et al., 2020) are discussed more commonly than negative conscious or unintended outcomes. For example, the expansion of hydro power stations distorting the mauri¹⁸⁴ of rivers. Many would not see destruction of mauri as an important consideration because they lack the cultural competence needed in a Te Tiriti-based Aotearoa New Zealand context. We need to change our systems and processes so that cultural competence is the default of decision making and that we don’t get a bunch of ‘solutions’ to climate change that are going to do more harm than good in the long run. We need a better understanding of how to talk to each other about climate justice-based

¹⁸⁴ In Māori culture, Mauri is the life essence or spark inherent in all living things that has been passed down from ancestors. “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.”
<https://maoridictionary.co.nz/search?&keywords=mauri>

solutions as the default, and how principles of climate justice and just transition can be embedded within policy and decision-making processes.

7.1.2.2 Sharing difficult conversations about justice and climate

The 'Story of us' chapter showed how creating and fostering a sense of community and connection was an important and effective part of participation in climate action. By doing so in a way that connects with others, especially around vulnerable topics such as climate anxiety or justice issues, there can be shared experience and mirroring of good behaviours for others. Your ability to be vulnerable, and to own your feelings of grief, anxiety, worry or shame can lead others to do the same. It can create a culture where that vulnerability is safe to be shared. It can ultimately help unpack and gain support for the more complex issues, such as justice, so that these can be addressed through appropriate actions.

To bear witness to the human potential for transformation through vulnerability, courage, and tenacity can be either a clarion call for more daring or a painful mirror for those of us stuck in the aftermath of the fall, unwilling or unable to own our stories. Your experience can profoundly affect the people around you whether you're aware of it or not (Brown, 2015, p. 10).

The following sections highlight my thoughts about personally delving into these difficult issues and the learnings I had along the way. By doing this, I highlight the value of creating space for sharing difficult discussions, as a mechanism for considering and making the choices that Ganz (2017) refers to as part of Question 2.

I am anti-capitalist. I am anti-colonisation. I am pro-climate justice. I am pro-disability justice. I am pro-LGBTQI+ rights. I am pro-indigenous rights and land back. I am pro-union and collective action. It is possible to be 'pro' all these things conceptually, but it is hard to connect with the identities beyond academic conceptualisation for the ones I am without the lived experience. I had an early realisation within the PhD journey that I can't help but dive into topics such as class structure, power and development and distribution of capital within my topic. I was embarrassed about not knowing as much as I thought I should about these topics, and ironically, I felt like I was always playing catch up around my amount of knowledge of some of the most-used concepts within politically 'left' activism spaces, such as socialism, capitalism, neoliberalism, and Marxism. There was a big

importance in these activism spaces placed on knowing the correct terminology and knowing the broader historical context of the movements.

I'm starting to feel like I didn't take the right courses at university or high school. I haven't found safe spaces to learn or ask questions, and I've seen people get a word wrong or out of context in an online discussion and they get brutally cut down. It feels like I am constantly playing catch up with people who know more and whose nuance on the issues grew exponentially while I was still trying to master the basics and historical context and not knowing how or where to dig any deeper [sic] (PhD Diary - 08/06/2017).

The following narrative from my PhD diary highlights my thoughts and worries around holding spaces for uncomfortable conversations that could be useful for the next generation of activists or people working in other climate change fields.

A key learning from the ZCA campaign journey was that the default is policies are made to protect white, middle class communities. Proposing ideas that go against that default is then claimed to be ideological. And that disconnection can be confusing and infuriating. Getting asked "so you're racist then?" because we wanted to take a cross-party approach to the law by someone who did not believe change could come from working with right leaning politicians. I learnt that it is not my place to counter their experiences or worldviews that leads them to ask this question. Learning how to sit through those discussions (online or in person) and not have the gut reaction to say 'yeah but..' or 'not all..' or 'but I'm not..' and instead to listen to both the dialogue in the convo and in your own brain and reflect on your own reactions to the confronting issues. It's a learnt behaviour and it can be awkward at first. Terms like coloniser – recognising that colonisation is a complex, nuanced, multicultural multiracial multi class issue. Working class/peasants to flee their lands and search for better lives. But that shouldn't take away from the immense harm done. Regardless of their motives or intentions or actions on the ground when they arrived, the colonisers were tools of colonisation. I know there are really harmful, explicitly racist/bigoted/ableist narratives that

infiltrate the climate and environmental spaces in Aotearoa and around the world. My job now is to stand up to those narratives. There is also more stealth forms of racism within movements, not done out of harmful intent but out of ignorance and not knowing how spaces can be for people who are marginalised. It is in these types of harm where I can still mess up. And there isn't much that can be done afterwards apart from to own it, to acknowledge and apologise for the harm, to take action to learn more about it and to actively want to do and be better. The climate movement is on a collective journey with these issues. My goal is to set up the next generation in a way to make less mistakes. And part of that is getting out of the way if they instinctively do things better [sic] (PhD Diary – 12/06/19).

A person can understand the theory behind being anti-racist, but putting it into practice can be hard and it's a lifelong journey of learning and unlearning (Tilley et al., 2023; Kendi, 2023). We are telling young people to join movements to go and be activists to act on climate change. But we're not telling them how. And then they join movements already in turmoil, and internally fractured. We were told by some in the movement, especially those of us who are Pākehā, white-presenting activists, that we were taking up space, and that our voices do not need to be heard. Hearing this can cause a lot of confusion and anxiety, and then individual anxiety around climate change can exacerbate even more. Because we continually get told the solution is to act, but the way we act is racist. It took a long time to unpick the nuance of it. I learnt that someone can cause harm even if they are not being intentionally malicious to another person (Richards, 2020). In most cases it is the system that's inherently racist (Kendi, 2023). We were working in an environmental movement born in centuries of colonial rule and ongoing inequities and structural oppressions that have continued unchecked for the most part and the movement has been slow to address over the last decades.

In many cases, not all, but in many cases, young people come into the climate movement with the knowledge of the wider political, social, cultural systems they have. They often don't see their privilege or know how the system has been benefiting them. They often don't know how it has been impacting on others and therefore they don't have the skills, tools and knowledge to change that system whilst finding their feet in it. They're also being told competing things by different structurally oppressed groups, and people within those different groups. Those

groups aren't homogenous and therefore the advice coming from different members is different. So people have been told, get out of the space entirely. You're racist, you don't belong here. And then other people are telling them you are working within a racist system. But you must stay and you must do the work. And you must learn how to do it better. And that can be a very confusing space to hold [sic] (PhD Diary – 12/06/19).

There is real pain and anger from groups of marginalised, dismissed, harmed people, people who have been talked over, often by people who looked like me or sounded like me, or in some cases was me, even when done unintentionally (Margaret, 2019). I know that I still have way more to learn in the space and I also know that I have learned so much on this decade long journey. I can now hold spaces with honesty and integrity that explicitly aim to not be harmful to others, especially people from structurally marginalized groups. That doesn't mean I get it right every time. I don't, and unfortunately, I probably won't. But that doesn't mean I stop trying. To me this is a part of being a pākehā or non-indigenous activist in an Aotearoa New Zealand context (Awatere, 2022; Margaret, 2019). Perfection isn't possible in pākehā activism, and that's really hard to accept at first, as a perfectionist, and in a culture that promotes and prioritizes winning, being the best, and being an individual that stands out.

Because of its success people see Gen Zero as bigger than it really is. It's a bunch of young people (predominantly pākehā) who really want to help solve the climate crisis so look to how they can change their local environment (usually city based) to speed up that transition to a zero-carbon world. It's young people who often have never heard of the concept of climate justice or can articulate a genuine definition and explain how it works in practice. And yes, this means that they shouldn't be setting the direction of climate action. But they don't know that. I didn't know that. You learn some very hard lessons about the world if you enter the climate movement, especially if you enter as a privileged white person. The lessons are uncomfortable and messy and often public and the shame can be a weight like you've never experienced [sic] (PhD Diary – 12/06/19).

I am still on a learning journey with learning about structural and systemic marginalisation. I get it wrong in these spaces, but I'm willing to listen and learn. I have needed to learn how to learn, and how to take feedback. I've also had to learn how to react when I don't like what I hear – be

vulnerable and dig into questioning myself as to why am I reacting that way; what has it triggered in me and why?

I know I've not always got things right. I've apologised when needed and tried to foster relationships from that experience that are more meaningful. Not knowing the right words to say can get you in trouble very easily in left/progressive spaces. It is very off-putting for a lot of people. It doesn't mean the feedback is wrong, the delivery is often what is the off-putting part. And it doesn't necessarily mean the delivery is wrong either [sic] (PhD Diary – 12/06/19).

I think the conflict I've felt in many spaces in the climate movement over the last decade is a consequence of young humans debating complex and nuanced topics that are loaded with emotion, intergenerational trauma, personal lived experiences, and grief. Being in a country where this level of free speech is acceptable means that holding those conversations is a privilege that many of our overseas counterparts do not have. They are precious moments when people get together to converse around such tricky issues. These conversations are unlocking fire within people around issues of human life and the right to a healthy environment versus corporate greed and profit. But these conversations can clearly be exhausting for those who feel they are forced to defend their existence when it is continually marginalised by society.

The next section attempts to pull together some frameworks that can better enable some of these considerations and conversations, for better-informed action.

7.2 Use of tools as prompts for reflection

The following section includes three diagrams that I hope will be useful to members of climate activism spaces, both current and future, to use when developing similar campaigns or wider climate justice related projects. They represent wider considerations for citizen-led climate action, that better incorporate intersecting aspects such as justice.

7.2.1 Justice-based Campaign Funnel

Campaigning using climate justice approaches requires interconnections with a range of other social, cultural, environmental, and economic issues. It also requires campaigning in the context of other previous and current justice-based work. To take an intersectional approach (Crenshaw, 2013) to

achieve a more justice-based climate project, people and the groups they are part of would need to learn more about these different connected issues so they have at least a basic knowledge before deep diving into their specific interest area. To undertake work that is intersectional in allyship with other justice-based campaigns, these are the types of skills and knowledge my reflexive experience has demonstrated an activist should have. It would also make the climate space a more effective movement if there were more activists that can work across and between different issues.

The idea of the 'Justice-based Campaign Funnel' (Figure 7) diagram is to learn from the knowledge, lessons, histories, and relationships from the other interconnected social and environmental justice issues, and then funnel them into a particular campaign or project. It is not meant as an extractive practice, rather a need for peer-to-peer sharing, and creating a give-and-take culture between different projects across all the different issue areas. It would allow people working in one area to better support those in another area, such as joining in with their work when extra capacity is needed, or supporting particular petitions or events when people are needed to create a crowd or wider movement behind a cause.

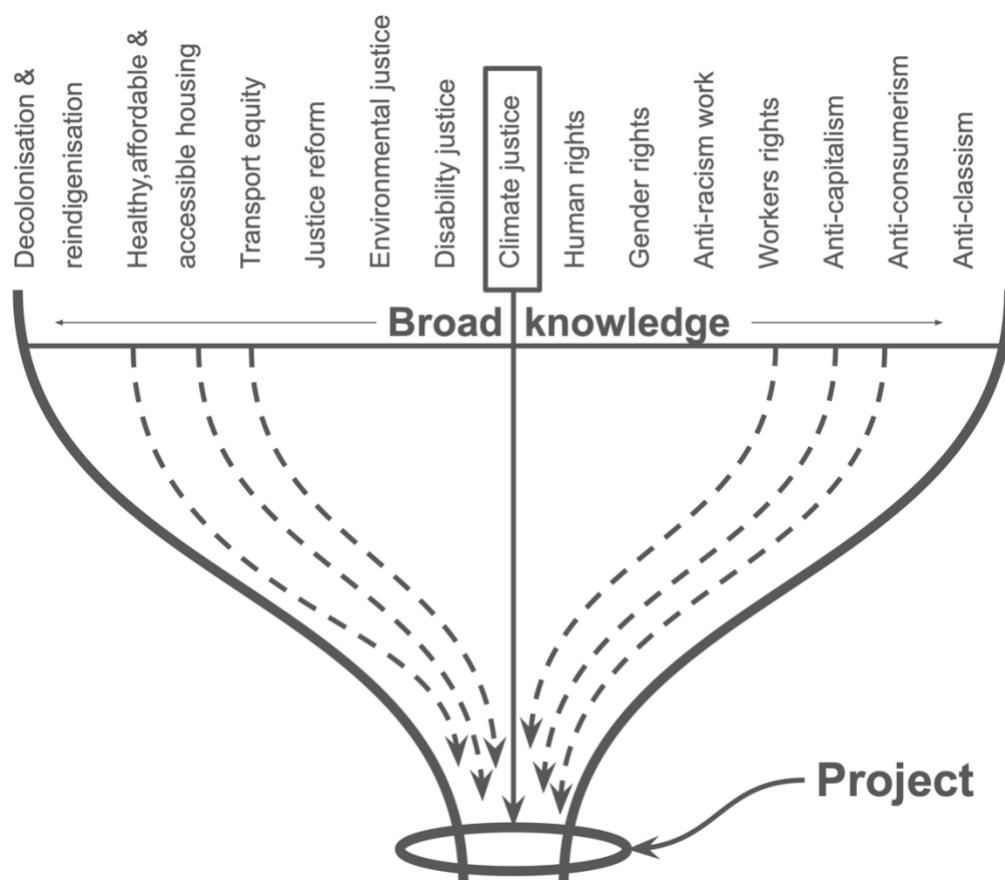


Figure 7 – 'Justice-based Campaign Funnel' diagram

Our ZCA campaign core team developed our knowledge across the different interconnected issues when we went through the campaign through the informal learning work highlighted in the ‘Story of Us’ (Chapter 6).

Developing activists who can navigate moving between these different issue areas and have knowledge about wider contexts is a choice that members of the climate change community could make. Taking this approach requires time to hold relationships across the different issue areas (Brown, 2017) and to learn what other people and groups are working on projects across the wider social and environmental movements.

In reference to the Framework (Chapter 3), this expands on and goes beyond the “Being reflexive” component in the framework. On reflection, I missed an important point when developing the Framework which was an important up-front comprehensive reflexive component in setting the context and identifying the key contextual issues and partners that might be affected. This was perhaps more important for the citizen-led ZCA campaign because climate change crosses all sectors of society, and impacts everyone, in ways that are far reaching. However, it could be argued that context should be explored in more detail for all citizen science projects, at the start, to ensure that the right people are included and the right approaches or actions are employed (Chesser et al., 2020).

7.2.2 Justice-based Climate Action Spectrum

To assist people and organisations with reflecting on where they are positioned on climate change, and how they might contribute effectively in future to justice-based climate action, I developed two further diagrams. As an experiment, I took the ‘becoming anti-racist’ diagram¹⁸⁵, adapted from the widely-used and adapted ‘comfort zone spectrum diagram’ (original source unknown), and attempted to modify it to reflect the lessons from the PhD on being more reflexive and vulnerable to our personal approach to justice-based climate activism. I tried to do this from my own individual lens and the following two diagrams, one for individuals (‘Justice-based Climate Action Spectrum’ diagram; Figure 8) and the other for organisations (‘Justice-based Climate Action Spectrum for Organisations’ diagram; Figure 9), are the result of that experiment. I offer these diagrams to the

¹⁸⁵ This chart was adapted by Andrew M. Ibrahim MD, MSc from “Who Do I Want to Be During COVID-19” chart (original author unknown) with some ideas pulled from Ibram X. Kendi’s work. It is re-used from *Black Life Matters: Anti-Racism Resources for Social Workers and Therapists*, June 2020, <https://www.socialwork.career/2020/06/anti-racism-resources-for-social-workers-and-therapists.html>

climate movement and citizen science field as a springboard for future discussions. I acknowledge neither include an extensive or all-encompassing list. Their content is based on my PhD findings and my experience over the last 15 years in climate change spaces. I welcome it to be expanded on or have parts challenged.

I also acknowledge that, while I've mapped out the diagrams as a spectrum, there is not necessarily a linear progression between the different stages. Some people or groups might already enter the climate movement with an extensive knowledge of climate justice based on their lived experience and worldview. While others find themselves connecting with multiple parts of the spectrum and place themselves in different parts of the spectrum depending on the niche topic in question.

I decided to include the diagram based on organisations ('Justice-based Climate Action Spectrum for Organisations') to accompany the diagram from an individual's perspective, as organisations, especially ones led by volunteers, are reflections of the views of those participating in them. Just as there are different stages an individual activist will go through; it can also be applied to groups too. There is also a collective responsibility of groups working in the climate movement and, more specifically, climate justice spaces to actively find ways to do work without harming others, including already structurally oppressed or marginalised communities.

Many people struggle at the start with acknowledging the climate crisis due to distrust of science or official advice, confusion of technical concepts, apathy, or too many competing personal struggles to invest time to investigating more on the issue (Oreskes & Conway, 2022; Sarathchandra & Haltinner, 2020; Davidson & Kecinski, 2022; Bright & Eames, 2022; Weber & Stern, 2011), represented on the diagrams as the 'Inaction Zone'. As outlined in Chapter 5, those that begin to understand there is an issue often move into the fear zone through increased climate anxiety or fear (Bright & Eames, 2022; Schinko, 2020), where they take on an approach of action coping (Becker et al., 2011). Action coping can quickly develop through 'over functioning' (Brown, 2017) into 'action bias' (Brown, 2015) and fall into the aforementioned urgency trap. The urgency trap is represented on both diagrams as the 'Fear-based Action Zone (the Urgency Trap)'.

As time progresses and learning more about the concepts of climate justice takes place, people can be in the 'Learning Zone.' This zone is about exploring complicated topics, such as justice, just transition, and intersectionality of issues, often for the first time, and doing so in connection to others (Amorim-Maia et al., 2022; Kistner & Jiménez, 2023; Ganz, 2017; Brown, 2015). It is a zone of

vulnerability, both for individuals and for organisations, and a space to make mistakes whilst learning how to do better.

And finally, in the 'Growth Zone', intersectional approaches are centred in climate solutions and continued learning and upskilling is prioritised. It involves actively decentring whiteness and making space for marginalised groups to champion their own solutions (Amorim-Maia et al., 2022; Collins, 2009; McLaren, 2013). Confidence grows in learning and using different terminology unique to climate justice spaces and in a person or organisation's ability to share and teach others about key concepts and approaches.

It is envisioned that these diagrams act as a guiding tool to assist people in understanding their current position and where they can progress with reflexive practice, with a goal of moving towards more just based climate action. These diagrams could also prove useful prompts for discussion when developing a citizen science project, or to further understand underlying complexities of participation in citizen-led science in general.

Both diagrams are based on the analysis within my thesis and are written from my perspective, with the lived experiences I've had and worldviews I hold. I've had to learn the hard way by making mistakes within my activist approaches and I have intentionally framed these diagrams as being from the point of view of someone coming from a majority/dominant culture trying to be more justice-based and intersectional in their work and life. It is aimed at other people coming from that same place, as the climate movement is full of well-meaning but 'ignorant' people who may unknowingly cause harm to marginalised community members in those same or associated activist spaces.

I also didn't want to talk for others or make assumptions about those whom I don't share experiences with. Because of this framing, some parts may be an oversimplification, or feel like too much focus on white fragility, or white guilt, or 'majority culture' issues. I believe we need to learn from each other so that we do not keep repeating mistakes while engaging in social / climate / environmental justice work. Future research could include socialising these diagrams within activist communities to see if they are relatable, and to build on them with the experiences of other activists involved in this work.

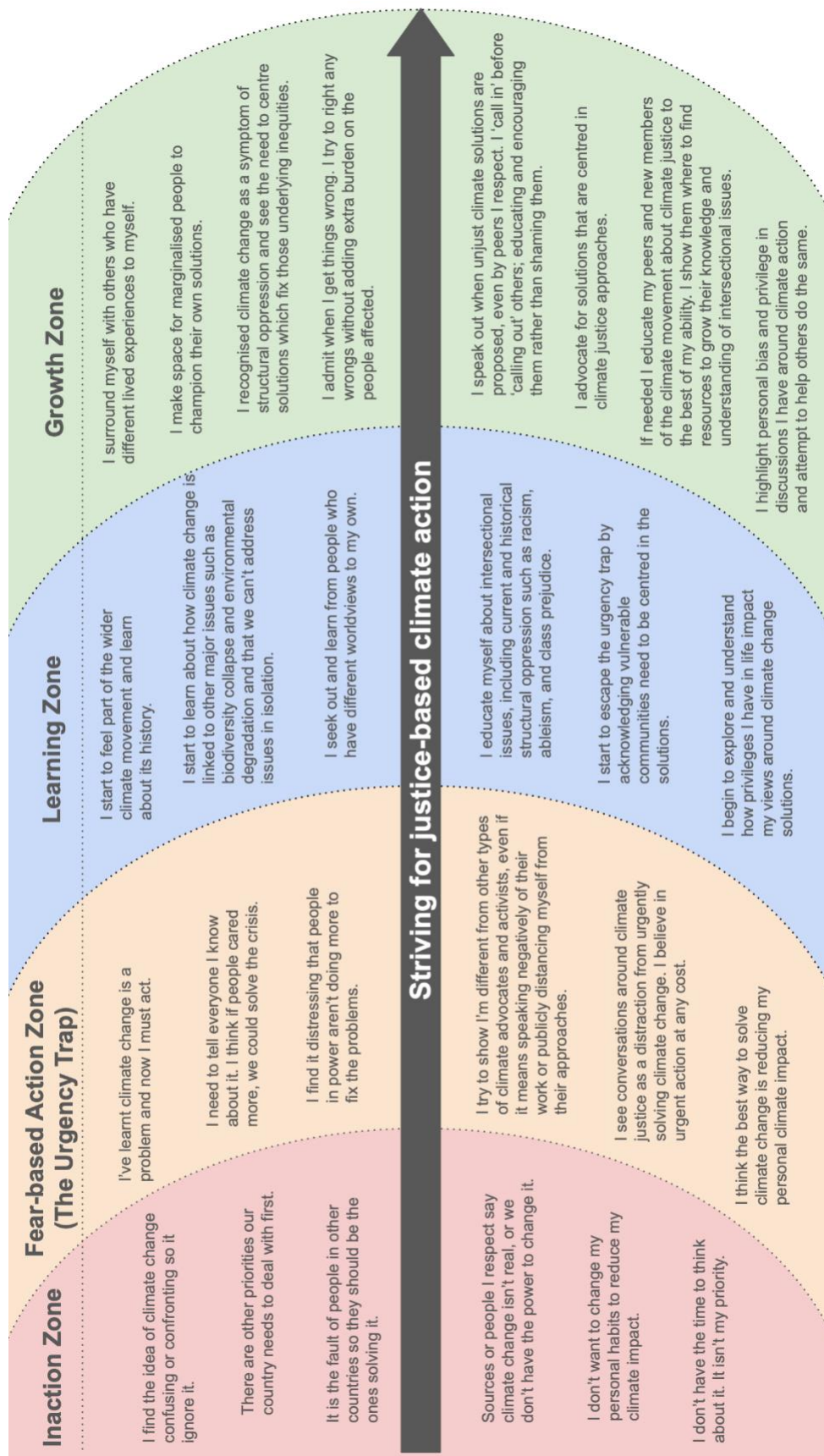


Figure 8 – 'Justice-based Climate Action Spectrum' diagram (created to reflect the lessons from the PhD on being more reflexive and vulnerable to our personal approach to activism)

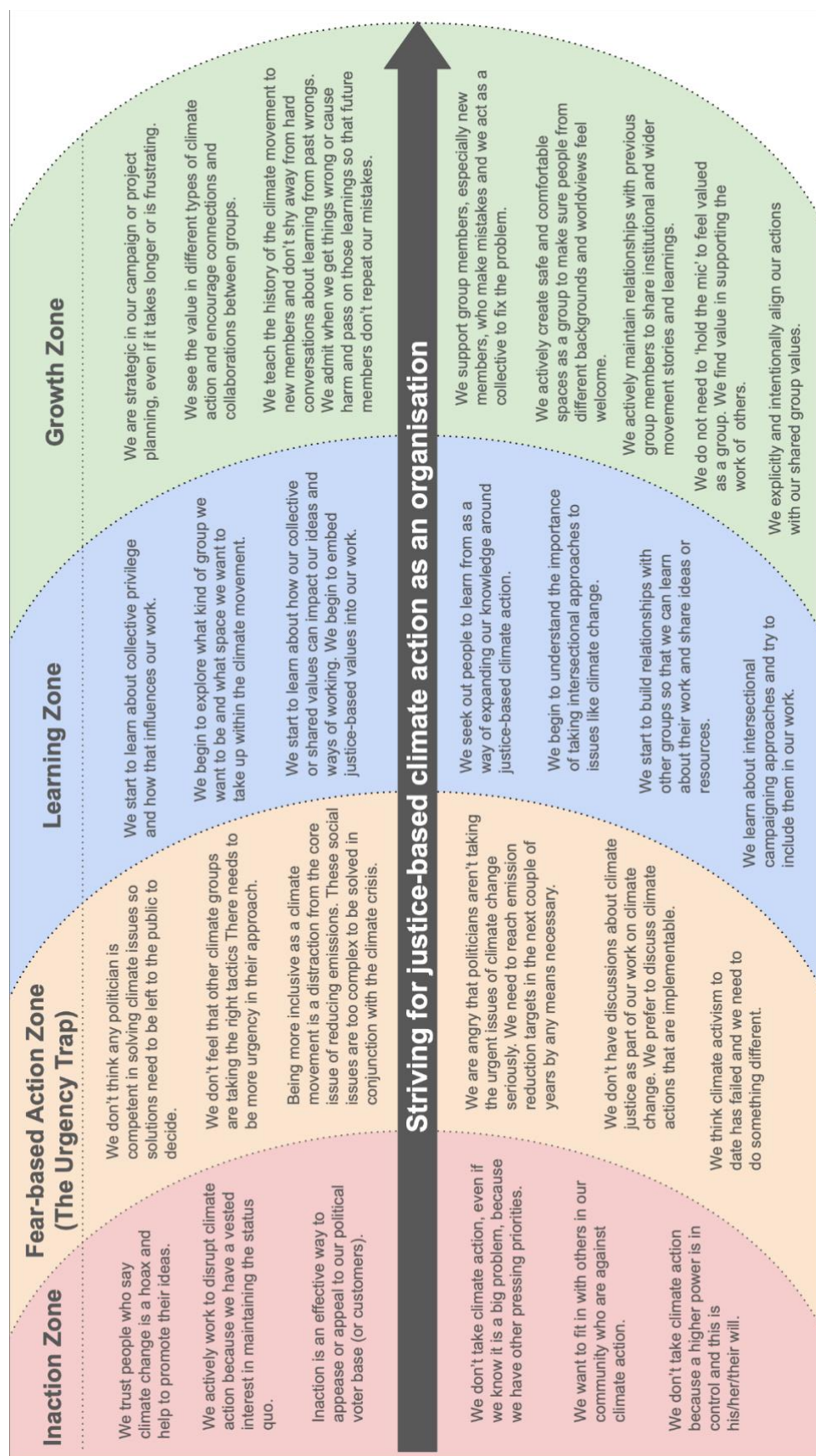


Figure 9 - 'Justice-based Climate Action Spectrum for Organisations' diagram (created based on how an organisation could progress on its climate justice journey)

7.3 Summary and Link to Chapter 8

The crux of Chapter 7, the “Story of now” is that it is important to take a step back and reflect before, during, and after a citizen-led project. The thesis suggests two ways of doing this: (1) by using questions to think about the key considerations of undertaking and actioning a project such as ZCA (using the example of Ganz, 2017); and (2) by using tools to guide reflection. In terms of tools, I developed and proposed several tools that might be used by future climate activists to help understand the complexities of climate change and climate action, consider who they might need to interact with, and reflect on where they sit currently in comparison to how they need to progress, to help with achieving effective climate action.

These reflexive tools are intended to help others accelerate their learning around these complex and competing topics when joining climate project spaces. The concept of growing power connects to Ganz (2017) when he makes the point that organising is not about creating dependency within a group of people, but instead that it is about enabling power. It also connects with the work of Becker et al., (2011) where empowerment is highlighted as a key principle in community resilience. Chapter 3 also shows how empowerment can be a key outcome of disaster citizen science efforts, but the details of how people might be adequately empowered are rarely explored. I hope these reflection tools might be one small way this thesis can contribute to the empowerment of others.

In using the questions by Ganz (2017) to reflect on the ZCA process, issues came up related to understanding long-term climate action. The first was the need to ensure that long-term strategic outcomes are not forgotten, particularly when under pressure for urgent climate change decisions. If longer term strategic thinking is forgotten, then this could be at the sake of climate justice, where already colonised and marginalised people are affected by poor short-term decision-making and actions. The second is the need to think more about who is at the table. To make better long-term decisions intersectional approaches are required, incorporating a range of people and conversations, and analysing the types of climate solutions that do not perpetuate harm to already marginalised groups. Some discussions may be difficult, but it is only through sharing these difficult and vulnerable conversations that complex issues can be unpacked, and the most appropriate climate-related actions can be taken. Other disaster-related citizen science projects could benefit from more of this broader strategic thinking up front (up-front pre-project reflective thinking), especially if the issue being studied is complex, and affects many people.

The final chapter, Chapter 8, is the concluding chapter, which provides an overview of the research questions and results, brings together the results of the citizen science research and citizen led ZCA study, and provides food for thought about current and future approaches to citizen science.

8 Chapter 8 - Conclusion

This thesis sought to understand how citizen-led science can contribute to disaster and climate resilience. The structure of the thesis was split in two halves. The first half of the thesis focused on a literature review and the development of a framework to understand how citizen science can build community resilience against disasters, including for current and future hazard impacts of the climate crisis (Part One). The second half of the thesis (Part Two) used an autoethnographic study of a citizen-led science and policy project; the Zero Carbon Act campaign for new climate change law in Aotearoa New Zealand (2016-2019). The Zero Carbon Act study explored reflexive and vulnerable project participation and offers lessons on how citizen science design can help turn project participants' values into actions (praxis). The research thus sought to answer four main questions:

Part One: Literature review and disaster citizen science framework development

- 1a) What elements / criteria / ingredients make up a citizen science project?
- 1b) How can project leads (researchers and/or community groups) be more reflexive of their development of and participation in disaster citizen science?
- 1c) How can citizen science projects be designed to intentionally increase community resilience to disasters and the climate crisis in a way that honours the participants involved, their communities, and works in non-harmful ways?

Part Two: Zero Carbon Act autoethnographic study

- 2a) What lessons can an autoethnographic analysis of the Zero Carbon Act campaign contribute to future community-led climate change projects, as well as wider disaster and climate change citizen science practice?

8.1 Part One: Literature review and disaster citizen science framework

8.1.1 Summary Results

A literature review was undertaken to answer the research questions for Part One. The 36 themes that emerged from the literature review included concepts such as data quality, resources, power dynamics, collaboration, learning, and equity. These themes were originally put into a logic model, which was then developed into a more comprehensive framework aimed at disaster researchers who want to start a new citizen science project. It is intended to allow disaster researchers to ask questions of themselves and their colleagues at different stages of their work and analyse if citizen science is a good fit for their intended purpose. The Disaster Citizen Science Project Development

Framework (henceforth called, 'the Framework') was organised into the following sections: Motivations for the Project, Level of Citizen Participation, Disaster Specific Considerations, General Project Design Considerations, Project Outputs, Project Outcomes, and a section for wider critical considerations labelled 'Being Reflexive'. The former sections were loosely based on the logic model format, while the 'Being Reflexive' section was added for critical analysis of the processes at each stage of a project. Thus, these aspects are key to developing a citizen science project, answering RQ1a ("What elements / criteria / ingredients make up an effective citizen science project?").

In developing a citizen science project an initial plan should be made for project development and implementation, but a reflexive review process should occur at multiple points along the project journey. The reflexivity and reflection on method allows for changes in process or direction to be made, based on findings or feedback. I settled on six themes for the Being Reflexive section due to their dominance in the literature, the centrality of the concepts in project development and because excluding them can exacerbate prior inequities. These six overarching themes are: inclusive participation, developing trust, creating partnerships, being context-specific, monitoring power dynamics, and valuing different types of knowledge. The addition of the Being Reflexive section suggests some ways to answer RQ1b, ("How can project leads (i.e. researchers and/or community groups) use reflexivity to set up or run an effective citizen science project").

Citizen science could be uniquely positioned to further increase resilience to disasters and the climate crisis through actively building in community resilience indicators within a project, such as informal disaster education, community participation, building trust, and action coping (Becker et al., 2011; Feng et al., 2018). Projects that are locally specific can increase knowledge of their surrounding area, and when paired with education on climate or disaster impacts for that location it could lead to increased preparedness and resilience for individuals participating in that project. Citizen science projects have the opportunity to bring otherwise hard to access academic funding to underserved communities (Soleri, et al., 2016). However, for these projects to succeed there needs to be community buy-in, or preferably community ownership, over the work at each stage of the project development. Having a community directly involved at the different stages of a project means that a project is less likely to include practices that are culturally or socially inappropriate or unsafe for members of that community. Having clear lines of communication and decision-making processes during the project will also help avoid taking the work in a direction that would be at odds with the community's vision, approaches, and intended outputs/outcomes of the project. The Being Reflexive section of the Framework, as well as the 'Questions to ask' in the General Project Design

Considerations, Outputs and Outcomes section, start to pull different project development aspects together which go some way to answering RQ1c) (“How can citizen science projects be designed to intentionally increase community resilience to disasters and the climate crisis in a way that honours the participants involved, their communities, and works in non-harmful ways?”). However, for such a big question, a more in-depth and specific study would be needed to provide a more comprehensive answer.

By using intentionality and reflective practices, key elements have been identified in Part One of the research which could lead to citizen science projects being designed to increase community resilience to disaster events and the climate crisis in a way that honours the participants involved, their communities, and work in non-harmful ways.

The definition of citizen science I have created with the lessons from the literature review is:

Scientific discovery done, at least in part, by people who wouldn’t self-identify as professional scientists or researchers. These people can be involved in different stages of the research process, including data collection, analysis and write up, as well as initial problem definition and project design. Projects may be community-led, with some having no professional scientists involved at all.

8.2 Part two: Zero Carbon Act autoethnographic study

8.2.1 Summary Results

Following the extensive literature review research focused on citizen, science, community resilience, and the development of a framework that supports effective citizen science projects, the next step was to find a case study where the aspects identified in Part One could be investigated further. After an initial search for a case study community, I made the connection that one of the communities of practice I was part of (youth climate change activists) were already involved in a citizen science project around climate change. This became the case study for my PhD as I was already leading a citizen-led science and policy project. The project was called the Zero Carbon Act campaign, and I was the National Convenor for the duration of the campaign (2016 - 2019). For this project, myself and our small team of volunteers from the youth climate group Generation Zero developed a

blueprint for a Zero Carbon Act, a climate law, which was adopted by government and passed by Parliament into law unopposed in November 2019.

The three data sources used for this autoethnographic study of the ZCA Campaign were my personal diary, seven semi-structured interviews with other campaign core team members, and textual artifacts from the campaign period, including newspaper articles and internal campaign documents. The data in the study was then triangulated to seek alignment between the data sets, highlight differences and seek alignment with the literature. I found 20 main themes, of which two – coping with climate anxiety and collective action – I focussed on in the discussion. I compared findings with climate activism literature, as well as compared the data with the citizen science and community resilience literature review findings from earlier in the PhD process.

The results/discussion section of Part Two was split into three chapters based on Marshall Ganz's "Story of self, story of us, story of now" framing (Ganz, 2009). The framework comprises three key parts. First, the 'story of self' centres on an individual telling the story and aims to elicit what motivates them to do social justice work and share emotive stories that connect with their audience with the hopes of inspiring collective action. In addition to the 'Story of self', the 'story of us' describes the values and experiences of the community involved in collective action, as well as theory of change and ways of working. Finally, the 'Story of now' outlines what their view of success looks like and how collectively the group or movement aims to make this vision a reality. It outlines the wider social, political, and economic context and why taking action is so important (Ganz, 2009).

8.2.1.1 Story of Self

This chapter presented the idea that the motivation to act through participating in perceived climate solutions could be defined as 'Action Coping'. Action coping has been shown to be helpful, by focussing on understanding and practically addressing a problem (in this case to reduce climate anxiety), rather than resorting to emotion-focussed coping (e.g. worrying) (Becker et al., 2011). Taking action in a climate crisis is a coping strategy for many. There are both pros and cons to action coping depending on the type of action coping taken, how it is done, what self-care was involved in the process, how stressful the action is, and if it is done in conjunction with others or in isolation. I argued that participation in citizen science activities, such as the ZCA campaign, can be a form of action coping, and therefore builds personal and community resilience. The theme of action coping as motivation for climate action was analysed through my 'Story of self' (personal experiences), as well as literature and interview responses from other ZCA team members. The section discussed

mental health issues arising from climate change and explored three concepts resulting from action coping identified in this research as a response to the climate crisis; creating hope through action, action without healthy boundaries leads to burnout, and navigating conflicting personal identities.

8.2.1.2 Story of Us

Ganz (2009) highlights the power of using stories to develop and shape public narratives for change. He states that public narratives allow communities to respond to challenges with courage, with hope, empathy, and self-advocacy as opposed to reacting to them in fear, isolation, and self-doubt. Humans know and experience the world through both facts and emotions (head and heart). Ganz believes it is important to appreciate that emotion has its own language just as cognition has its own language, and both can be influenced through shaping dominant public narratives. An aim of the ZCA campaign was to use storytelling to motivate collective action through sharing values and vision. The 'Story of us' section included nine different topics that were discussed based on the autoethnographic data: interpreters of science and policy set the narrative, visioning and imagination through story, cultural shifts through dominant narratives, building power through creating connection, values based messaging, building trust with unlikely allies, the value of social connections and collective action, collaborative informal education, and shared learning on how to have uncomfortable discussions. These aspects were all important in the collective action process.

8.2.1.3 Story of Now

As part of his 'story of now' concept, Ganz (2017) poses a series of prompting questions that people can use to determine how they want to go forward with an idea for a campaign, project or movement. These questions include:

- What urgent challenge do you hope to inspire others to take action on?
- What is your vision of successful action?
- What choice will you call on members of your community to make if they are to meet this challenge successfully?
- How can they act together to achieve this outcome, and how can they begin now, at this moment? (Ganz, 2017).

The 'Story of now' chapter was my attempt to answer the two of these five questions based on autoethnographic analysis of my experiences from the ZCA campaign. The two chosen were closely related to the findings from the first two discussion chapters. These two questions were, firstly, what urgent challenge do you hope to inspire others to take action on, and secondly, what choice

will you call on members of your community to make if they are to meet this challenge successfully? Such questions are useful tools for any citizen science or citizen-led project to reflect on the purpose, outcome and implementation so any actions are effective. Other reflective tools can be useful too, as highlighted by the development of Figures 7 - 9 which I developed specifically for use by those leading and participating in future climate projects. Upon self-reflection using Ganz's two questions it was apparent that social justice issues need to be better incorporated into projects such as the ZCA campaign, and this could only be done through longer term strategic thinking (without giving in to urgent pressures and poorly-considered decisions) and taking intersectional approaches.

8.3 Discussion

This discussion draws from Part Two of the thesis to answer RQ2a ("What lessons can an autoethnographic analysis of the Zero Carbon Act campaign contribute to future community-led climate change projects, as well as wider disaster and climate change citizen science practice?"). I discuss six lessons that could be applied to the wider disaster and climate change citizen science field.

- Action coping can be an effective reaction to learning about the issues of climate change.
- Action coping without boundaries can lead to burnout.
- Being reflexive to navigate intersectional approaches can be one small antidote to injustice.
- Action coping without intersectional approaches can lead to action bias and the urgency trap.
- Connecting people through shared values to re-vision and re-imagine how communities look, feel, and function.
- Climate change leadership includes holding spaces for difficult conversations.

The following sections are an offering for current or aspiring climate activists who want to **explore more intersectional and justice-centred ways of engaging in climate action** and reflect on their own place in the climate movement.

8.3.1 Action coping as an effective reaction to learning about the issues of climate change

Because climate change is a deeply psychological issue, understanding the emotional barriers to action can help devise better guidelines for communication, advocacy and policy. Cunsolo et al. (2020) suggest that a connection to, or relationship with, the natural world can cause ecological grief and anxiety due to the stress over current or future change. Action coping is a form of problem-

focused coping where actions are taken to address the cause of a problem directly, which has been found to predict resilience (Becker et al., 2011). While action coping is seen as problem-focused coping rather than emotion-focused coping, it still has the potential to alleviate the symptoms of ecological grief and anxiety (Cunsolo et al., 2020). Action coping connects to the mental health aspects of the climate crisis through using action as a way to feel hopeful about the future, as well as through creating or being invited into safe spaces for discussions around climate grief and climate solutions. I helped start the ZCA campaign as a way of action coping to make sense of, and reduce anxiety about, the climate crisis. I related to the phrase ‘stubborn optimism’ (Figueres & Rivett-Carnac, 2021) as it refers to the refusal to give up hope in the face of increasingly dire climate change predictions and unbudging layers of entrenched political apathy or inaction.

Curnock et al. (2019) suggest feelings of hope, protection and custodianship are necessary for both individual actions and collective response to climate change. Nairn (2019) showed that participants in her study of young climate change activists were not dissuaded from action by ‘end of world’ narratives, but instead were motivated to try to change the outcomes through personal action. Her research also suggested that some climate activists saw that a sense of despair could be useful in countering ‘blind optimism’ (Nairn, 2019), which in my experience can also be disruptive when solutions are not developed with an intersectional approach.

8.3.2 Action coping without boundaries can lead to burnout

Taking action on climate change is not always a positive experience. Lertzman (2015) suggests that we should help others to channel strong emotional responses to climate change into creative and constructive expressions. However, she purposely did not use the word **action** and suggests that the way people are currently constantly pushing each other to act might not be as helpful as intended. Instead, she suggests that we need to find what action means for each individual person and that we should be reminding everyone, especially young people, that the burden of action is not all on the shoulders, and that we’re in this together as a species. In her book, *Rising Strong*, Brown (2015) highlights the need to self-monitor expectations of action taken and how emotionally involved someone is in actions that may fail or turn out differently to expected, as well as manage expectations in campaign disappointments that, for the most part, are so far beyond a person’s control.

In climate activism there are many people angry and disappointed – at the inaction of governments, at the greenwashing of business leaders, at international science and policy processes which can feel

painfully slow and complicated. As a movement there needs to be honest discussions around confronting expectations of action. It doesn't mean not being ambitious or calling for more/better action, but ensuring processes that protect the mental health of participants in those actions. Nairn's (2019) research on young activists highlighted that participants in that study spoke of burnout as an individual problem due a person's failings at finding balance in the ways they were working or by being too hopeful. She suggests that the issues of burnout and despair need to be looked at through a broader, collective lens connected to climate change denial. Self-care is a big part of the internal narratives within youth climate activist culture (Lertzman, 2015) but during our ZCA campaign I found it often easier in theory than in practice. Many organisations within the wider climate movement are becoming more explicit about asking people to take care of themselves, as they have seen activists in the space 'burn out' over the last decade (Wettlaufer, 2015; Gorski, 2019; Chen & Gorski, 2015).

8.3.3 Being reflexive to navigate intersectional approaches can be one small antidote to injustice

There are expectations of and within many climate groups, in that they should be much more than climate action groups – they also need to be experts in climate justice, decolonisation and re-indigenisation concepts and practice, as well as take intersectional approaches to campaigning (Crenshaw, 2013; Kaijser & Kronsell, 2014). Many of us are expecting our young people to do better and be better at intersectional ways of working in the climate space than previous generations, though we are not always sharing the lessons on how we attempted this, either well or poorly. Despite this, many young people are forging their own path with these difficult, inter-movement conversations.

Our personal motivations, experience, and worldview affect how we approach campaigning and in turn can really impact how others in the climate movement perceive you. Consciously and explicitly aligning my actions with my values (praxis) (Freire, 1996) is now the guide I use to not create inappropriate solutions that have unintended consequences, or cause harm. To centre values in our actions, both as individuals and groups, we need to know what those values are and how to practically apply them to our work. Internal reflection or tricky interpersonal discussions can be one way to explore these values. Those tricky conversations and internal musings require the person to be vulnerable to making mistakes, or acknowledging past wrongs and learning how to counter any shame that comes with those discussions (Brown, 2015). Navigating organisational and movement legacies is complicated and messy, and people shouldn't have to be an instant expert in this work to act on climate change.

8.3.4 Action coping without intersectional approaches can lead to action bias and the urgency trap

Brown (2015) highlights a concept called ‘over functioning’ – which she describes as going straight to action to avoid dealing with feelings in stressful situations, and the concept of ‘action bias’ – which she describes as people defaulting to action instead of strategizing about the problem first. Brown suggests it can be easier to enact surface level solutions instead of discovering what the underlying causes are of an issue, and that pausing to learn more before launching into action can make people feel vulnerable. Brown (2015) notes that this pause can be daunting for people to do but it can lead to better outcomes where solutions target the real causes and mean that the problem doesn’t need to be solved over and over again. She suggests people recognise the power of emotion and try not being afraid of leaning into the discomfort. The ‘Story of now’ section (Chapter 7) outlined how there are similarities between the three concepts of ‘action coping’, ‘action bias’, and ‘over functioning’, and how a combination of these can lead to a person new to the climate action space falling into the ‘urgency trap’.

The challenge associated with action coping or action bias is when someone rushes to solve problems without consideration of the wider social, cultural, economic, class, and environmental contexts. The research from Brown (2018) shows that people often rush into solutions before they’ve identified the true cause of the problem, including underlying root causes. Rushing into these solutions makes them ineffective which can be costly and demoralising as the issues will continue. For the purposes of this thesis, and in relation to climate change, I called this phenomenon the ‘urgency trap’, where someone is not being intentionally reflexive or strategic in the process for developing climate action. My decade-plus experience in different parts of the global climate movement has shown me that it is full of false solutions and misdirected enthusiasm which can hurt other people or wider movement ambitions, and the climate movement in Aotearoa New Zealand is not immune. Not all action is created equal, and many attempts to ‘solve’ the climate crisis can do more harm than good. An action may technically count as climate action if it is reducing emissions, but that doesn’t mean it is done in just and equitable ways. A risk with rushed responses due to fear of urgency is that they are not thought through properly or their impacts on vulnerable groups are ignored under the guise of the situation being too urgent not to act, such as the suffering of already vulnerable communities being exacerbated from a rush to geo-engineering solutions (Preston & Carr, 2018).

Urgency shouldn't mean rushed and ineffective solutions which keep the status quo ways of working instead of branching more into climate justice or intersectional approaches. It is important to create the time to be self-reflexive when everything feels urgent. So often people look for solutions that are considered easy, shown to them by friends or family, or are promoted in the community, or popular in other areas or on the internet. I am proposing that the urgency trap concept is a reminder to take intentional and well-considered actions that will create systemic change, rather than a call to not take action. It is intended as a prompt for people joining the movement or proposing solutions to ask themselves questions, such as:

- Who is already doing this work?
- What types of consequences will come from this proposed action?
- And, are there any potential unanticipated or unwanted consequences that haven't been identified?

8.3.5 Connecting people through shared values to re-vision and re-imagine how communities look, feel, and function

Ganz (2017) highlights the power of using stories to develop and shape public narratives for change. He states that public narratives allow communities to respond to challenges with courage, hope, empathy, and self-advocacy as opposed to reacting to them in fear, isolation, and self-doubt.

An aim of the ZCA campaign was to use storytelling to motivate collective action through sharing values and vision. The power of story and narratives can shape a new vision for the future, and that vision can hold the course for heading in that direction. The vision becomes the 'north star' we are aiming for as society, and the stories are ways of sharing and adapting that vision along the way. Our brains are wired to respond to stories as a way to connect, empathise, and make meaning out of situations (Brown, 2015). Consequently, stories and narrative can be useful in the climate change context to help people understand the issues that need addressing, and connect with any initiatives that will achieve a future vision.

We used visioning and storytelling as a major part of the ZCA campaign in an attempt to help communities imagine what a community transition could look like for them, and what it might take to make that vision a reality. We started our campaign's strategic planning with an exercise on what our 2050 vision was for Aotearoa New Zealand and how we saw the law playing into that vision. We built a shared vision, and the campaign was then constructed from that vision.

Telling stories, through in-person events, mainstream media, and social media became our main tool in imploring different community groups to sign onto that vision. We sold the vision of a climate law and what that could mean for Aotearoa New Zealand, rather than the law itself. We had the draft policy blueprint one year into the campaign, but leading up to that draft blueprint we sold the vision of what it could do, how we thought it would help our emissions reductions and adaptation planning, and why people should care. In the words of The Workshop's climate communications guide, "we sold the cake, not the ingredients." We aimed to highlight in our messaging how the law would make tangible changes in Aotearoa New Zealand's climate change response and how that would make positive changes to people's lives. Whilst our law drafting took a science-based approach, we got better as the campaign went along at not leading with the policy details in our public communications.

We strategically used values-based campaigning (Elliott & Berentson-Shaw, 2019) as a way of leaning into, rather than away from, these complex and depressing realities of climate change. We used resources from the public narratives and communications research organisation, The Workshop¹⁸⁶, on implicit versus explicit motivations and ways of communicating, and we aimed to connect people to the solutions, rather than focus too much on the negatives. We also aimed to connect people to those who were already doing the work to show them that they weren't alone in wanting to make change.

8.3.6 Climate change leadership includes holding spaces for difficult conversations

Within the ZCA campaign, our core team took on shared leadership and positions of power to both shape the campaign's design and the draft national climate policy. Brown (2015) suggests that the domain of leadership is one of pursuing purpose in the face of uncertainty rather than maintaining control. She defines a leader as "anyone who takes the responsibility for finding the potential in people and processes, and who has the courage to develop that potential" (Brown, 2018, p. 6). Similarly, Ganz (2017) suggests leadership in the context of social movements is a practice in which those leading are helping others to develop their personal capacity to respond to uncertainty. He suggests that leaders develop this capacity in people in three distinct ways; skills to cope with challenges, strategy of how to use our resources, and ways to find hope and courage to inspire others.

¹⁸⁶ <https://www.theworkshop.org.nz/>

I found holding conversations around solving climate change during our ZCA campaign were sometimes messy, complicated, and felt like they were going round in circles. We had many nuanced and in-depth discussions on how to unpack different cultural aspects of solutions being proposed around the world to both mitigate and adapt to climate change. Our team, as leaders, needed to create a comfortable and safe learning culture for these complex and often emotive discussions on complex climate issues. Brown (2015) describes those tricky conversations as a ‘rumble’ where participants must lean into vulnerability with curiosity and fearlessness. As part of the ZCA campaign, we needed to create safe spaces for vulnerable dialogue which required constant work to maintain good team culture, including through open communication, mediating conflict, reconnecting with shared values and goals, and checking how and why power is shared.

Discussions around climate change are hard and require safe spaces, however the idea of a ‘safe space’ is not the same for everyone, and safe for one group or individual does not mean safe for another (Burke & Brown, 2021). I learnt to use the terms ‘comfortable/uncomfortable’ or ‘appropriate/inappropriate’ as it was hard to guarantee fully safe, culturally-competent spaces and approaches for all during the ZCA campaign, especially as many of us in the core team were learning as we went for a lot of these issues.

8.3.7 Prompts and tools for reflection

Brown (2015) states that asking for help is an act of courage and compassion and through this discussion chapter I encourage groups to lean into the challenging reflections and conversations that come with challenging their own ways of working and asking for help to do things better. The ‘story of now’ chapter included three diagrams that I hope will be useful to those developing climate justice-related citizen science projects.

Firstly, a ‘Justice-based Campaign Funnel’ was created to help prompt discussions around a project and the interconnections between a range of other social, cultural, environmental, and economic issues. It was intended to highlight a need for peer-to-peer sharing and creating a give-and-take culture between different projects across all the different issue areas.

Secondly, a ‘Justice-based Climate Action Spectrum’ diagram was created to reflect the lessons from the PhD on being more reflexive and vulnerable to our personal approach to activism.

Thirdly, a 'Justice-based Climate Action Spectrum for Organisations' diagram was created based on how an organisation could progress on its climate justice journey. The diagram is intended to accompany the diagram from an individual's perspective, as organisations, especially ones led by volunteers, are reflections of the views of those participating in them. Just as there are different stages an individual activist will go through, these stages can also be applied to groups too.

I welcome these diagrams to be expanded on, or have parts challenged. I want to reiterate that, while I've mapped out the latter two diagrams as a spectrum, there is not necessarily a linear progression between the different stages. Some people or groups might already enter the climate movement with an extensive knowledge of climate justice based on their lived experience and worldview. And others might go between different parts of the spectrum depending on the niche topic in question.

8.4 Alignment with general Citizen Science practice

Through Part Two of this thesis, the ZCA campaign was explored as citizen-led science interpretation and policy development using autoethnography. The lessons from this analysis could be useful for other similar types of climate change or disaster related community-led science, or indeed in some cases for the wider field of citizen science. These findings would apply more to the co-created or extreme types of citizen science projects, especially projects that are aiming to create some type of external impact or change. The following section outlines several lessons and why they were useful.

8.4.1 Lessons for citizen science

There are various different projects that aim to either build community resilience to disaster events or to help communities respond or recover when an event happens. Participation in citizen science in the hazards space can lead to education and engagement in wider hazard or climate change related issues. Fatti and Vogel (2011) demonstrate how beginning a discussion on climate change using thunderstorms as a focus can be an effective way to approach such a technical, complex topic. Citizen science is well placed to act as a catalyst to engage communities by working on projects that have easy entry points, which can then turn into discussions around more complicated issues (Fatti and Vogel, 2011). As such, the ZCA campaign acted as a catalyst for future discussions and activities within a community of practice around community resilience. There are infinite ways that this could be replicated by future climate change-related, citizen-led projects, whether directly focused on scientific data collection, or in data interpretation as was the case with the ZCA campaign.

Applying the PhD lessons around actively reflecting on intersectional approaches and issues could help stop repetition of prior ways of working that didn't work for underserved parts of a community. Climate change exacerbated disasters will worsen social inequality and climate change impacts will be racialized. In many Global North countries, emergency management, and emergency services, have traditionally been designed for middle-class white needs. The inequity in response provisions, combined with existing fears of engaging with police or government officials or representatives, causes some communities to be less willing to ask for help in an emergency or they may wait until it is too late to seek assistance. I suggest there is a role for citizen science to help heal some of these trust issues if the projects are intentionally designed with that in mind.

Because cultural competency has often been missing in disaster reduction and response (Seidenberg, 2005; Knox, 2020), for example sending supplies of emergency food that don't consider cultural dietary requirements (Jones et al., 2022), there is an opportunity here to include more people in those reduction and response initiatives through citizen science. These mistakes are often due to underrepresentation of these communities in emergency planning – the people impacted need to be in the room to make the plans work for the whole community. As an extension of emergency management, intersectional approaches are found to be useful when analysing approaches to climate change adaptation as well. Ravera et al. (2016) looked at intersectionality in adaptation strategies among Indian farmers and found that “intersecting identities, such as caste, wealth, age and gender, influence decisions and reveal power dynamics and negotiation within the household and the community, as well as barriers to adaptation among groups” (Ravera et al., 2016, p. s335). I suggest this poses an opportunity where climate adaptation-focused citizen science could be expanded further to deepen levels of community engagement on disaster issues, foster trust with local disaster management officials, as well as provide a means for undertaking informal disaster education.

The community resilience indicators from Becker et al. (2011), described briefly in Chapter Two, are all interconnected and can be used in varying ways to increase the adaptive capacity of a community. For example, participation builds resilience by allowing community members to collectively discuss issues (i.e. articulate problems), learn about issues facing their community (informal disaster education), and empowers them to come up with practical solutions (action coping), that they can either implement themselves, or implement with help from an agency or other facilitator. Citizen science projects have the ability to be specifically designed to help increase

the occurrence of these indicators in a particular community. Our campaign was blatant in its purpose. We were not trying to prove if climate change existed or not, nor if Aotearoa New Zealand should do something about it or not. Our campaign centred on the idea that climate change is real and that legislation was needed to force government action. We created that legislation in a way that used science-based targets and policy response, but also focused on equity, indigenous rights, and a just transition.

Bonney et al (2016) calls for more research into how citizen science can help participants to learn and whether this helps to support lifelong science engagement. They state that there is little known about how a person's perceived role in science changes as they participate in citizen science, or how it affects their sense of self efficacy and empowerment (Bonney et al., 2016, p. 13). Projects have been developed to capture the experiences of participants in citizen science projects. One such project that aims to do this is the 'Exploring Engagement and Science Identity through Participation' project (Bonney et al., 2016). The three-year study investigated six different citizen science projects to explore the ways people participate in scientific research and how that relates to their skills, interest and self-efficacy in the science field. Phillips et al. (2014) suggest that participants can have meaningful interactions with science and science institutions if they are involved with more than just data collection. Similarly, the Citizen Cyberlab project explored how data processing projects impact the participants involved and interviewed them about their experiences and learning opportunities (Bonney et al., 2016, p. 13).

Riesch and Potter (2014, p. 108) suggested that there was little data on what scientists involved in citizen science projects really think about the citizen science as a method of science and engagement. They state that this is due to the fact that reflections and lessons learned are often not voiced, and that scientists that do publish this reflection would be hesitant to paint their project in a bad light. There appears to be a lack of objectivity and deep analysis in the critique of citizen involvement in science projects. One of the barriers that could impact the success of a project is the public's lack of understanding around the uncertainties involved in science.

From the outside, science is seen to deal in facts. The public acknowledgement of uncertainty is the first step towards collective experimentation. More and more institutions that use science now know that, if they want to make good decisions and keep the public onside, they must look for what they don't know. Collective experimentation invites wider

discussion of bits of science that are often kept behind closed doors, which makes it messy.

Society becomes the laboratory (Stilgoe, 2009, p. 22).

This experimentation is often at odds with what the public, policy makers, or politicians are expecting to get out of the research – hard facts that can be used to prove or disprove issues that are impacting their community. This type of open research needs a willingness to understand and have an open mind on all sides (Stilgoe, 2009). From the analysis of the ZCA campaign, and depending on the purpose and design of the project, citizen science can deliver on both of the benefits discussed above. Riesch and Potter (2014, p. 107) highlight that citizen science projects can be a ‘win-win situation’ for both the researchers looking to get assistance from the public and also the citizens who are able to contribute to, and learn from, genuine scientific study. In our ZCA campaign case, it was our core team who were benefiting from the work of volunteers, whilst also helping train them in policy development and campaigning, which increased their skill sets and allowed them to be part of something with a clear sense of purpose.

However, as pointed out by Tweddle et al (2012), projects with education elements need to allow for additional support and ongoing engagement with the participants. Our ZCA campaign training was informal and ad hoc, and most training was done for and by team members. It was more informal skills, knowledge, and experience sharing than formal training. There wasn’t a requirement to undertake any training to join in our work, which in some ways made it a low barrier of entry for potential participants. However, there was a high perceived barrier to entry as people thought they needed to have knowledge around legal process and policy development before they could join. And in many ways that was true, as there was a steep learning curve once a person started volunteering on the campaign if they wanted to join our core team conversations because those discussions did get technical and complex. One example of a training that we spent money on was a whole of campaign team training centred around Te Tiriti o Waitangi from a pākehā trainer who specialises in helping people or groups unpick issues around colonisation. Through the various types of education and upskilling we did, a lot of people who had been more casually volunteering during the ZCA campaign went on to take a leadership role in Gen Zero after the campaign, especially as a lot of the core team had burnt out by that stage and withdrew from participating in Gen Zero further.

There were countless conversations had by volunteers around climate change issues during the four years of the campaign, often informally in meetings or at social events. Citizen science projects could also help facilitate the exchange of ideas and experiences of disaster events, as well as the

opportunity to include indigenous knowledge about disasters. As shown by the 'Being Reflexive' section of the Framework (Chapter Three), building reflexivity directly into the project design of citizen science is one opportunity to normalise this type of process, and to encourage more project leads (whether professional scientists or community volunteers) to engage in deeper reflections on the current or potential impacts of their work. The lessons on vulnerability from Chapter Five, based on the research of Brown (2015) are most useful here, as to be that reflexive in analysing our work is a vulnerable act. Going into those reflexive conversations requires patience and compassion with ourselves and group members, and the creation of comfortable spaces where people can share their reflections without fear of retribution.

The case study of the ZCA campaign was a very specific type of citizen science, in which it was citizen-led science interpretation and policy development. It was more of a social science approach to citizen science, and the ZCA campaign was retroactively designated or labelled as a citizen science project for the purposes of this PhD. The team didn't go into it with a citizen science approach in mind, it was focused on a campaigning approach instead. There are lots of aspects of campaign design that could be transferable to citizen science, including the best way for getting people involved in an issue to create change, but that was outside the narrow lens of this study and could instead be a useful topic for further investigation.

My interest in getting involved in developing the project was the personal need to be doing something about climate change, rather than a specific interest in legislation drafting. There might be a wide range of different motivations that draw people to a citizen science project, and I would recommend exploring those more fully with project volunteers. Learning about what motivates volunteers to get involved in a citizen science project (as outlined in Chapter Three) may be one way to collect the information required to adapt the project to better suit the needs of the volunteers (Riesch & Potter, 2014; Soleri et al., 2016). For the ZCA campaign, we explicitly had conversations around what motivated us to do this work. While there were a variety of different reasons for team member motivations, a connecting thread was the decades of climate inaction by governments around the world, and the slowness of international processes to force any action. These motivations link to the concept of Action Coping (Chapter Five) where a person takes action as a response to not feeling great about an issue. It would have been useful for volunteer retention to learn more about their motivations and what kept them joining in the work.

Another connecting motivation among core team members was creating a law that forced governments to undertake climate action over several decades, no matter what political party was in power. The ZCA campaign became a clear and effective way for people to feel like they were forcing change to happen. In this approach, the ZCA campaign team is similar to many other science-for-change type projects, where the project has the motivation to change something they perceive broken in their community, such as air quality monitoring projects to prove companies are breaking air quality standards or regulations. For projects with these clear, justice-based motivations, harnessing the power of story to share a collective vision can be an effective way to connect a community and get them interested in a citizen science project.

One of the downsides from the community-led or initiated projects is often the complete lack of funding that goes with it. While many citizen science projects have professional scientists involved who have funding attached to them from different academic grants, our campaign was done on very little money. We fundraised for a website, stickers and t-shirts (campaign merchandise) and for the logistics of meeting as a whole team once or twice a year (flights, accommodation, and food). Most of the campaign was done by unpaid volunteer hours (care labour, policy drafting, talking to MPs, presenting to communities). The project was run so cheaply through lack of alternatives. One suggestion would be reflexivity around citizen science project budget spend, and finding ways that any resources that are put back into the community through the project are ones that will be useful for that community at the conclusion of the project. For example, not spending a significant portion of the project budget on a specific piece of technology that can be donated to the community afterwards but that they have no ongoing need or want for. And instead putting that money into upskilling people in the community using training that will be of use to the community members in other circumstances after the project ends.

There is a power dynamic in a project where a professional scientist is being paid to run the work, or even to co-create the project with communities. If there is a co-creation approach, and one party in that co-creation is getting paid and their time is compensated through their employer, versus community members who are giving up their time to participate in that co-creation, then there is a power and resource imbalance. The imbalance will impact how those community members can show up in that space whilst also taking care of commitments or responsibilities in their own lives (jobs, families, community positions, etc.). In our ZCA campaign it was a team of volunteers who led the work. We met more regularly, made decisions (predominantly by consensus) on key campaign moments. That group took on the role of both developing and leading the project, bringing others

into the project, and seeing that project right through until the end when the climate law was established. Within that time there were a few people who came and left the core team, but many of the members stayed consistent right the way through. We were all unpaid volunteers, and the work was done in our lunchbreaks, on weekends, or after work/school. Or in my case, I gave up my job to do national convening work, as did a few others within the core team by the end of the campaign. There were still power dynamics, however, despite our volunteer status. And we had to be careful about creating comfortable spaces for new volunteers to join in, where their ideas and knowledge were valued. Where we were successful in this space was being cognisant of these dynamics and trying to do our best to stay mindful of them even when there were stressful campaign moments, and it would have been easier to just work as a core team.

One part of the ZCA campaign that did not help with volunteer retention was that we could not give any specific timeframes for how long the campaign would take, or even if it would be successful. We could not give people certainty on how long their participation would be needed before the project was finished. Breaking the campaign into different chunks of time helped, for example, having discrete pieces of work that volunteers could get involved in such as policy drafting, creating informative posters, or developing community presentations. Another part of the ZCA campaign that may not have helped volunteer retention was that our process was very iterative in developing and running the campaign, i.e., we were making up a lot of processes as we went. The fluid timeframe, the processes made up as we went, and the fact that we were dependent on a lot of things happening that were out of our control to win the campaign, meant that we lost volunteers along the way who might have stuck around if we had been more organised or had a more clearly defined plan.

Taking an iterative process meant that we could adapt our methods along the way, which enabled us to go on a collective journey to learn about climate justice and intersectional issues. It also meant we could start to try to partner with groups who had intersectional issues as their main focus. These lessons from that adaptive approach to our journey, including being open to change and reflexive in how the project was being run, were a key part of our success. As researchers, we don't know what we don't know. It's hard to embed intersectional approaches into a project if we haven't taken the time to upskill ourselves. That would be the first and most obvious place to start, to take that upskilling on as a high priority within professional development. If academics want to do highly participatory citizen science design and research, then they need to take on that upskilling themselves before they can teach or embed those approaches in their project development.

Including researchers or community members in a project who bring lived experience is key to working in more intersectional ways, with the aim knowledge sharing and mutually beneficial collaboration, rather than tokenism. Building engagement with structurally marginalised groups in culturally appropriate ways (and using culturally safe spaces) is important to do from the project outset. The project lead needs to upskill in how to create culturally safe spaces before the outreach begins.

My key finding from Part Two of the research is that, through examining my participation in the Zero Carbon Act campaign using autoethnography, I have found that reflexivity of both researchers and participants in any project could have many wider ranging benefits, both for the individual and for the wider group or project. Communities (whether of geographical location or practice) getting together to explore an area of interest has the potential to inspire, empower, and connect those involved. For some groups, this scientific exploration could be used to share stories that capture the attention of others and create change in their local community, their region, or country.

8.4.2 Citizen Science Typology – Version 2

To wrap up the PhD process, I retrospectively looked at the citizen science typology (Chapter Three, Table 5) after drafting Part Two of the thesis. I observed that, because it was combining two existing typologies together, I hadn't thought wider than those project categories. The most participatory types from that diagram were a combination of **Co-create** (projects are designed by scientists and citizens working together and at least some of the participants are actively involved through all/most of the scientific process) and **Extreme** (collaborative science, problem definition, data collection and analysis), which both have the expectation that a trained or professional scientist involved as an equal partner in the process. In hindsight, I would have added an additional two categories for the community-led projects that either request help from scientists for a specific part of the project (temporary participation), or do not have a professional scientist involved at any stage of the project.

For our ZCA campaign, we would have fit in the former of those two new categories, due to the help we requested from a group of scientists and policy experts to review our drafting notes on our proposed law. Their participation in the project was crucial to our feeling confident that the draft law idea would be taken seriously within government and academic spaces once we had launched.

They were invited into the campaign to serve an important purpose, and that **invitation** was key to our team still feeling like we had agency and control over the project. It was our own choice to have those experts critique our work and we got to choose who they were and how they participated.

To capture these lessons from the ZCA campaign and apply them to the wider citizen science field, I have included three new categories in the Citizen Science Typology diagram. These new categories are:

- **Community practice** (citizen-led problem definition, data collection/interpretation and analysis)
- **Community designed and led** (projects are designed by citizens working together and professional scientists are invited to be involved in part of the process)
- **Community owned** (projects are designed by citizens working together and professional scientists are not involved at any stage of the process).

An updated version of the citizen science typology diagram is included below as Table 16. Our ZCA campaign would fit number seven in this new typology; Community practice (citizen-led problem definition, data collection/interpretation and analysis) and Community designed and led (projects are designed by citizens working together and professional scientists are invited to be involved in part of the process).

Table 16 – Citizen science typology [version 2] (adapted from Bonney et al. 2009, Shirk et al. 2012, and Haklay 2013; consistent with concepts in IAP2; and expanded using the findings from this thesis).

	Crowdsource: Citizens as sensors (active and/or passive)	Distributed Intelligence : Citizens as basic interpreters	Participatory: Citizens participate in problem definition and data collection	Extreme: Collaborative science, problem definition, data collection and analysis	Community practice: Citizen-led problem definition, data collection/interpretation and analysis
Contribute: Projects are designed by	1	2			

scientists and citizens contribute data					
Collaborate: Projects are designed by scientists and citizens contribute data, but may help in project design, analysis or dissemination		3	4		
Co-create: Projects are designed by scientists and citizens working together and at least some of the participants are actively involved through all/most of the scientific process			5	6	
Community designed and led: Projects are designed by citizens working together and professional scientists are invited to be involved in part of the process					7
Community owned: Projects are designed by citizens working together and professional scientists are not involved at any stage of the process					8

8.5 Unique contributions

Although there are now academic studies which include parts of the Zero Carbon Act development (Bailey et al., 2021; Semmelmayr, 2020; Dreyer & Ellis, 2021; Blackman, 2019), this thesis presents a unique contribution through the use of autoethnography as the methodology. My point of view as the national convenor of the ZCA campaign, alongside interviews with members of the core team, allow for unique insights into the background and development of the Zero Carbon Act legislation. It is especially important to acknowledge the part that civil society plays in the creation of policies and legislation, as it often takes years of lobbying and activism to get these to Parliament, yet it is normally the political parties involved that get most of the recognition for the development. This thesis provides insight into what that process looks like for this one specific piece of legislation.

The thesis also gives an offering to the citizen science field in the form of one typology, one framework and three diagrams to be used as tools or prompts for future project development:

- Citizen science typology
- Disaster Citizen Science Project Development Framework
- Justice-based Campaign Funnel diagram
- Justice-based Climate Action Spectrum diagram
- Justice-based Climate Action Spectrum for Organisations diagram

Two specific uses of the thesis outputs are included below:

- The literature and citizen science typology sections were used as the basis for the World Meteorological Organizations' High Impact Weather Citizen Science Guidance Note (2021)¹⁸⁷ and resulting paper – Vinnell, L., Becker, J. S., Scolobig, A., Johnston, D. M., Tan, M., & McLaren, L. (2021). Citizen science initiatives in high-impact weather and disaster risk reduction. *Australasian Journal of Disaster and Trauma Studies*, 25(3), 55-60.
- I tested out the 'Justice-based Climate Action Spectrum' diagram at a Generation Zero national meeting (Summerfest) in 2020 as a way to teach others about intersectionality of activism, which received a positive reaction and it has been used at subsequent Summerfest events by others in the group. I've also had multiple requests from others in the climate space, both in Aotearoa New Zealand and overseas, to use the diagram in their work.

¹⁸⁷ <https://library.wmo.int/records/item/57657-high-impact-weather-hiweather-citizen-science-guidance-wrp-2021-2>

8.6 Limitations

As with all PhD theses, there were many limitations at different stages of the research and writing process. One limitation is that the literature search was restricted to English-language articles, and therefore may not represent the breadth of material available across different nations, languages and cultural contexts, leading to some themes perhaps being missed.

As applies to all autoethnography, how my writing might make others feel when they read it is hard to predict and could evoke strong memories or feelings that are unpleasant for the reader (Bochner & Ellis, 1996).

Due to the time limits of a PhD process, not all themes from the ZCA analysis could be studied, and only one case study could be used which reduces the amount and type of data analysed. The autoethnographic methodology also makes the data specific to this case study and my experience within it. The lessons from the case study cannot be used as generalisable data, but they can be used to inform other citizen science projects of similar nature. I was intentionally collecting detailed information about a process, rather than generalisable data, and whilst appropriate for the thesis, it limits how the findings could be applied to other contexts.

There is a lot of perceived bias within autoethnographic methods due to the researcher analysing their own thoughts, feelings, and experiences. The outputs of this thesis were not of rigorous quantitative scientific standards, by design. My positionality was centred at the start of the thesis which influenced my approach, as well as my interpretation and analysis of the research data. My perceptions of the Zero Carbon Act campaign are centred by the autoethnographic method and could differ from other team members' experiences of that time. The interviews of team members have been included through my interpretation of their quotes and how that relates to my own experiences and the wider literature.

I did not focus specifically on my role (National Convenor) in the ZCA campaign as I felt this could only really be explored fully in contrast to what others viewed my role as, and this was outside the scope of the thesis.

I was limited in what quotes I could include from interview participants to maintain their anonymity. There were some compelling and insightful quotes that I chose to leave out due to the anecdotes

they describe being too easily attributed to a particular person if a reader was to know the team members well. If in doubt of preserving anonymity, I left the quote out.

I also left out parts of the strategy that went into the Zero Carbon Act campaign which I didn't feel I had the right to share. I chose to share strategic tactics and approaches that were publicly available in some form, e.g. the youth political parties backing the climate law idea, or the Elbow your Elders tactic that was run in collaboration with the School Strike 4 Climate group. I left out any detailed descriptions of political and industry lobbying due to the sensitive nature of those discussions which limited the findings of the data analysis.

8.7 Future research ideas

The core aim of a PhD study is to generate new knowledge about a hyper specific topic to continue shaping future research pathways. My small study has contributed new insights to the fields of citizen science, disaster risk reduction, and climate change social science. There are many themes and concepts identified through the literature review and data analysis parts of the thesis that could be expanded upon in future studies.

On reflection of the concepts, themes, and findings of this PhD research, the following ideas could be explored as future research opportunities:

- Further applications of citizen science in disaster research spaces using the Framework; using case studies to test out the Framework as it relates to starting and running a disaster-related citizen science project.
- The connection between education and citizen science; the role of school children in community citizen science projects as part of the science curriculum.
- Structured evaluation of the Justice-based Climate Action Spectrum diagram; using case study approaches to evaluate what does and doesn't work about them in practice.
- Potential for using citizen science projects to inspire feelings of connection to place as a tool for increasing environmental protections or disaster risk reduction initiatives.
- Exploring through case studies how citizen-led action could impact the future of democratic or civic participation.
- Exploring the role of 'urgency trap' narratives within other climate change groups.
- Potential of citizen science for increasing a sense of purpose, responsibility and connectivity within a community.

- Explore the power dynamics between members of citizen science projects and how these are linked to status within the group.
- Potential for the concept of 'action bias' to be explored in different types of climate policy development processes.

Epilogue: Reflections on research process

2024

In activist spaces it is commonly known that the “personal is political” (Hanisch, 1970) and that we are constantly negotiating and weaving our intersectional identities. Carol Hanisch, who wrote the 1970 essay which coined the “personal is political” phrase, argued that experiences can be identified by locating a person’s position within a system of power relationships. As mentioned previously, the intersectionality of our lives can’t always be separated out into categories. I soon realised in the PhD process that I couldn’t separate out two important parts of my identity, academic and activist, completely (Cahill, 2007). I related to the disconnect from practice/experience that McAlpine (2006) found in academia, especially as I was re-joining academia from an emergency management practitioner point of view. It was hard to show my experience as valid evidence when it wasn’t easily quoted or backed up by sources in the literature. I found through my PhD journey that I was starting to resist and challenge social norms within academic spaces, and I could see this start to develop my identity as a researcher (McAlpine, 2016; Riessman, 2008).

Autoethnography

My reflections on using autoethnographic methodology are that it is a way of researching that takes my thoughts, my vulnerabilities, and my experiences and asks others to connect with them; to agree or disagree, to relate or not relate. To seek similarities and differences within their own life experiences. I found writing the PhD using autoethnography as the method to be confronting and emotionally taxing. Finalising and publishing the PhD was intimidating as it meant I had to put a line in the sand with my views at the time. I’m always learning and developing my knowledge based on new ideas, concepts, and experiences, and so this thesis reflects my research at this one moment in time. The act of committing the words to paper felt very vulnerable, like they were now permanent and I was losing control of them, especially as they are wound up in a PhD that is to be critiqued and marked; a pass or fail.

I have contemplated how telling my story through this work will matter to me long term, both within academia and in my personal life. I decided it was a manageable risk to get the right method with the perceived benefits of taking an autoethnographic approach outweighing the potential risks and negatives aspects. However, despite the work of researchers legitimatising the method, I still had hesitancy in adopting an autoethnographic approach. One reason for this was the accounts of previous autoethnographers who described the vulnerability that comes with the emotional candour

of the method. Of particular note was the experience of Eisenbach (2016) who described their experience of defending their autoethnographic PhD topic.

I always expected my final defense would be my opportunity to defend my research methods, findings, and discussion. I never anticipated I would find myself sitting at a conference table, surrounded by my committee, family, and friends; defending my identity, choices, and lived experience (Eisenbach, 2016, p. 607-608).

The description of their experience in the PhD defence of being challenged, not only on academic merit and achievement, but also on their personal role in their family life, allowed me to acknowledge and reflect on my fears of defending myself beyond my identity as a researcher, through the PhD defence process. I was also worried about how my topic would be perceived by other academics, as outlined in my PhD diary quote below.

I'm worried how to tie my initial literature review it into the autoethnographic methodology. It comes back to the issues around what is considered 'real' science (even social science) and is it better to have 'real' articles published, with the auto-ethno stuff wrapped around it to tie its narrative together – my narrative around the work. I still feel the need to publish the literature review findings as the 'real' part of the research – need to unpick why I'm feeling like this more. I have a lot of unlearning to do. Will autoethnography be respected when I try to get a job? Should I be worried about this? [sic] (PhD Diary - 13/04/2019).

I was questioning the validity of autoethnography research methods because I am constructed by, and socialised to, privileged positivistic ideas of validity and objectivity, even though I viewed autoethnography as a legitimate method of data collection, analysis, and presentation. Here, I needed to navigate my internal tension. I questioned my position, as an early career researcher with little academic power, to write a PhD largely based on my own experience. I questioned why my story would be of interest to people, especially other academics, and how it would add to the wider body of knowledge around citizen science, community resilience, participation and climate change activism.

To me, using an autoethnographic method was exposing, in that I felt like I was inviting academics and scholars to rummage through the contents of my inner thoughts. In doing this, I had to be willing to welcome their critiques to these thoughts. This approach required me to be vulnerable by putting my deepest fears and aspirations in a public arena and I found it intimidating labelling myself so openly as an activist within academia. I recorded my thoughts about being vulnerable in research in the following diary entry.

Vulnerability

To be reflexive in research and in life is to be vulnerable.

To acknowledge privilege is to be vulnerable.

To take a pause and not get swept straight into urgency and doom climate narratives is to be vulnerable.

To go against the grain, to critique own assumptions on science, to think of time differently and critique one's own actions and prior involvement with 'solutions'.

To critique your own world views and how that dominates and shapes your vision for the future is to be vulnerable.

To analyse how your actions do not line up with your values is to be vulnerable.

To analyse where your actions failed to take intersectional approaches is to be vulnerable.

To analyse your personal motivations behind your actions is to be vulnerable.

To analyse the motivations behind actions taken by a group you are part of is to be vulnerable.

To analyse when a passion project is using exploitative or harmful methodology or approaches is to be vulnerable.

To ask to stop a project because the method or approach is unethical or harmful is to be vulnerable.

To say things that could be interpreted as career limiting but which are your truth is to be vulnerable.

To acknowledge when you have spoken for groups instead of making space for them to speak their own truths is to be vulnerable.

It can be vulnerable to think these things and it can be even more vulnerable to share these things out loud or in writing.

Sharing your vulnerabilities opens you up to critique from others, but sharing also offers others the chance to learn both from your mistakes and successes.

Leaning into the uncomfortableness that comes from sharing vulnerabilities can be a gift to others. But not an easy gift to share [sic] (PhD diary – 12/06/19).

There are inherent unequal social and knowledge power dynamics (Foucault, 1980; French, 1956; Gaventa & Cornwall, 2008) at play within a supervision/student relationship, with the student having less power overall than the supervisor(s). Numerous studies helped me (Clarke, 2004; Manathunga, 2007; Heller et al., 2011; Berk et al., 2005; Doloriert et al., 2012; Driscoll et al., 2009; Hemer, 2012) explore the influence of the supervision relationships on PhD projects and early career research, each of these studies demonstrating how supervision is a crucial element in completing the PhD successfully. My biggest fear was of doing things wrong and I felt a lot of shame initially when receiving feedback on my work from my supervisors due to not being perfect (Brown, 2006). During the PhD journey I discovered that I have a neurodivergent brain with significant rejection sensitivity, and therefore being open to advice and critique without taking it personally was a challenging and daunting part of the process. Thankfully, I had three dedicated and inspiring supervisors who were very patient with my ways of working which were often outside the norms of traditional PhD processes. For example, once I had identified how my rejection sensitivity was impacting the research process through my ability to take on feedback, my supervisors graciously adapted their styles to not exacerbate those issues, but instead give feedback in a way that was useful for progressing with the thesis writing.

Submitting the PhD, especially one that was so directly personal, took longer because of this fear. But I have now learnt the skills to see feedback as a useful tool rather than a scary critique of self. I looked to the work of Brown (2006), who described her experiences of vulnerability and feelings of fear and shame while working on a grounded theory study on women and shame, and also the discomfort of learning. Brown asserts that even when one experiences failure it is still a form of learning.

My self-doubt and shame during the PhD process was, at least in part, a product of prior six years within a neoliberal university system; one that encourages individualism and competition. The ability of a student to write well places a student into 'good' and 'bad' categories from an early stage (Lea & Street, 1998). Whilst my feelings of vulnerability are lived and experienced and impact on my work, I have to acknowledge my high level of privilege within a system that was designed to benefit people with my ethnicity and socio-economic upbringing (Cole, 2016).

My ability to sit with comfort in this deeply uncomfortable space has increased. I am more okay with my position as a hypocrite – benefiting in many ways from a system I'm both embedded in and that I'm trying to fight against. But it has taken me a long time to reach this place. It was the same with feelings of white guilt after starting to unlearn a whole bunch of internalised racism and colonially centred Te Tiriti o Waitangi (Treaty of Waitangi) thoughts. I'm now in a really good place with that guilt; not to say it's gone away, but I recognise where I'm actually putting more of a burden on individuals or groups by going on about it instead of trying to be a good ally behind the scenes and teach others to be the same.

Our climate law

Our ZCA campaign was an example of citizen-led science interpretation and policy development which has had far ranging impacts on those of us who participated, and also for Aotearoa New Zealand with the introduction of the Climate Change Response (Zero Carbon) Act in 2019 (Zero Carbon Act, 2019), and the following establishment of the Climate Change Commission and other subsequent policies and interconnecting laws. It has so far survived two changes in government to date, initially moving to a majority New Zealand Labour Party (centre left) in 2020, before a switch to the (far) right leaning coalition government of New Zealand National Party, Act Party, and New Zealand First from October 2023. Considering how many other significant environmental laws and policies have been scrapped in the six months since that election, the fact that the Zero Carbon Act climate law is still in place is testament, at least in part, to our main goal for the campaign of having cross-party support for the law. I can only hope that it remains in place for the remainder of their socially, culturally, and environmentally destructive term in government.

Looking to the future

Climate change is more than science, more than the environment. It is also about social justice, about the economy and how our societies function. We can't address the deeper systemic and structural processes that have led to climate change without addressing other injustices, including racism and poverty. People who live in poor communities, or communities of stigma, often provide valuable labour power under capitalism, but the gap between rich and poor people is massively extended. Wealth is concentrated to the ruling class, but also to ruling nations. There are, and will continue to be, significant climate impacts on the working class who have traditionally been paid less, have longer working hours, and worse working conditions. The parts of capitalism that upended our climate and social systems have been highlighted again during Covid-19 pandemic. The way we restructure our social systems, including the economy, after the disruption of the Covid-19 pandemic will shape our emissions reduction pathways for decades to come. Whilst the pandemic has been terrible on multiple accounts, one of the shining lights has been the opportunity for communities to function differently. As a society we were shown that we can't live without essential workers, and this has given space and the spotlight for discussions about how those workers are often treated poorly. Many people are now looking at life differently since the start of the Covid-19 pandemic and this is a key opportunity to embed ways of living that make us more resilient to the many challenges a changing climate will throw at our communities over the coming years and decades.

Final thoughts

My PhD took longer than it should have, not just because of self-doubt, vulnerabilities, and perfectionism, but because of working full-time or part-time throughout, the world-changing Covid-19 pandemic, working in emergency management following the major 2016 Kaikōura earthquake, three years of severe long-Covid, the complexities of a neurodivergent brain, supporting family, a neck injury, coordinating the ZCA campaign, burnout, falling in love, and the many amazing overseas adventures to present my research that I was privileged to receive as part of the PhD process. What a journey it has been to get to this final point.

There were some great highlights during the process, including being recognised in 2020 with a Queen's Service Medal for services to climate change advocacy, as well as a Te Herenga Waka—Victoria University of Wellington Distinguished Alumni award in 2021.

My knowledge and worldview has exponentially expanded through this process. Throughout the journey, my PhD supervisors have been a constant source of academic inspiration and personal courage. From deep theoretical and conceptual discussions, to planning exciting (and slightly farfetched) future research opportunities, I have simply loved my supervision team. Their help editing and learning how to craft academic writing whilst I was working in public service for most of the PhD was critical. The reason I finished this PhD is because of them.

I hope I have a bright future in academia in some capacity. I'm sure I will continue to be passionate about localising climate change and disaster conversations and bringing communities together to face the challenges of the climate crisis head on.

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Please note – if there were more than seven authors for one source, three dots has been used to abbreviate the reference.

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Appendices

Appendix One

The Framework (Figure 10), as described in Chapter 3, is aimed at researchers who want to start a new citizen science project. It is intended to allow disaster researchers to ask questions of themselves, their colleagues, and allow them to analyse if citizen science is a good fit for their intended purpose. It was originally designed to be used to investigate how the development of citizen science projects in the climate change / disaster fields can include more community resilience building practices and it will be used as an anchor point for future research in this area.

Figure 10 – Disaster Citizen Science Project Development Framework

MOTIVATIONS FOR THE PROJECT				
Gathering data, especially large or geographically diverse data sets	Process large data sets	Educate people on a particular issue or topic	Creating science data to change something in a community or environment	
LEVEL OF CITIZEN PARTICIPATION	Crowdsourcing Citizens as sensors (active and/or passive)	Distributed Intelligence Citizens as basic interpreters	Participatory Citizens participate in problem definition and data collection	Extreme Collaborative science, problem definition, data collection and analysis
Contribute: Projects are designed by scientists and citizens contribute data	1	2		

Collaborate: Projects are designed by scientists and citizens contribute data, but may help in project design, analysis or dissemination		3	4	
Co-create: Projects are designed by scientists and citizens working together and at least some of the participants are actively involved through all/most of the scientific process			5	6
(Adapted from Bonney et al. 2009, Shirk et al. 2012, and Haklay 2013; and consistent with concepts in IAP2)				

DISASTER SPECIFIC CONSIDERATIONS				
Predictability of event location	Predictability of event timing	Specific project focus	Frequency of event occurrence	Number of different hazard events
- Predictable - Not predictable / random	- Predictable - Not predictable / spontaneous	- Preparation - Mitigation - Monitoring - Response - Recovery - Adaptation	- Daily - Weekly - Monthly - Yearly - Decadal - Longer	- Singular hazard - Multi-hazard - Cascading hazards

GENERAL PROJECT DESIGN CONSIDERATIONS	
- Ethics	What does success look like for the project?
- Scale	What will the project cost and who is funding it? And for how long?
- Resources / Tools	What resources are needed to run the project? Is the project offline, online or both?
- Cost / Funding	What data is collected and how often? Will you validate the data? What are the quality controls needed?
- Training / Upskilling	Does it need to be scientifically accurate data to be usable/useful? Do you have the citizens needed to cover the geographical range or
- Terminology	data volume of collection or analysis the project requires? If not, what
- Learning	is the plan to recruit more volunteers?
- Participant motivation	Who owns the data collected? Who can access the collected data? Who can use the data? What for?
- Roles	Where and how is the data stored? Who pays for this storage?
- Technology	What skills are needed from citizens to join in?
- Reciprocity / Reward	What makes your project attractive to groups or individuals to take part? Or what incentives do you provide for people to do so? Is the project giving citizens enough assistance and training? What ethical issues may arise from the project? How are you increasing the diversity of the citizens involved?

PROJECT OUTPUTS	
Considerations...	Questions to ask...
- Data quality	Were the results to be of rigorous scientific
- Data quantity	standard?
- Publishing rights	What are your criteria for scientific accuracy or
- Public engagement with findings	legitimacy?
- Access to data	Are you going to publish the findings in
	academic journals? Are you intending to
	acknowledge the participants for their work?
PROJECT OUTCOMES	

Considerations...	Questions to ask...
- Empowerment of citizens - Science for change - Creating knowledge - Activism - Democratising science	Has the project given citizens agency to affect outcomes of issues in their community? Has it drawn attention to a particular issue? What knowledge has the project generated in citizens and has this knowledge then been shared with others?

BEING REFLEXIVE	Throughout the project, consider the following six key issues in each stage...
Inclusive participation	Seeking out diverse participation. Project designed for people of different backgrounds, needs and experiences. Accessible projects.
Developing trust	Designing projects to build trust in science, in fellow participants, in the citizen science process through participation in the project.
Creating partnerships	Build genuine relationships with relevant partners e.g. indigenous nations, government agencies, academics & community groups.
Being context specific	Knowing how the project fits into the socio-cultural context of the area involved. Using locally specific/relevant language & content.
Monitoring power dynamics	Being actively conscious of your power as a paid researcher when engaging with unpaid volunteers. Creating realistic expectations. Monitoring racial, gender, age, language and ability biases you and others bring to the project.
Valuing different types of knowledge	Accepting local and indigenous forms of knowledge and knowledge generation & sharing practices are legitimate. Consider giving them value within the project where appropriate. But also monitor possible cultural appropriation.



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STATEMENT OF CONTRIBUTION DOCTORATE WITH PUBLICATIONS/MANUSCRIPTS

We, the candidate and the candidate's Primary Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of candidate:	Lisa McLaren
Name/title of Primary Supervisor:	David Johnston
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Please select one of the following three options: ☐ The manuscript/published work is published or in press - Please provide the full reference of the Research Output: ☒ The manuscript is currently under review for publication – please indicate: - The name of the journal: Progress in Disaster Science - The percentage of the manuscript/published work that was contributed by the candidate: 95.00 - Describe the contribution that the candidate has made to the manuscript/published work: Literature review/data collection, data analysis, discussion, writing of paper. ☐ It is intended that the manuscript will be published, but it has not yet been submitted to a journal	
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