Article

Informing Future Land Systems Using Self-Reported Pathways and Barriers to Connections to Nature: A Case Study in Auckland, New Zealand

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Abstract: Empirical research exploring what increases an individual's connection to nature is growing, however research seeking respondents to self-report what they feel acts as a barrier or pathway to their connection to nature is scarce. Previous empirical literature suggests a link between connections to nature and pro-nature actions. Therefore, understanding what acts as a barrier or pathway to people's connection to nature can provide insight as to what may promote, or hinder, pro-nature actions. From a land systems perspective, the research is crucial, given that human disconnection from nature is argued to be the reason behind large scale ecological crises and species extinction which threaten the land systems in which we live. Consequently, a cross-sectional qualitative study was undertaken in 2019 with 976 respondents from Auckland, New Zealand to explore self-reported perceptions of what acts as a barrier or pathway towards their connections to nature. The findings suggest that respondents perceive modern society modalities such as 'life takes over', 'urban life', etc., as being barriers to their connections to nature. Being exposed to nature, was perceived as a pathway to prompting, and/or sustaining their connections to nature. These learnings highlight the benefit of exploring the perceived influences on connections to nature and the findings can be applied to improve the human–nature connection and therefore potentially increase pro-nature actions. We also use the findings to provide practical actions for environmental managers in the Auckland region by advising as to how the human–nature connection can be supported through future urban planning and better designed urban land systems.

Keywords: human–nature connection; pathways to connection to nature; barriers to connection to nature; biophilia; human–nature relationship; future land systems

1. Introduction

Since the beginning of the Anthropocene, the attitudes and behavioural actions that humans exhibit both individually and collectively can be attributed to being one of the primary causes behind the degradation of the natural world [1]. This is particularly concerning as the planetary boundary associated with land system change is in a zone of uncertainty and faces increasing risk [2]. Given that the goals of environmental management are to understand the complex socio-ecological mechanisms that lead to environmental degradation and to work to halt and reverse the deterioration of the natural world, it is beneficial to understand the key drivers behind these attitudes and actions if we are to create more sustainable land systems in the future.

A key concept in socio-ecological theory is the consideration of the complex human–nature connection to leverage sustainability changes [3,4]. Specifically, over the past century, the relationship that humans have with nature has changed due to varying political and economic paradigms (e.g., the rise of capitalism and the resulting industrial revolution) [5].

Through this technological and modern development, the intricate relationship with nature that humans had is no longer there, and many humans no longer immediately rely on land systems for sustenance [6,7]. This undoubtedly has had an impact on humans' connection to nature [8] and therefore may be influencing the way in which nature is treated, specifically since the socio-ecological empirical literature has strongly suggested a link between feelings of connection with nature and pro-nature actions [9]. Therefore, it is useful to further understand what is perceived by individuals to either prompt and/or sustain their feelings of connection with nature (a pathway) or what is perceived as a barrier [1]. By deepening these understandings, we increase the knowledge of the dynamic human–nature relationship in socio-ecological theory and practitioners/researchers can work toward designing interventions to enhance human–nature connections and thus increase people's likelihood to engage in pro-nature actions [4,10–12]. This will have a positive impact on future land systems, as shifting individuals to engage in more respectful actions toward nature will result in healthy and functioning environments, which in turn, play an important role in sustaining the health of the global population.

Exploring the dimensions and factors of the human–nature connection is not new in empirical research, which spans across numerous socio-ecological disciplines such as psychology, sociology, or geography [4]. Tools used to measure feelings of connection with nature are predominantly scales that have been developed from the psychological discipline, such as the nature relatedness scale [13], the connectedness to nature scale [14], the inclusion of nature in self scale [15], and the emotional affinity toward nature scale [16].

Given the link between the increased feelings of connection with nature and pro-nature actions [9] and improved health and wellbeing [17–19], research seeking to understand what activities (pathways) can increase feelings of connection to nature to achieve environmental sustainability and health and wellbeing outcomes has significantly increased. Most commonly, this is achieved by deliberately engaging respondents in certain interventions, such as conservation education programmes, exposing them to natural environments/scenes, and then testing whether their feelings of connection to nature changes, and if so, to what degree [14,16,20–23]. However, on the contrary, empirical research seeking to understand what decreases/hinders people's connection to nature (acts as a barrier) to people's feeling of connection to nature is scarce. Despite this, scholars have long speculated that the increase in urbanisation and modern ways of living has acted as a barrier to people's feelings of connection to nature [24–28].

Research specifically seeking to explore self-reported perceptions of what either acts as a pathway or barrier to a person's connection to nature is scarce. This gap in research has been highlighted by authors such as Lumber, et al., [10]; Ives, et al., [4]; Richardson et al., [11]; Salazar, Monroe, Jordan, Ardoin and Beery [12] and thus all call for greater emphasis to understand these notions to increase knowledge of the dynamics and complexity of human–nature connections to advance socio-ecological theory. The current gap in research could be considered problematic, as there may be pathways or barriers that are perceived by people, of which researchers are not aware and thus mean that opportunities for potential interventions to improve the human–nature connection and subsequent pro-nature actions or health and wellbeing benefits are missed. For example, Lumber, et al., [10] call attention to the fact that connections to nature are extremely subjective and are formed through numerous experiences, thus making the development of specific pathways which increase/prompt/sustain connections to nature difficult. Therefore, there is significant merit in undertaking empirical research which allows for respondents to self-report their subjective thoughts, feelings, and beliefs relating to what are perceived as being pathways or barriers to their connection to nature.

Consequently, the key focuses of the study outlined in this paper are to firstly, address the gap in the empirical literature from an environmental management perspective, secondly, to advance the socio-ecological theory by providing insights from a case study exploring these notions, and thirdly, to propose recommendations for future environmental management initiatives spanning across practice and planning, with particular emphasis

on the study location—Auckland, New Zealand. The study is relevant in the Auckland context, as understanding the complex and dynamic human–nature connections, are urgent in this region as the natural environment continues to face challenges due to the continuing population growth [29]. We used a sample group of 976 respondents from the Auckland population to provide this important, albeit partial, empirical insight into the self-reported perceived influences on personal connections to nature with specific focus on what are perceived as pathways or barriers to 'connections to nature'.

2. Materials and Methods

2.1. Ethics

This research followed the Massey University human ethics guidelines and procedures and was granted ethics approval before the online survey was circulated and before any interviews took place (Ethics Approval Number: 4000020091). The ethics was considered 'low-risk' as it involved human participants over the age of 16 years, did not target vulnerable groups [2], and did not include questions that were likely to cause irrational behaviours or reactions.

2.2. Study Location

Auckland is a city on the North Island of New Zealand. New Zealand is considered a developed country [30], and has an estimated population of 5.1 million people with an ongoing population growth estimated to be 1.0% every year until 2048, predominantly from the increase in net migration [31]. New Zealand's human history is considered short, as it was one of the last inhabited landmasses in the world [32]. The Polynesian settlers who came to be called Māori were believed to be the first settlers to the country. They settled in New Zealand somewhere between the 10th to 14th centuries [32]. In the early 1640s, the first European to arrive to New Zealand was the Dutch explorer Abel Tasman, and just over a century later, in 1769, the English navigator James Cook mapped the country's coast [32]. Major colonization took place in the 1840s after the signing of the Treaty of Waitangi [3], resulting in a strong European influence and set of customs that largely reflect those of the European settlers who emigrated to the country, which is further evident in contemporary times [33].

The country's tangata whenua (original people of the land) are Māori. Foundational colonization took place in the mid-late 19th century, and this has resulted in a strong European (particularly British) influence in the country since then [33].

The Auckland region contains the largest urban area of the country and is home to a population of approximately 1.6 million people. This accounts for 33.0% of New Zealand's population [31]. The rate of the population growth in Auckland is increasing rapidly and is driven by international and domestic migration and urbanization. A projected 70.0% of all further development in the region is expected to occur in the urban municipality of Auckland over the next 50 years [29]. This future development puts increasing pressure on the local natural environment as the region is already facing significant pressures from the population's activities and actions [34]. For example, Auckland covers 2.0% of the country's landmass and is home to an array of flora and fauna which are unique to New Zealand [34], however a fifth are considered threatened [34]. Auckland also used to be almost entirely covered by indigenous forest, but presently only 30.0% of this forest remains due to development and land clearance [34,35]. There has been an ongoing loss of terrestrial native flora due to pests, urban expansion, and development [35]. The Waitakere Ranges, which are home to a kauri (*Agathis australis*) forest—one of the most ancient forests in the world—now represents the most heavily infected area of kauri dieback disease (*Phytophthora agathidicida*) (spread by humans), currently recorded in Aotearoa, New Zealand [36].

Furthermore, Auckland has significantly degraded rivers and streams with most of them being in 'fair' or 'poor' condition [34] and the region has one of the highest rates of wetland loss in New Zealand [37]. Lastly, Auckland's marine environments are also subject to significant pressure due to on-land activities such as coastal development,

resulting in increased sedimentation, increase in pests threatening seabird populations, degraded stormwater infrastructure, agricultural practices, and over-harvesting of marine species [38]. Auckland is culturally diverse but 53.5% of the population identify as NZ European/Pākehā [4], the next highest ethnicity is Asian at 28.2%, followed by 15.5% Pacific peoples, and 11.5% Māori [31].

2.3. Design and Procedure

The study took place in late 2019. Online surveys and interviews were undertaken to explore the self-reported perceptions of what are considered pathways or barriers to connections to nature. As a first step, the online survey was employed and thereafter interviews were conducted. To recruit respondents for the online survey, the advertising feature in Facebook was utilized to target individuals residing in the Auckland region who were over the age of 16. Using the Facebook advertising feature, an invitation to partake in the research appeared on individuals' Facebook news feeds at random. Invitations to Facebook community groups were circulated through an anonymous account. The advertisement was revised several times to ensure it did not just target 'pro-nature' people. However, we acknowledge that it is difficult to avoid the fact that people who are more engaged with nature would have been more likely to partake in the survey and therefore there may be a level of sampling bias toward this group of people. To avoid this, the advertisement tried to attract people by asking them to "have your say on nature-related topics".

The opportunity to take part in a draw to win a NZD 50.00 shopping voucher was offered to maximize the response rate. The study was also promoted by advertisement posters being placed strategically in public areas and through a mail drop of promotional material to approximately 1000 dwellings with the specific focus on areas of Auckland which had a low internet uptake. Respondents were also able to request a physical copy of the survey with a free postage return envelope in the situation that they did not have internet access. The online survey was hosted by Qualtrics^{TM} and the respondents were first asked to read and agree with the respondent information sheet. As this study was part of a larger research project, the survey contained 37 questions, of which four were related to this study (as well as demographic questions).

Further individual interviews were conducted after the online survey. These interviews had the same questions as the online survey but were carried out to ensure that the responses received through the online survey were representative of any person selected at random, and to compensate for the potential sampling bias from the heavy online input to produce data which is as robust as possible [39]. Potential respondents for these interviews were approached in public places, e.g., beaches, parks, and markets in the Auckland area. Interviews were conducted on the spot and lasted approximately 20-min. When initially approaching potential participants, a conscious effort was made to approach only people who looked over the age of 16 years due to human ethics requirements that prevent the questioning of minors. Once they agreed to participate in the research, participants were asked their age to further ensure that they were over 16 years of age. Respondents were also asked if they lived in Auckland prior to commencing the interview as the aim was to sample residents only.

These interviews were supplemented further by in-depth, longer interviews. Participants for these interviews were sought via a Facebook advertising post and were given a NZD 20.00 cash voucher for their time. The interviews lasted approximately one hour. The aim of these interviews was to ensure that even if a participant was interviewed in their own time in their own home (the interviews were conducted over Skype or telephone) and given as much time as required to respond and to discuss their perspectives, no other dominating themes would emerge, based on this different context. Therefore, these interviews were not conducted to draw new conclusions, but to ensure the data was as robust as possible.

All interviews were recorded and transcribed by the lead researcher. The informed consent by respondents was provided by reading and agreeing to the participant information sheet and consent form (online survey), or by signing the consent form (interviews).

2.4. Respondents

In total, 976 respondents took part in the study via the online survey ($n = 942$), structured interviews ($n = 30$), and semi-structured interviews ($n = 4$). The respondents either took part in the online survey or interviews, not both. This sample of 976 respondents would be big enough to reject a hypothesis of zero correlation with a *p*-value of <0.05 significance level with a power of 90.0 percent, provided the true correlation between variables was at least 0.11, had this study been a random sample from the Auckland region. As this study was a convenience sample of volunteers versus random, it is important to acknowledge that this is an exploratory study only.

Respondents represented a range of ethnicities, age groups, and genders. Some ethnicities were over-represented (e.g., NZ European/Pākehā by 27.9%, Māori by 1.5%), and others were under-represented (e.g., Pacific Peoples by 9.5%, Asian by 18.7%, MELAA by 0.3%), compared to the regional ethnicity split [31]. The gender split of respondents was 47.7% male, 51.2% female, and 0.5% non-binary, which is closely representative of the gender makeup of the region [31]. During the live Facebook advertisement of the online survey, the targeting had to change to male only as we initially had a dominating response from females. This may be due to the fact that females are more likely to engage in surveys. Research within the health discipline similarly notes a higher ratio of females to males who respond to surveys [40–43]. Furthermore, it is documented that females tend to report a greater concern for nature related issues [44,45], so it makes sense that this could result in a higher tendency to provide input into nature related research. Females have also been reported to use social media more than males, and are slightly more likely to click on Facebook advertising [46].

The age of the respondents ranged from the youngest cohort being 16–20 and the oldest cohort being 81–90. The most common age group who engaged in the research were those between 21–30 (25.8%), followed by those in the age group 31–40 (19.3%), the age group 41–50 (15.6%), the age group 51–60 (15.2%), the age group 16–20 (12.9%), the age group 61–70 (7.3%), the age group 71–80 (2.6%), and lastly, the age group 81–90 (0.4%). Three people preferred not to disclose their age group (0.3%). Five respondents have no data associated with them as the four semi-structured interviews were not asked for their age group, and one person who engaged with the online survey provided no response. Age groups were not reflective of the Auckland [31] age demographic.

Given the high response rate to this research by those who engaged in an online capacity and undertook the QualtricsTM based survey, a limitation that should be noted is that there is a level of response bias towards individuals who have access to the internet and actively engage in social media. Furthermore, we acknowledge that this study omitted those under the age of 16 and therefore the findings only reflect the views of adults. Furthermore, those considered vulnerable were excluded and therefore there is also a response bias to those outside of this group.

2.5. Self-Report Measures

In the online survey and interviews, respondents were asked to select 'yes', 'no', 'sometimes', as to whether they felt they had a connection to nature. To identify the perceived pathways or barriers to 'connections to nature', the respondents were asked to describe why (respondents who selected 'yes' ($n = 659$)), or why not (respondents who selected 'no' ($n = 24$)), or why only sometimes (respondents who selected 'sometimes' ($n = 212$)), they had the connection to nature described. The respondents who said they were 'unsure' ($n = 81$) were given the opportunity to add comments. The respondents were given a free-text box to write their answer or were given as much time as needed to

respond in the interviews. The survey reiterated several times that there was no right or wrong answer and was seeking the respondents' subjective thoughts, beliefs, and feelings.

This study was part of a broader research project (see Fehnker, Pearson and Howland [47–49]). The questions asked to respondents of which the responses are analysed as part of this article, were asked half-way through the online survey/interview. Prior to these questions, the respondents were asked to discuss what 'nature' and a 'connection to nature' meant to them. Therefore, respondents were able to answer according to their own understanding of these terms. Briefly, the conceptualisations we identified in these studies were firstly, that 'nature' is considered something separate from humans/human activities, consisting mainly of flora and fauna, and secondly, that connections to nature were enacted by respondents mainly in cognitive, affinitive, and experiential ways. We acknowledge that it would be an interesting avenue to examine the responses of this study in the context of these other findings. However this was outside of the scope of this paper.

2.6. Data Analysis

The responses to the online survey and the transcribed responses to the interviews were exported to Microsoft Excel. To perform the data analysis, the processes of the content analysis was employed [50], which is a technique which has become prevalent within the field of environmental management [51]. Content analysis allows for research to generate tangible outcomes to develop management actions [52]. This is achieved through the analysis of qualitative data and transformed into quantitative data [51], by following a coding process to generate categories, with the aim of 'describing the meaning' of the data, in order to generate theoretical relationships [53,54]. Coding was subsequently reviewed by an independent colleague. Any discrepancies were addressed through mutual agreement. The categories were then grouped into overarching themes (Figures 1 and 2).
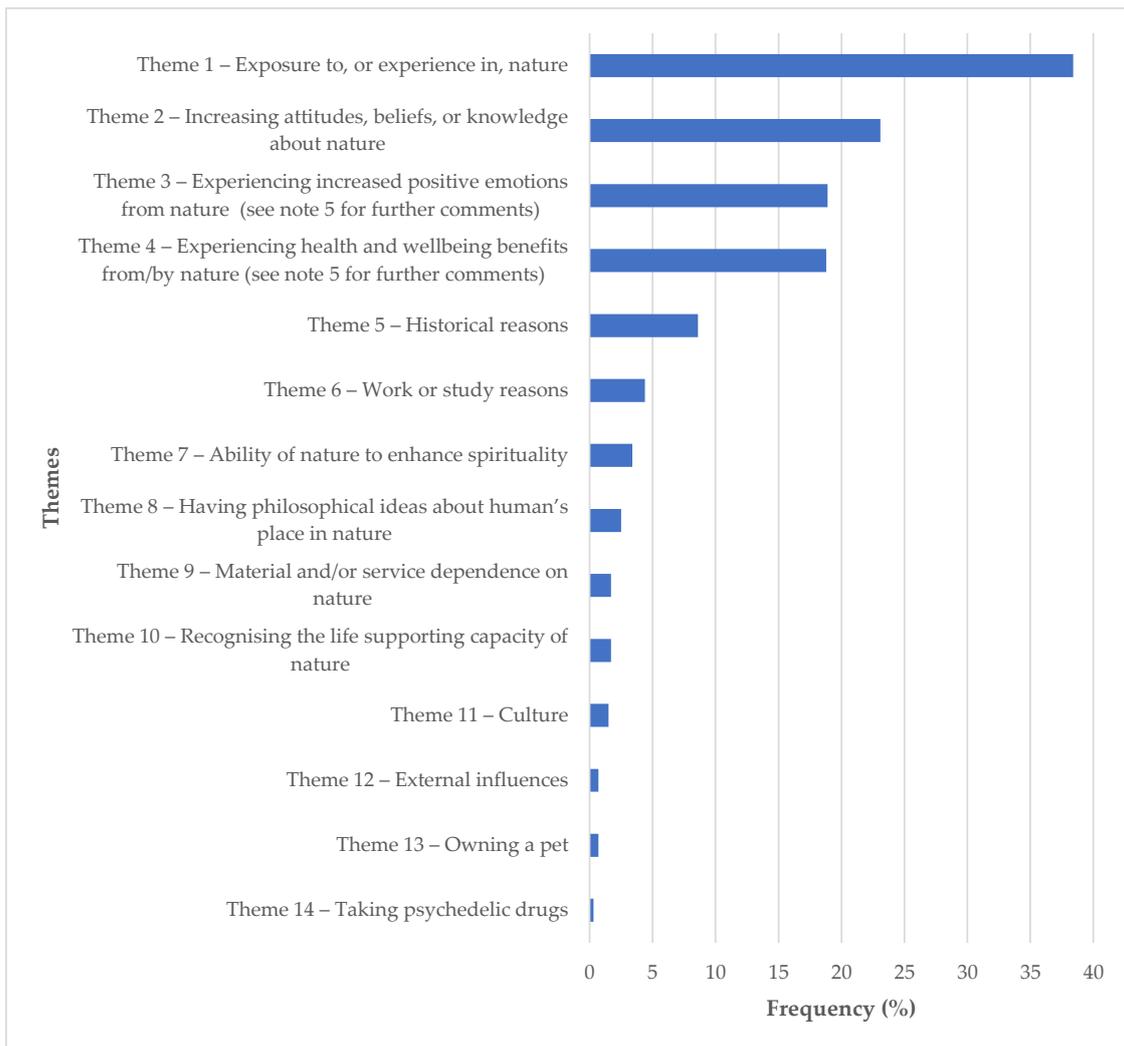
Figure 1. Perceived pathways to the connections to nature.
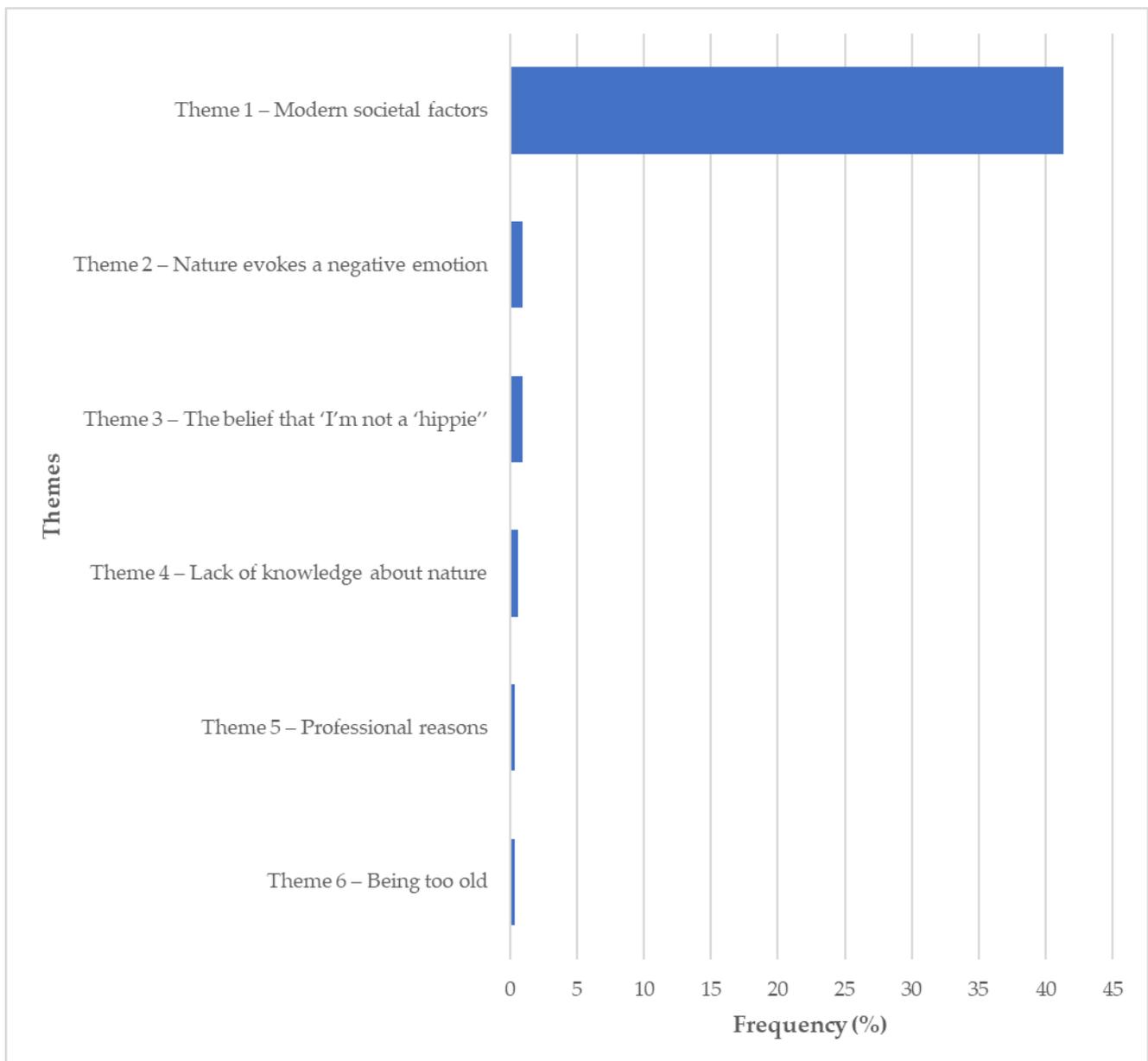
Figure 2. Perceived barriers to the connections to nature.

3. Results

The results of the content analysis are outlined in both Figures 1 and 2. Due to the subjectivity of the coding, it is impossible to identify all potential codes within a set of open-ended responses. Accordingly, the most effective representation of themes within such a set of responses, is to establish the percentage of respondents that referenced each theme. This is opposed to any attempt to calculate the percentages of the overall comments (which would require an objective and absolute measurement of all comments). For example, the frequencies (%) on both Figures 1 and 2 were calculated based on the number of respondents who selected either 'yes', 'no', 'sometimes', or 'unsure' and provided comments. Therefore, for Figure 2, a total of 952 respondents selected either 'yes', 'sometimes', or 'unsure' and provided comments on the factors that are perceived pathways to their connection to nature, and in Figure 2, a total of 317 respondents selected 'no', 'sometimes', or 'unsure' and provided comments on factors that are perceived to be barriers to their connections to nature. Themes were not mutually exclusive, as some responses referenced multiple

categories. For example, if a respondent who discussed that being outside in nature prompts their connection to nature and that the positive emotions nature evokes for them in that setting, also increases their connection to nature, their response would be included in both Theme one and Theme three in Figure 1.

Firstly, our findings suggest that there are 14 perceived pathways to connections to nature (Figure 1). The most common pathway reported by respondents was the exposure to nature or being outdoors (38.4%). This was followed by the perception that cognitive influences likewise prompted and/or sustained the personal connections to nature (23.1%). This included (pro-environmental) beliefs, knowledge (e.g., having knowledge about aspects of nature such as flora/fauna, or weather systems, etc.), or attitudes (e.g., pro-environmental attitudes). Next, the respondents reported that positive affections, such as nature engendering positive emotional states, prompted and/or sustained the personal connections to nature (18.9%). Lastly, the respondents reported that health and wellbeing benefits arising from interacting with nature prompted and/or sustained the personal connections to nature (18.8%). Lesser themes reported were historical reasons (e.g., how they were raised, where they grew up), work/study reasons (e.g., they work/study in an environmental related field), philosophical ideas about humans' place in nature (e.g., evolutionary instincts), enhancement of spirituality, life supporting (e.g., nature supports human life), material/service dependence (e.g., dependence on services such as air, food, etc.), culture (e.g., part of the respondent's culture is to be connected to nature), influence of other sources (e.g., how other members in society connect with nature), owning a pet, and psychedelic drug use.

Secondly, our findings suggest four perceived barriers to connections to nature (Figure 2). Most commonly the respondents reported modern societal factors as being a dominant barrier to their personal connections to nature (41.3%). The term 'modern societal factors' is used to describe notions that respondents' referred to as 'modern demands', 'time pressures', 'residence constraints', 'modern lifestyle pressures', 'urban life', or 'life takes over'.

Five smaller perceived barriers were identified by less than 1.0% of respondents, respectively, including the perception that the respondents were not 'hippies', age (e.g., not young enough), that nature evokes a negative emotion, professional reasons, or that a lack of knowledge about nature, act as barriers to connect with it.

Aside from the reported pathways or barriers discussed above, an interesting finding emerged that a cohort of respondents indicated that their connections to nature were unstable. For example, that a connection to nature can change based on context or time (8.3% of all respondents who engaged in the study).

4. Discussion

Our findings provide important understandings about the human–nature relationship within the current Anthropocene epoch—a time whereby humans are having a significant impact on the planet's climate and ecosystems [55]. The findings provide further context to those attempting to identify the current/status quo 'worldview' with regards to how humans interact with nature and what factors influence these interactions, such as authors Daigle and Vasseur [56]. Our findings also contribute to socio-ecological theory, by providing insight into the complex factors of the human–nature connection/relationship. As the human–nature connection is considered an important leverage point for the global sustainability transformation in socio-ecological theory [3,4], our findings can go some way in supporting global efforts to sustain and foster connections to nature.

In terms of understanding what are perceived as pathways to connections to nature, the findings identified 14 variables and/or factors as reported by the respondents but four of these were more dominant and these were related to experiences. The study also identified six perceived barriers to connections to nature as reported by the respondents but here, there was one significant dominant grouping that was related to modern societal factors. These insights can be used to support interventions that environmental managers

could design and implement to strengthen people's connections to nature and that urban planners factor into their plans and designs of urban land systems, thus engendering greater pro-nature actions across the population.

The fact that our study suggests that modern societal factors are the most perceived barriers to connections to nature provides a valuable insight into the impact of 21st century living and people's relationships with nature. It also provides evidence to substantiate theoretical discussions by scholars, such as Orr [24]; Shepard [25]; Metzner [26]; Pyle [27]; Roszak, et al. [28], who discuss the implications of modern societal factors on individuals' connections to nature, as stemming from the rise in consumerism, technology, globalisation, and the quickening pace of life.

Within this theme, the respondents gave indeterminate responses regarding their perceived barriers to their connection to nature and referred to (including, but not limited to) 'modern demands', 'time pressures', 'residence constraints', 'modern lifestyle pressures', 'urban life', or 'life takes over'. Although we can only speculate what is meant by these terms, the idea of general 'modern living' and how this may act as a barrier to a personal connection to nature has been theorised in the cross-disciplinary literature, previously. For example, Keniger, Gaston, Irvine and Fuller [6] discuss how throughout pre-industrial/pre-capitalist history, humans immediately relied on, and thus had to directly engage with, non-human nature phenomena for their sustenance. This reliance and constant engagement generated and sustained a range of intimate and constant connections with nature. However, modern society has effectively freed, or distanced, many communities and individuals from such direct nature experiences premised on this reliance and therefore fundamentally shifted the way in which people connect with nature. From consistently working, being in, and thus directly engaging and consuming perceived natural phenomena, many are now only seeking nature interactions episodically and for recreational purposes. The contemporary rise of technology and its capabilities, consumerism, overpopulation, economic hardship, and compulsions to live and work in highly urbanised environments, have generally resulted in diminished perceived connections with nature in the developed world [27]. Through this development both technologically and culturally, historical ways of living, such as living off the land and relying on locally produced goods, have especially become effectively redundant for most people in developed nations [7]. These technological and cultural developments that we now see in the modern society has undoubtedly provided a basis for economic development. However, it is argued that this technological and cultural development has pushed away these historical ways of living, removing us from our intricate connection with nature [7].

Considering the findings in an Auckland, New Zealand context, the country ranks highly across several wellbeing indicators on the OECD Better Life Index. However, the indicator associated with work–life balance scored below average, for example, out of all 40 OECD countries, New Zealand ranks 29th [57]. Furthermore, the population of New Zealand has been shown to work longer hours on average, per capita, compared to other OECD countries, for example, 15.0% of the population works over 50 h per week, compared to the average of 11.0% [57]. Stress associated with work–life is also thought to be further increasing as measured through anxiety levels amongst employees, as part of the annual Workplace Wellness report by Business NZ [58]. It is not surprising that our study's findings reflected that a high number of respondents felt that specific modern societal modalities such as 'life takes over', act as barriers to their 'connections to nature'. Moreover, given the recent speed and intensity of the urbanization of the Auckland region [34]), it is not surprising that the respondents feel that 'urban life' or 'residence constraints' (e.g., living too far away from nature), contribute to reducing their connection to nature and this is likely to increase given the future development trends. For example, over the next 30 years, it is expected that 40.0% of future development will occur outside the current urban boundary, meaning that around 15,000 hectares of rural land will be converted to urban land [29]. Furthermore, in response to the national Policy Statement on Urban Development, developed by central government to address the housing crisis in New

Zealand [59], Auckland Council will be allowing greater intensification of housing in the urban area.

On the positive side the findings suggest that exposure to nature is a key pathway to connections to nature. Since our findings indicate that individuals similarly recognize and observe that interacting with nature increases their connection to nature, our results compliment global research which has shown that exposure to nature increases an individual's connection to nature through planned interventions, such as deliberately engaging respondents in activities outdoors (e.g., Mayer, et al. [14]; Rosa, Profice and Collado [60]; Nisbet, et al. [61]; Fretwell and Greig [23]). This highlights the importance of ensuring accessibility to nature for people as a pathway to prompt, increase, or sustain their connections to nature and therefore potentially to help engender their pro-nature actions. The importance of exposure to nature is recognised by the United Nations, whose report Harmony with Nature [62] discusses the influence that physical distance from nature, through situations, such as urbanisation, can have on an individual's overall connection to nature, due to the lack of exposure to it. In a local context, the finding is worrying as Auckland is considered to have the largest urban area in New Zealand with a further 40.0% of all future development occurring outside the existing urban boundaries, resulting in urban expansion as the main trend for the region over the next 50 years [29]). Alongside this, Khajehzadeh and Vale [63], who explored time use in various settings, found that the population of New Zealand spend slightly more time at home indoors than other the countries studied, spending 68.9% of the day indoors (compared to the average of 64.9%). Thus, there are potential implications for future environmental sustainability as ongoing urbanization of the Auckland isthmus area will continuously result in fewer opportunities for people to spend time in, or be exposed to, nature, thereby potentially implicating their connections to nature. The result indicates that, based on the strongly suggested link between connections to nature and pro-nature actions [9], there may be a decrease in the population engaging in pro-nature actions.

The second pathway reported by the respondents was the cognitive aspects (including having an increased knowledge about nature, beliefs about nature, and attitudes toward nature), which is consistent with a study by Liefländer, et al. [22]. In this study, they investigated how specific environmental education can increase experiences and perceptions of connectedness across a range of age cohorts and found that increased levels of knowledge increased feelings of personal connections to nature. This could mean that increasing general environmental education amongst the lay population, either through government agencies or organisations, could further support personal connections to nature.

The third pathway reported by respondents was the increased positive emotions derived from nature (either physically, or in other ways e.g., watching nature on TV). This finding is consistent with the range of literature that highlights that feeling happy results in connections to nature (and similarly, visa-versa) (for a full review, see Capaldi, et al., [7]). This was closely followed by the cohort of respondents who discussed the health and wellbeing benefits experienced when connecting to nature, as what prompts and sustains their personal connections to nature. Despite the extensive literature theoretically and empirically exploring the pathway of connections to nature and the subsequent health and wellbeing benefits (for a recent meta-analysis, see Twohig-Bennett and Jones [64]), there is little research that has explored the pathway of health and wellbeing benefits derived from nature connections, subsequently prompting and sustaining personal connections to nature. Despite this, these two findings elaborate the benefit of environmental management practitioners, health practitioners, and/or psychologists working closely together. The findings may suggest that supporting individuals' personal connections to nature has benefits for both disciplines.

Considering the key findings from our study that the most reported pathway to connections to nature is exposure to/experience in nature, but that a key barrier is modern societal factors, the interest lies in facilitating deliberate active close contact with nature in a range of contexts, so that people are exposed to nature as much as possible even

when pre-occupied with aspects of modern society living, such as living in urban areas, limited time for recreation, consistent interaction with technology, etc. Environmental managers could therefore work alongside other disciplines, such as recreation, outdoor education, etc., to design programmes, such as outdoor workshops or retreat activities, ecotourism, environmental festivals, or community gardening. Other common practices which have been empirically shown to increase feelings of connection to nature, include forest bathing, which has become popular in Japan [65] urban foraging [66], or ecological restoration projects [21]. On a practical level this would be easily achievable and would require limited resourcing. For example, active participation in activities such as these could be prompted through Auckland Council and environmental organisations maintaining a community calendar of annual events and working alongside businesses to commit to including activities such as these within work hours for employees. Further, environmental managers in the region could undertake further research as to which activities are the most effective at prompting connections to nature and work with Auckland Council, environmental organisations, and businesses to implement such activities.

To ensure that access to nature is possible in indirect ways which do not require much time and effort from people, given that this was considered a major barrier, the design of future urban land systems is important. Adding natural features and settings in urban areas, such as plants and animals, would ensure that there are consistent opportunities to experience nature regardless of the location or context. Currently, in our study area, Auckland Council, the regional authority, has developed two key strategies to ensure access to nature in urban areas. One strategy is the Urban Ngahere (forest) Strategy [35], which was developed to ensure that alongside growth and development in the region, there remains a clear framework for the management of Auckland's forest and to increase the total forest area. The other strategy is the City Centre Masterplan [67], which is aimed at creating a network of open and green spaces in the city centre. This deliberate design of nature-connecting habitats has been recognised as being a core strategy to combat disconnection from nature, generated through the extinction of outdoor and nature-based experiences that tend to dominate urban dwellers [68]. This proactive approach from Auckland Council is a positive step towards prompting individuals to spend time in nature. Furthermore, integrating biophilic design principles (e.g., integrating nature into buildings both directly and indirectly) into the remaining urban architecture alongside open spaces could further help people connect with nature [69]. This further ensures that people do not necessarily have to leave the urban environment to connect with nature.

There are also multiple opportunities for planning processes within the urban land systems to acknowledge the importance of retaining easy access to nature to prompt and sustain people's connections to nature. This could result in a greater emphasis on retaining open spaces and nature areas within the urban environment for the increased accessibility to nature for the population. It is important to acknowledge that research from the planning discipline in New Zealand, has placed much emphasis on understanding how different age groups interact with/access nature Therefore, to consider the findings from this research on the benefits of exposure to nature for connections, in the context of the specific findings that have emerged from other researchers (e.g., Freeman, Stein, Hand and Van Heezik [70], Freeman, Waters, Buttery and Van Heezik [71] Freeman, Buttery and Van Heezik [72], would be recommended when applying the findings to a planning context. Similarly, the findings should be considered alongside international work by Colding, et al. [73], who provided both theoretical and practical recommendations as to how children's connections to nature can be supported through urban design in cities, and the work by Parker and Simpson [74], who propose the use of green infrastructure specifically, to facilitate the human–nature connection to also strengthen the urban resilience to natural hazards. Overall, we posit that by ensuring that access to nature is everywhere, this could help to offset the perceived barrier of modern societal factors on connections to nature.

The findings from this study also complement the findings from Richardson, et al. [11], who propose a pathway to nature connectedness approach. Specifically, they propose a framework to encompass the varying ways that people connect with nature (as identified in their earlier study, Lumber, Richardson, Sheffield [10]) and translate them into interventions that can be adopted to improve the human–nature relationship. Our findings firstly confirm that contact and experience with/in nature is an important pathway to connectedness and thus support their proposed intervention to increase the opportunities for people to interact with nature through measures such as landscape design. Our findings also complement their work by providing insight into the potential barriers that people may face to connect with nature that would need to be considered when applying interventions to facilitate connections to nature. For example, how to increase contact and experience with/in nature if modern societal factors are perceived as a key barrier.

Another important acknowledgement are the traditional values of the country's original inhabitants (Māori), in the context of our study location. Māori values were, (and still are), embedded in the concept of kaitiakitanga (guardianship) of 'nature'. The significance of looking after and respecting 'nature', was rooted in substantial religious philosophy, which was embedded in the view by Māori, that they are interconnected with 'nature' [75,76]. Māori therefore strongly emphasize that the health of 'nature' is directly linked to their own spiritual and cultural well-being [77]. This is underpinned by the concept of mauri, a life force which connects all living and non-living things [78,79]. Similar to some eastern cultures, there is no single word for 'ecosystem' in te reo Māori (Māori language). Instead, terms such as whakapapa (ancestral lineage) are used to understand the perspective of what an ecosystem is. From a Māori perspective, the universe is a series of genealogical webs that go back generations [79]. For Māori, humans are descendants from the ātua (Gods), specifically Papatūānuku (Earth Mother) and Rangi-Awatea (Sky Father) [80,81]. This concept of whakapapa between Māori and Papatūānuku and Rangi-Awatea connects Māori with all flora, fauna, and natural resources through these recognised and highly valued genealogical bonds [79]. This interconnected view was evidenced in the ways in which historical Māori chiefs would practice the custom of taunaha whenua, where land would be claimed and named after a part of the body [80], and how the term whenua (land) also means 'placenta', signifying this interconnected and vital relationship through which humans are born from Papatūānuki [79]. Although our study did not analyse the responses according to ethnicity (or other demographic variables), it is important to acknowledge these important world views that can impact on people's perceptions. This provides context when implementing the recommendations or findings from our study. Tor example, it is suggested that planners actively recognise and respond to important socio-cultural aspects of connections to nature that could be capitalised upon for better environmental outcomes.

Lastly, an interesting finding which emerged from this research is that 8.3% of respondents perceive their connection to nature as being unstable and that it can change depending on the context (e.g., what activities they are currently engaging in, whether they are outdoors, whether they are in Auckland or not, etc.). This is consistent with research by Nisbet, et al. [13], who through their development and testing of the nature relatedness scale, which assesses the affective, cognitive, and experiential aspects of people's connection to nature, concluded that nature connections are not completely fixed. Thus, this finding further highlights that those self-reported influences on connections to nature can be extremely subjective and requires further research such as that undertaken in this study.

Given the ability for connections to nature to change, it is also important to acknowledge that the study was undertaken prior to the COVID19 pandemic, and the restrictions associated with COVID19 have changed the way in which people interact with nature [82]. For example, Soga, et al. [82] summarize findings from other empirical studies which have all suggested that exposure to nature (e.g., forests and/or greenery) were increased during the COVID19 restrictions across Norway and Germany (e.g., Venter, et al. [83]). This was also found in Wuhan, China [84] and in Washington, United States of America (with further

identified differences across ethnicities) [85]. MacKinnon, et al. [86] found that greenspace visits increased during the COVID19 lockdowns in Wellington, New Zealand, with the reported reasons from their respondents being that it enhanced their mental wellbeing. In the study location, most of the population was forced to work from home, for all six months of restrictions, collectively. This may have resulted in people having more time to spend outside in nature and thus may have increased their feelings of connection to nature and decreased the view that 'modern societal modalities' are a barrier to their connections. Thus, it would be interesting and recommended to reproduce this study post-COVID19 to explore whether restrictions have influenced or changed the common perspectives recorded in this study.

To conclude, the findings of this study suggest that the issues that influence the connections to nature are complex with many socio-ecological factors coming into play and therefore a multidisciplinary approach needs to be taken to address the implications of these complexities. We emphasize that the results are discussed within the context of the cultural, political, and social environment of Auckland and thus the recommendations may not be translatable to other regions and therefore future research based on our findings, in other regions, is recommended. However, given the multicultural nature of Auckland, the study provides an important foundation from which other research can build upon and acts as a starting point to inform urban land system design.

As argued by numerous sustainability scientists (e.g., Ives, et al. [4]; Folke, et al. [87]; Abson et al. [3]), the need to reconnect our wider community with nature, is crucial in order to facilitate the social transformation required towards global sustainability. Understanding, and then influencing, the complex dimensions within a person's connection to nature is considered an important leverage point to shift society to a more environmentally sustainable one [3]. This has also been recognized by the United Nations Environment Programme [88] and thus the findings from our research contribute to the knowledge needed to foster and facilitate people's connections to nature for future, global sustainability outcomes.

In order to effectively work towards reducing some of the barriers to the connections to nature it is important that environmental managers and urban planners work with psychologists, sociologists, and/or anthropologists, to address the challenges of removing some of the barriers. Furthermore, bringing people closer to nature in order to sustain personal connections to nature involves collaboration amongst recreational practitioners, urban designers, planners, architects, landscape architects, and landscape ecologists working alongside environmental managers.

5. Conclusions

This exploratory study filled a gap in research by exploring self-reported pathways and barriers to connections to nature and has provided new understanding for environmental management in Auckland, and globally that can help to inform the design of future land systems. Through the employment of an online survey, structured, and non-structured interviews with a sample group of 976 respondents, we identified that a dominant perceived barrier to connections to nature are modern societal modalities. Conversely, the exposure to nature or time spent outdoors was identified by respondents as being a pathway to their connection to nature, by either prompting and/or sustaining their connection. This gives a better insight into what may underpin 'disconnections' and what can be accomplished to facilitate stronger connections to nature in the future. These findings are particularly relevant to environmental management given the widely suggested link between the connections to nature and the pro-environmental perspectives or actions [9]. Therefore, it is important that agencies, organisations, researchers, or businesses who strive towards environmental sustainability, consider deploying several diverse strategies to promote an active close contact with nature through facilitating outdoor events/activities, and for urban planners to place greater emphasis on bringing natural environments into urban environments to prompt 'connections to nature'. We postulate that by increasing access to nature in a range of contexts, this could offset the perception that modern societal modalities are a barrier

to 'connections to nature'. However, we acknowledge that perceptions such as this are complex and based on several factors that may be out of the control of environmental managers. Despite providing recommendations as to how pathways to connections to nature could be implemented, future research and application of certain interventions will require multidisciplinary approaches and collaboration between a range of stakeholders, planners, and scientists across the spectrum of the social and physical sciences, to facilitate a society that has a strong connection to nature.

Although this study has provided valuable new insight into understanding connections to nature in environmental management, there is still more work to be carried out to address the gaps in our knowledge and to develop strategies from which better decision making for environmental sustainability targets can be achieved. For example, as the study was undertaken pre-COVID19, it would be strongly recommended to replicate the study again to test if there are any differences in perspectives. Furthermore, given the strong Māori values discussed earlier, it is recommended that future research in the region undertakes a comparison across the different ethnicities in order to examine if there are any variations across ethnic groups, as undertaking this comparison was outside of the scope of this particular study. Furthermore, as we acknowledged earlier, the findings are representative of the Auckland, New Zealand context and therefore the recommendations made are intended for this region. The study does however provide a foundation for research that can be built upon in other regions around the world or even to support a study which is international. For example, as the region is in a developed country, it would be interesting to reproduce this study in developing countries in order to draw comparisons. Increasing this area of research around the world from an environmental management perspective, to increase the socio-ecological empirical understanding of the perceived pathways and the barriers to connections to nature, can further support the creation of urban land systems that have beneficial environmental as well as human wellbeing outcomes.

Notes

[1] Note that we use the term 'pathways' to illustrate what sustains/prompts a respondent's connection to nature, as aligned with discussions by Lumber et al. ([10], p. 2) who define pathways as being the "factors [and different indicators] which facilitate increased connection to nature". We use the term 'barriers' to illustrate what is perceived to limit/hinder a respondent's connection to nature, as all respondents when asked the survey question (discussed in the methods section), discussed the varying factors as being an active barrier to their connection.

[2] We use the term 'vulnerable' to mean "those individuals whose capacity to safeguard their own interests as research participants, through the process of informed consent or refusal, is compromised" ([89], p. 248).

[3] A controversial treaty between the British Crown and Māori that arguably ensured both groups' sovereignty.

[4] The term Pākehā refers to any non-Māori, European person in New Zealand.

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