

RESEARCH ARTICLE

Socio-demographic correlates of nature connection: An Australia-wide study

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Abstract

1. A large body of literature illustrates that nature connection is associated with both higher wellbeing and a greater likelihood of displaying more pro-environmental behaviours. This indicates that higher nature connection is an important leverage point for sustainability. It is important to understand correlates of nature connection to improve both individual well-being, and the health of the planet.
2. This study is the first survey to explore nature connection and its variation across diverse geographies and environments at a national-level in Australia. We aim to understand the overall level of nature connection in Australia, the socio-demographic correlates of nature connection and the barriers to connecting with nature.
3. The distributions of nature connection according to two different instruments: the CN-12 and the INS indicate that nature connection is relatively high in Australia.
4. Nature connection is higher for older Australians, individuals who identify as female, individuals who grew up in rural or regional area, those who work part-time or are self-employed, Indigenous Australians and those who speak a language other than English.
5. Being time poor is the most common barrier to engaging with nature, with individuals on higher incomes being more likely to identify this barrier. Other barriers, such as lack of access, cost of access and safety concerns, were more likely to be raised by people on lower incomes.
6. Our research identifies numerous structural barriers to engaging with nature that have global relevance and indicate the need for socio-ecological policy reforms.

[Correction added on 30 October 2025 after first online publication: The author's name has been corrected to 'Lily M. van Eeden'.]

Pauline Marsh and Emily J. Flies are senior authors.

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7. *Policy implications.* Our research points to valuable policy levers such as increasing green space in urban areas, enhancing opportunities for meaningful interactions in nature and addressing structural inequalities to enhance access to nature for certain groups. Doing so will help create positive change for both people and planet.

KEYWORDS

barriers, demographics, nature connection, social justice, socio-demographic correlates

1 | INTRODUCTION

Nature connection is associated with higher well-being and increased likelihood of performing pro-environmental behaviours (Martin et al., 2020). A person's connection with nature may shape, or be shaped by, how they perceive nature. For example, people with a strong connection with nature tend to describe nature in experiential terms (e.g. positive emotions felt in nature) rather than descriptive terms (e.g. landscapes, plants) (Hatty et al., 2022). Previous research indicates that stronger nature connection is associated with reported feelings of wellbeing (e.g. reduced stress) when spending time in nature (Mena-García et al., 2020). Thus, understanding relationships between nature connection, wellbeing and pro-environmental behaviours can be useful for informing policy that influences any one of these dimensions.

Spending time in or near nature can improve health and wellbeing through many mechanisms, the most prominent of which are exposure to clean air and the opportunity for exercise, socialisation, and emotional and cognitive restoration (Hartig et al., 2014; Remme et al., 2021). Having a higher connection with nature is considered to positively impact wellbeing, especially measures of personal growth, as well as measures of autonomy, self-acceptance and positive relationships (Barragan-Jason et al., 2022; Grénman et al., 2025; Pritchard et al., 2020).

Pro-environmental attitudes and the restorative effects of connecting with nature on human wellbeing are also enhanced with better ecosystem conditions (Giusti & Samuelsson, 2020). Strong nature connection has been associated with higher levels of pro-environmental or conservation behaviours (Mayer & Frantz, 2004; Richardson et al., 2020; Whitburn et al., 2020): People who feel most connected with nature are also the most likely to take action to care for it. This aspect of nature connection is why it features prominently in several conservation policies, including the Kunming-Montreal Global Biodiversity Framework adopted by 188 countries including Australia (Convention on Biological Diversity, 2023), Australia's Strategy for Nature (Commonwealth of Australia, 2024), Canada's 2020 biodiversity goals and targets (Biodivcanada, 2015), the United Kingdom's 25-year environment plan (DEFRA, 2018) and New Zealand's Te Mana o te Taiao biodiversity strategy (New Zealand Government, 2020). The combination of well-being and pro-environmental behaviour benefits make nature connection an important leverage point for sustainability (Martin et al., 2020).

Nature connection is a concept that has been used variably across different disciplines (Ives et al., 2017), but generally entails combinations of elements related to a sense of identity, behaviour and activity, and the perceived cognitive and emotional relationship with the natural world. The proposed dimensions of nature connection are multifaceted and include cognitive, emotive, philosophical, material, experiential and behavioural elements (Hatty et al., 2020; Ives et al., 2017). For example, nature connection research ranges from examining relational interactions between people and place to studying nature connection as a distinct psychological entity that affects behaviour (Hatty et al., 2022; Ives et al., 2017; Lengieza et al., 2023; Mena-García et al., 2020).

An increased interest in studies on human-nature connection has resulted in numerous validated scales to measure nature connection. Widely used scales or measures include Inclusion of Nature in Self (INS) (Schultz, 2001), Connectedness to Nature Scale (CNS) (Mayer & Frantz, 2004), Nature Relatedness (NR) (Nisbet et al., 2008) and the CN-12 (Hatty et al., 2020). These scales vary in how they conceptualise and measure nature connection. Some scales are unidimensional, single-item scales, such as the INS, which conceptualises nature connection through cognitive beliefs (Schultz, 2001). In contrast, other scales are multi-dimensional, seeking to conceptualise a range of different ways individuals can connect with nature. For example, the CN-12 has 12 statements to measure one's connection with nature through the dimensions of identity, experience and philosophy. These dimensions explore how one includes nature in their self-identity, thoughts and emotions, behavioural elements, enjoyment of nature and worldviews on the interconnectedness between humans and nature (Hatty et al., 2020). Research on the CNS, another multidimensional scale, has found that the identity dimension tends to be the most variable across population groups (Hatty et al., 2020; Nisbet et al., 2008).

Despite these scales measuring nature connection differently, research has indicated that they are highly correlated (Hatty et al., 2020; Tam, 2013). For example, the CN-12 and its dimensions have shown positive correlations with NR, time spent in nature, biospheric and altruistic values, and pro-environmental behaviours (Hatty et al., 2020). It has also been posited that multidimensional scales may be more appropriate for measuring nature connection due to their having stronger correlations with related variables such as pro-environmental behaviours (Hatty et al., 2020; Tam, 2013; Whitburn et al., 2020).

These scales have been applied around the world to better understand the different ways in which communities in different

countries connect with nature. Indeed, in a multidisciplinary review, Ives et al. (2017) identified that nearly a quarter of longitudinal and cross-sectional research on nature connection used scales to measure it, and that researchers were interested in nature connection as both a driver of other outcomes and a benefit in itself. Much of the research on nature connection has been biased towards western and high-income countries, with most coming from the USA, Australia, Canada, Czech Republic, Germany, Japan, Singapore, United Kingdom and the Netherlands (Ives et al., 2017; Soga & Gaston, 2023). It is possible that this bias is linked with concern for nature connection over the detrimental effects of urbanisation in these regions (Soga & Gaston, 2023). A global systematic review examining trends of nature connection across (predominantly) high-income countries reports a general decline in nature connection which varies based on geographical and socio-economic factors (Soga & Gaston, 2023).

By applying a macro-level perspective on nature connection, Richardson et al. (2022) compared the association of country-level factors of declining nature experience across 14 countries across the United Kingdom and Europe. They observed that nature connection, as measured through the INS, was most strongly correlated with higher levels of biodiversity, followed by having an ageing population (positively), smartphone use (negatively) and income (negatively). This highlights the significance of the biodiversity–nature connection relationship, identifying nature connection as an important factor in enhancing conservation behaviours and a valuable leverage point for societal shifts towards sustainability (Richardson et al., 2022).

At the individual level, studies are shedding light on the complex associations with nature connection represented around the world. For example, while the act of smelling wildflowers has been found to be associated with health and well-being, the same study in the United Kingdom found no association between time spent in nature and health and well-being (Richardson et al., 2021). Additionally, a large number of previous studies have examined the demographic predictors of nature connection. According to a review of the nature connection literature by Lengieza and Swim (2021), older adults tend to be more nature-connected than younger adults and those identifying as female tend to be more nature connected than those identifying as male. While some studies do find differences, most have found no relationship between education, race and socio-economic status with nature connection (Lengieza & Swim, 2021).

Through a nationally representative survey, the overarching aims of this study are to understand how connected to nature people are in Australia, the socio-demographic correlates of nature connection and the barriers to nature connection. Australia has a history in studying nature connection and interactions between people and nature; however, much of this research has been concentrated in cities. Over the past decades, Australia has experienced a rapid transition towards greater urbanisation, with a growth in coastal cities (Newton et al., 2017) leading to a changing national profile and distribution of the population across the nation. Although there has been growth in regional areas since 2007, with more people moving

out of cities than into them from the regions (Gurran et al., 2025), Australia nevertheless remains highly urbanised.

Within Australia, several studies have shown that different socio-demographic factors are linked to one's level of connection with nature. In general, research shows similar patterns to those found internationally, with individuals who have a higher level of education, higher income, identify as female and are older generally having higher levels of nature connection (Chawla, 2020; Fuller & Irvine, 2010; Keniger et al., 2013). For example, a national survey in Australia found that age, income, education, marital status and household structure are all important influences on various types of nature engagement (nature connection specifically, however, was not examined) (Zuo et al., 2016). Similarly, Sockhill et al. (2022) explored the correlates of having ecocentric (as opposed to anthropocentric) values and found that those with ecocentric values tended to be older and identify as female but earn below the median income.

A study conducted in the Australian city of Brisbane found that people with higher nature relatedness reported fewer symptoms of depression, anxiety, stress and better overall health (Dean et al., 2018). Overall nature relatedness was higher in older people, individuals identifying as female, those without children living at home, not working and people speaking English at home. Lin et al. (2017) have shown that aspects such as urban form in terms of yard size and certain socio-demographics are connected to the frequency and time spent in private green space. House age and yard size are positively correlated with vegetation cover in yards, and people with greater nature relatedness and lower socio-economic disadvantage also had greater vegetation cover. Finally, in the state of Victoria in Australia, women and older people were found to have a stronger connection with nature and were more likely to spend increased time in nature during the COVID-19 pandemic compared with other residents (van Eeden et al., 2023). Living in an area of higher socio-economic advantage and having access to nearby nature (e.g. parks, waterways) were also predictors of spending time in nature during the pandemic.

This study explores nature connection and its correlates across the whole of Australia. Prior to this work, research examining nature connection in Australia was localised to a city or state. These limitations have resulted in piecemeal knowledge of nature connection in Australia, with a particular gap in our understanding of nature connection for regional and rural populations. Australia presents an important case study because it provides an opportunity to move beyond city or regional-based research foci, to understand the nuances and complexities of differences and variation in nature connection across urban, climate and socio-economic gradients.

This study is underpinned by three key research questions. Firstly, how connected with nature are people in Australia? Secondly, are socio-demographics associated with nature connection in Australia? Finally, what are the key barriers for people in Australia that prevent them from connecting with nature? Together, these questions help shed greater light on nature connection in Australia and highlight policy levers that can support individuals in Australia to have a higher connection to nature.

2 | METHODOLOGY

2.1 | Survey design

The online survey was administered to an existing panel sample run by the Online Research Unit. While the survey was administered online, the Online Research Unit recruitment methods use both online and offline (post, phone and print) approaches. The survey included questions on demographics, open-ended questions on nature engagement and connection, nature connection scales, nature contact, barriers to engaging with nature, well-being and health-related quality-of-life scales, level of interconnection with different environments and activities undertaken in different environments (see [Supporting Information S1](#) for full survey). This project has been approved by the University of Tasmania Human Research Ethics Committee (project ID 28109). All participants provided written informed consent to participate in this study. Prior to commencing the survey, participants were provided information on the study. They were then asked to indicate their consent to participate before proceeding to the survey questions.

Nature connection was measured using two different measurement tools—the INS scale, and the CN-12. The frequency of environmental visitation was also analysed to examine how these results contrast with the nature connection scales. The INS asks respondents the degree to which they feel they are interconnected with nature, while the CN-12 comprises a series of 12 questions regarding nature connection across three dimensions (identity, experience and philosophy) (Hatty et al., 2020). Following the approach used by Hatty et al. (2020), the 12 data items were averaged to calculate an overall score, with the data items in each of the three dimensions also averaged to obtain the dimension scores. Finally, the question on environmental visitation asks respondents how often they have spent time in nature, with nine response options provided ranging from 'never' to 'every day'. These three variables were chosen as they conceptualise nature connection and contact in different ways (the INS being a single dimension scale, the second being a more standard multi-dimensional, quantitative scale and the third being a more objective scale of nature connecting behaviour).

Barriers to nature connection were assessed based on a question asking respondents, 'do you wish you could spend more time in nature?' For participants who selected 'yes', eight response options were provided, while four response options were provided for those who selected 'no'.¹ Responses that selected 'other' were analysed and re-coded to existing codes where appropriate.

¹Response options for those who selected 'yes' were: Too busy/not enough time; Lack of access to nature; Costs of accessing nature; Health issues prevent access; Friends and family are not into nature; Safety concerns; Unsure of where to go; and Other. Response options for those who selected 'no' were: I don't like spending time in nature; I feel I spend enough time in nature; I think nature is scary or unsafe; and Other. Note there was a minor technical error in the survey, with participants who selected 'yes' being asked 'Why are you not interested in spending more time in nature?', instead of 'Why are you unable to spend more time in nature?'. The majority of the sample (86.3%) responded as expected using the response options, while 13.7% of the sample responded as 'Other'. 5.2% ($n=154$) of these responses noted an issue with the way the question was asked. These responses were removed from the analysis on specific barriers.

2.2 | Sample

A total of 4114 people participated in the survey, of which 108 responses were removed after undergoing a data cleaning process to remove speeders (those who completed the survey in less than 20% of the median completion time), straight-liners (those who gave identical responses to a battery of questions) and those who responded to open-ended questions with nonsensical responses. While the process screened for respondents who provided illogical combinations of responses, none were identified. This resulted in a final sample of 4006 de-identified individuals, with the response rate being 5%, reflective of response rates for large online panels which are typically lower than other traditional survey methods (Daikeler et al., 2020).

The sampling strategy ensured that good representation was achieved across several demographic characteristics. This included a quota to obtain approximately equivalent sample sizes ($n=500$) in each state and territory, and an urban/rural quota of 50% of respondents residing in capital cities, 25% residing in major cities outside capital cities and 25% in all other areas. Quotas were also set for levels of education within each state to help ensure the sample was representative of a wide range of educational backgrounds. These quotas were broadly met, with only the quota in the Northern Territory not being reached ($n=306$), an area that is typically hard to reach in surveys (Australian Bureau of Statistics, 2022a). The sample characteristics indicate that there was good representation across key demographics such as gender, age, education status and income (Table S1).

2.3 | Data analysis

Associations were assessed using regression modelling. For outcome variables that comprised a single Likert scale (INS and environmental visitation), ordered logit models were produced with the demographic variables being the independent variable. For the CN-12, which is a continuous variable, ordinary least squares models were produced. In our analysis, a 5% significance level is used (associations that are significant at the 10% level are noted in tables but not considered significant).

Population groups examined were based on key demographic variables collected in the survey: age, gender, Indigenous identification (Aboriginal and/or Torres Strait Islander), whether the individual self-identifies as having a disability, language spoken at home, employment status, highest level of education, personal income, socio-economic status of area, state of current location, remoteness level (i.e. urban/rural gradient) of current location (based on Australian Bureau of Statistics ASGS Edition 3 classifications) and remoteness level of where the respondent spent their childhood.

Some data transformation was undertaken for three of the independent variables: employment status, personal income, and childhood remoteness level. For employment status, an additional

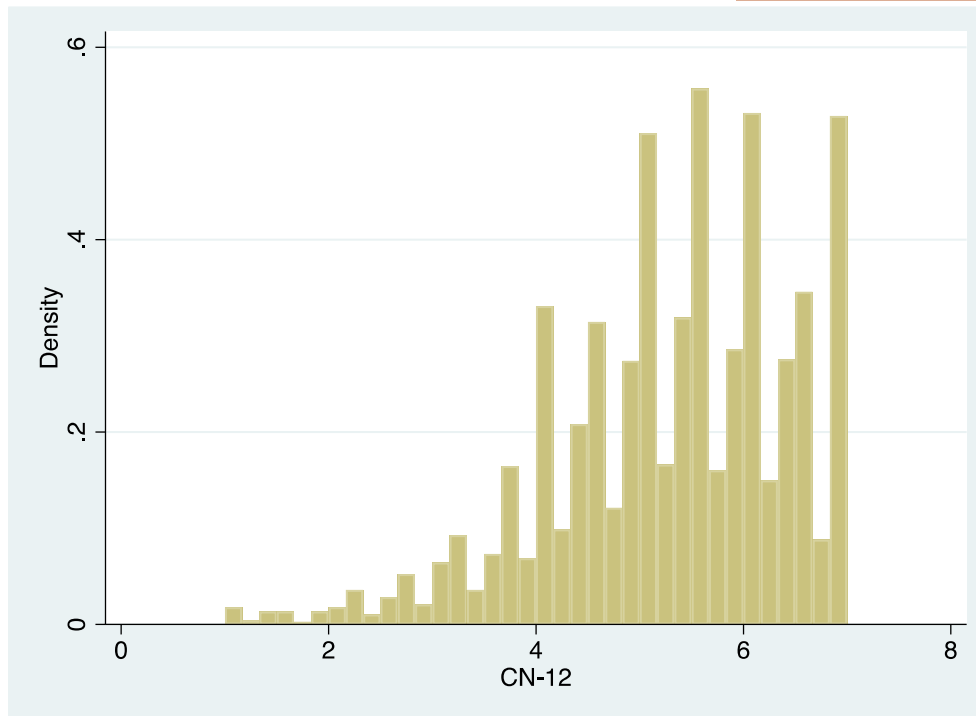


FIGURE 1 Distribution of CN-12 responses.

category for 'student only' was created through identifying which respondents were students (through a specific question on whether the respondent was currently studying) who were also not undertaking any employment (determined through the question on employment). Respondents who identified 'other' (along with an open-ended response) to questions regarding employment or childhood remoteness level were re-coded to existing categories where appropriate. Finally, personal income was transformed to income quintiles data from the Australian Bureau of Statistics (2022d).

3 | RESULTS

3.1 | Level of nature connection in Australia

The distribution of responses to the CN-12 indicates a negative skew (Figure 1). It should be noted that a relatively large proportion of responses (5.14%, $n=206$) obtained a score of '7', corresponding to participants noting they 'strongly agree' with all 12 items of the CN-12. Only 0.25% of responses ($n=10$) obtained a score of 1, corresponding to participants noting they 'strongly disagree' with all 12 data items.

Analysis of the individual CN-12 items indicates a high level of variation in how individuals in Australia responded to the different CN-12 dimensions and data items (Figure 2). On average, Australians are most connected to nature through the Philosophy dimension. The responses to the INS show a normal distribution, with the median and modal response being the centre option of 'D' (Figure 3).

The CN-12 and INS are highly related, with a correlation coefficient of 0.648.

3.2 | Socio-demographics of nature connection

Regression models were produced to examine the key socio-demographic characteristics associated with the two measures of nature connection—INS and CN-12 (Table 1).² Those in older age groups were found to have higher nature connection according to both the INS and CN-12 ($p<0.01$). Individuals identifying as female had higher nature connection based on both the INS ($p<0.05$) and CN-12 ($p<0.01$) compared to those identifying as male. Indigenous Australians had higher levels of nature connection according to the INS ($p<0.05$), but not the CN-12. People who speak a language other than English had higher levels of nature connection based on both measures ($p<0.01$).

Highest level of education was found to be associated with nature connection. Those with a certificate/diploma had higher nature connection according to the INS ($p<0.01$) and CN-12 ($p<0.05$), as did those with postgraduate qualifications (INS $p<0.05$, CN-12 $p<0.01$) compared to those whose highest level of education was high school. Individuals with undergraduate qualifications had higher nature connection only when measured through the CN-12 ($p<0.01$).

²To ensure no multicollinearity amongst the independent variables, variance inflation factors were calculated which indicated that multicollinearity was not an issue (Table S2).

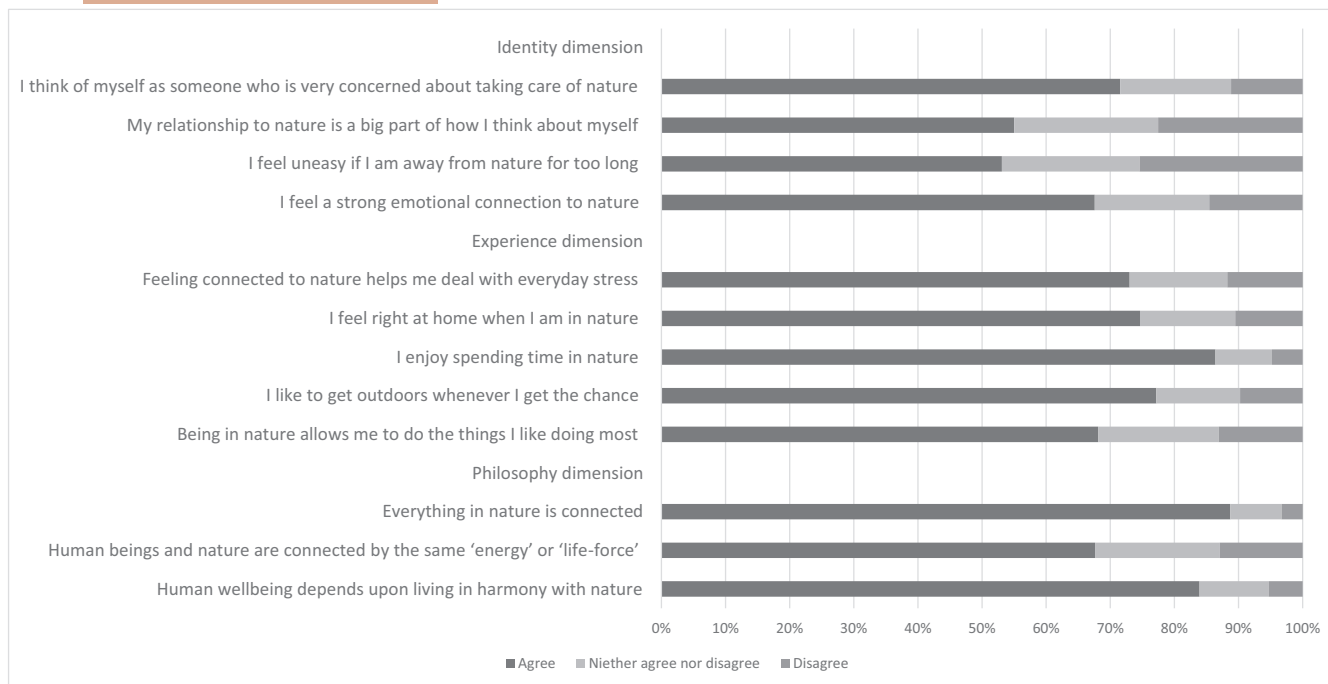


FIGURE 2 Results for individual CN-12 items.

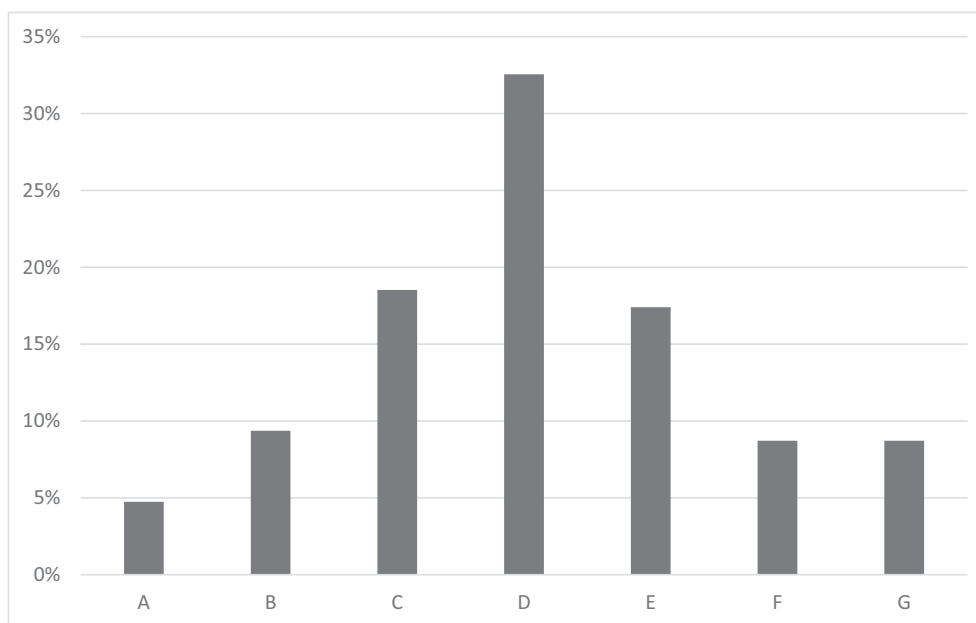


FIGURE 3 Distribution of Inclusion of Nature in Self scale responses.

In examining employment status, compared to those who work full-time, individuals who are self-employed were found to have higher nature connection based on the INS ($p < 0.05$), and those who work part-time had higher levels of nature connection based on the CN-12 ($p < 0.05$). There was also an association between income level and nature connection, with those in the lowest quintile having higher nature connection according to the INS ($p < 0.01$) compared to those in the middle-income quintile.

There was little variation found between states and territories. When using the INS, the Australian Capital Territory had lower levels of nature connection ($p < 0.05$) compared to New South Wales (but not when using the CN-12).

There was also little variation observed based on remoteness level. Those living in regional areas had significantly higher nature connection when using the CN-12 ($p < 0.05$), with no difference found based on the INS. Childhood environment appears to be an

TABLE 1 Associations between socio-demographics and two measures of nature connection.

	INS	CN-12
Age		
18–30 years	−0.672*** (0.143)	−0.236*** (0.0911)
31–50 years	−0.389*** (0.136)	−0.108 (0.0862)
51–70 years	−0.0864 (0.115)	0.0347 (0.0729)
Gender		
Identifies as female	0.159** (0.0632)	0.206*** (0.0399)
Non-binary	0.515 (0.533)	−0.0347 (0.361)
Identifies as Aboriginal and/or Torres Strait Islander	0.562** (0.233)	0.213 (0.137)
Has disability/ies	−0.0155 (0.114)	0.0402 (0.0702)
Speaks language other than English at home	0.424*** (0.107)	0.190*** (0.0678)
Highest level of education		
Has not completed high school (year 12)	−0.0276 (0.137)	−0.126 (0.0855)
Certificate/diploma	0.260*** (0.100)	0.153** (0.0631)
Undergraduate	0.147 (0.101)	0.216*** (0.0646)
Postgraduate	0.268** (0.109)	0.273*** (0.0691)
Employment status		
Part-time	0.0552 (0.103)	0.140** (0.0656)
Casual	−0.148 (0.136)	0.00509 (0.0881)
Self-employed	0.336** (0.133)	0.129 (0.0840)
Engaged in home duties/volunteer work	0.0440 (0.155)	0.119 (0.0951)
Retired	−0.0562 (0.116)	0.0708 (0.0736)
Not working/studying	0.164 (0.196)	0.0920 (0.121)
Student only	0.119 (0.240)	0.102 (0.158)
Personal income quintile		
Lowest income quintile	0.357*** (0.119)	0.0761 (0.0740)

(Continues)

TABLE 1 (Continued)

	INS	CN-12
Second-lowest income quintile	0.172* (0.102)	0.0595 (0.0648)
Fourth-highest income quintile	0.00371 (0.0968)	0.0190 (0.0614)
Highest income quintile	−0.0397 (0.110)	−0.123* (0.0701)
Standardised IRSAD score	0.0390 (0.0398)	0.0372 (0.0251)
State/territory		
Victoria	0.0291 (0.117)	0.0704 (0.0742)
Queensland	0.0218 (0.118)	0.0448 (0.0744)
South Australia	0.101 (0.120)	0.116 (0.0754)
Western Australia	−0.169 (0.119)	0.0639 (0.0749)
Tasmania	−0.161 (0.127)	−0.00470 (0.0805)
Australian Capital Territory	−0.250** (0.127)	0.00571 (0.0806)
Northern Territory	−0.103 (0.151)	0.137 (0.0951)
Current remoteness level		
Regional	0.0903 (0.0904)	0.125** (0.0569)
Remote	0.336* (0.184)	0.188 (0.116)
Childhood remoteness level		
Small/medium city	0.0735 (0.0820)	0.0691 (0.0522)
Rural/regional	0.250*** (0.0778)	0.199*** (0.0491)
A mix	0.0668 (0.256)	0.228 (0.170)
N	3510	3510
Pseudo R-squared/adjusted R-squared	0.014	0.035

Note: Regression coefficients shown (standard error in parentheses). Base case is aged over 70, identifies as male, Aboriginal and/or Torres Strait Islander, does not have a disability, speaks only English at home, highest level of education is high school completion (year 12 certificate), employed full time, is in the third income quintile, currently lives in NSW, lives in a major city and grew up in a large/capital city. *Significant at 10% level. **Significant at 5% level. ***Significant at 1% level.

important factor, with those who grew up in rural/regional areas having significantly higher nature connection using both the INS ($p < 0.01$) and CN-12 ($p < 0.01$) compared to those who grew up in a large/capital city.

The relationship between the socio-demographic variables and time spent in nature is shown in Table S3, indicating some conflicting relationships when compared with nature connection. For example, there is little variation between age groups on time spent in nature, while our analysis has indicated that nature connection varies significantly. Analysis of the CN-12 dimensions indicates overall consistent findings between the three dimensions (Table S4).

3.3 | Barriers to connecting with nature

We found that 74.0% of respondents would like to spend more time in nature than they currently do. Time poverty was identified as the biggest barrier to spending time in nature (72.2% of respondents; Figure 4). This was followed by lack of access to nature (15.8%), health issues preventing access (11.8%), unsure where to go (11.5%) and costs of accessing nature (11.5%). A small portion of respondents provided an 'other' response (2.3%), mentioning barriers such as weather, ageing, restrictions in allowing pets to certain nature areas, caring duties, access to transport and not wanting to impact the environment.

Logit models analysing all the barriers by demographic and geographical characteristics indicated that certain groups are facing multiple barriers (Table 2). The disparities by income are particularly apparent, with those in the highest quintile being significantly more likely to report being too busy or not having enough time to engage with nature. In contrast, most other barriers were faced predominantly by individuals on lower incomes who were significantly more likely to identify lack of access, cost of access and safety concerns (the reported barriers by income level are illustrated graphically; Figure 5). People with disabilities were significantly more likely to

identify health issues and safety concerns, while certain groups, such as younger people and those who speak a language other than English at home, were significantly more likely to identify being unsure of where to go as a barrier.

4 | LIMITATIONS

Before discussing the results in greater detail, there are some limitations in the study that should be noted. First, as this was an online survey, the sample will be biased towards those who are more digitally literate and have internet access. The sample was broadly representative of the Australian population (Table S1) and had adequate representation from older Australians who may be more likely to be offline. However, there may be some bias through unobserved characteristics.

Second, while the sample size was adequate for this analysis and broadly representative of the population, there were some population groups who were under-represented. Indigenous Australians, people who speak a language other than English, and those with the highest education level as high school were under-represented in the survey. It should be noted also that more populous states and those living in major cities were also under-represented by design through the sampling approach to ensure that analysis could be undertaken for all states and to understand the perspectives of people living in regional and rural areas.

5 | DISCUSSION

This is the first national survey to explore nature connection and its correlates across diverse geographies and environments in Australia.

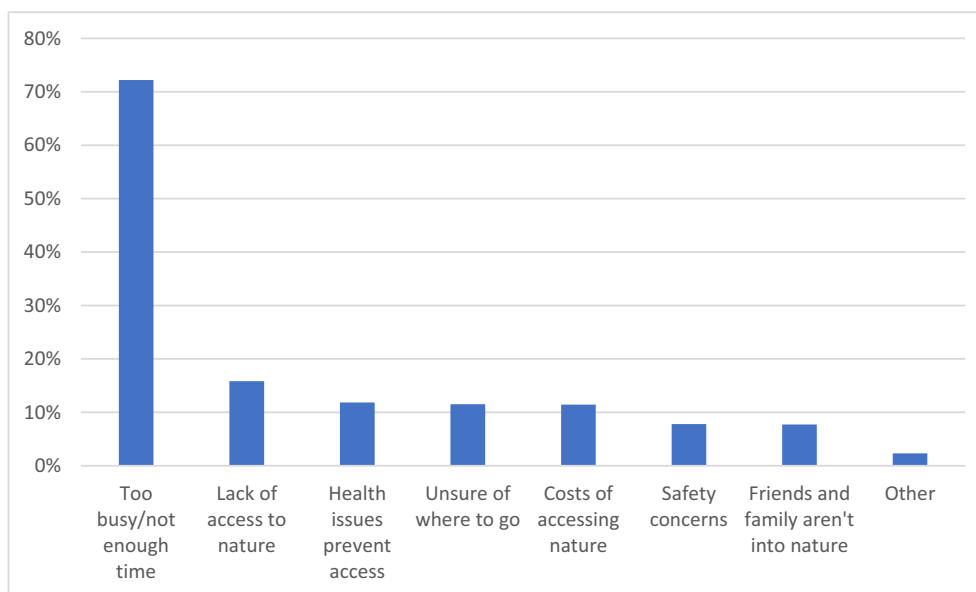


FIGURE 4 Barriers to spending more time in nature.

TABLE 2 Regression output with barriers as dependent variables.

	Not enough time	Lack of access	Costs of access	Health issues	Friends are not interested	Safety concerns	Unsure of where to go
Age							
18–30years	0.455* (0.234)	0.692** (0.296)	-0.167 (0.318)	-1.619*** (0.335)	0.281 (0.383)	-0.685* (0.377)	1.109*** (0.395)
31–50years	0.184 (0.221)	0.340 (0.288)	0.243 (0.295)	-1.147*** (0.293)	0.302 (0.368)	-0.562 (0.356)	0.930** (0.388)
51–70years	0.0539 (0.191)	-0.00668 (0.252)	0.288 (0.254)	-1.108*** (0.224)	0.0901 (0.309)	-0.573* (0.307)	0.304 (0.350)
Gender							
Identifies as female	0.0576 (0.0992)	0.0228 (0.117)	-0.445*** (0.134)	0.0384 (0.154)	-0.215 (0.160)	0.420** (0.167)	-0.00204 (0.136)
Non-binary	0.0157 (0.814)	-1.031 (1.105)		2.095** (0.864)		0.682 (1.111)	1.205 (0.765)
Identifies as Aboriginal and/or Torres Strait Islander	-0.266 (0.302)	-0.222 (0.384)	-0.623 (0.537)	-0.658 (0.645)	-0.447 (0.611)	0.376 (0.464)	0.223 (0.368)
Has disability/ies	-0.997*** (0.164)	0.341* (0.191)	0.214 (0.203)	2.044*** (0.183)	0.228 (0.261)	0.688*** (0.233)	0.254 (0.226)
Speaks language other than English at home	-0.131 (0.158)	0.212 (0.171)	0.280 (0.208)	-0.432 (0.308)	0.308 (0.235)	0.239 (0.240)	0.418** (0.195)
Highest level of education							
Has not completed high school	-0.409* (0.213)	-0.108 (0.268)	-0.0887 (0.275)	0.288 (0.312)	0.0779 (0.334)	-0.00359 (0.314)	0.147 (0.275)
Certificate/diploma	-0.0838 (0.157)	-0.107 (0.188)	-0.000411 (0.203)	0.516** (0.250)	-0.230 (0.249)	-0.654*** (0.250)	-0.155 (0.199)
Undergraduate	-0.0540 (0.162)	0.131 (0.183)	-0.326 (0.220)	0.374 (0.267)	0.104 (0.240)	-0.174 (0.241)	-0.290 (0.201)
Postgraduate	-0.0974 (0.174)	0.120 (0.203)	0.0349 (0.232)	-0.00810 (0.294)	-0.383 (0.281)	-0.396 (0.275)	-0.755*** (0.250)
Employment status							
Part-time	-0.0219 (0.159)	-0.00529 (0.185)	0.322 (0.213)	0.650** (0.258)	0.0264 (0.266)	0.0738 (0.242)	0.0513 (0.204)
Casual	-0.0577 (0.216)	0.215 (0.240)	0.412 (0.278)	0.0116 (0.417)	0.772*** (0.292)	-0.422 (0.373)	0.119 (0.266)
Self-employed	-0.144 (0.214)	0.0242 (0.276)	0.135 (0.304)	0.327 (0.366)	-0.488 (0.477)	0.0278 (0.366)	-0.390 (0.365)

(Continues)

TABLE 2 (Continued)

	Not enough time	Lack of access	Costs of access	Health issues	Friends are not interested	Safety concerns	Unsure of where to go
Engaged in home duties/volunteer work	-0.768*** (0.210)	-0.316 (0.304)	0.477* (0.285)	0.675** (0.322)	0.0278 (0.403)	-0.538 (0.394)	0.397 (0.273)
Retired	-1.516*** (0.184)	0.264 (0.245)	0.143 (0.249)	1.188*** (0.274)	0.689** (0.307)	-0.384 (0.326)	0.0437 (0.305)
Not working/studying	-0.940*** (0.269)	0.916*** (0.291)	0.802*** (0.325)	0.414 (0.397)	0.326 (0.475)	-1.103* (0.575)	0.146 (0.366)
Student only	-0.396 (0.334)	0.970*** (0.328)	0.725* (0.408)	0.954** (0.486)	0.327 (0.505)	-0.243 (0.559)	0.579 (0.362)
Personal income quintile							
Lowest income quintile	-0.637*** (0.180)	0.0110 (0.212)	0.337 (0.232)	0.179 (0.267)	-0.110 (0.287)	0.439 (0.281)	0.0872 (0.241)
Second-lowest income quintile	-0.413*** (0.158)	-0.0148 (0.184)	0.217 (0.206)	0.0764 (0.245)	-0.193 (0.256)	0.147 (0.253)	-0.0135 (0.214)
Fourth-highest income quintile	0.0612 (0.155)	-0.402** (0.179)	-0.404* (0.212)	0.0864 (0.253)	-0.204 (0.242)	-0.544*** (0.259)	-0.151 (0.202)
Highest income quintile	0.163 (0.180)	-0.383* (0.202)	-0.827*** (0.272)	-0.540 (0.342)	-0.0862 (0.274)	-0.769** (0.309)	-0.364 (0.244)
Standardised IRSAD score	-0.00123 (0.0624)	0.0850 (0.0735)	-0.0355 (0.0830)	-0.0228 (0.0940)	0.000127 (0.101)	-0.0521 (0.103)	-0.0507 (0.0848)
State/territory							
Victoria	-0.266 (0.186)	0.355 (0.223)	-0.0353 (0.232)	0.218 (0.281)	0.861** (0.346)	0.529 (0.331)	-0.0415 (0.285)
Queensland	-0.374** (0.186)	0.466** (0.225)	-0.322 (0.246)	0.280 (0.277)	0.389 (0.378)	0.518 (0.338)	0.221 (0.277)
South Australia	-0.0104 (0.192)	0.165 (0.231)	-0.319 (0.246)	-0.0565 (0.294)	0.372 (0.374)	0.0121 (0.363)	0.312 (0.270)
Western Australia	-0.235 (0.185)	0.0919 (0.226)	-0.345 (0.245)	-0.250 (0.289)	0.594* (0.351)	0.523 (0.329)	0.407 (0.266)
Tasmania	0.0799 (0.205)	0.137 (0.275)	-0.261 (0.266)	0.269 (0.309)	1.206*** (0.380)	0.503 (0.387)	0.527* (0.286)
Australian Capital Territory	-0.00298 (0.203)	-0.115 (0.237)	-0.270 (0.277)	0.180 (0.317)	1.013*** (0.351)	0.632* (0.354)	0.506* (0.283)
Northern Territory	-0.353 (0.231)	0.823*** (0.281)	-0.525 (0.340)	0.142 (0.397)	0.944** (0.438)	1.275*** (0.394)	0.328 (0.348)

TABLE 2 (Continued)

	Not enough time	Lack of access	Costs of access	Health issues	Friends are not interested	Safety concerns	Unsure of where to go
Current remoteness level							
Regional	0.0644 (0.135)	-0.717*** (0.174)	-0.123 (0.179)	-0.231 (0.204)	-0.455* (0.248)	-0.574** (0.243)	-0.273 (0.194)
Remote	-0.0615 (0.280)	0.0495 (0.314)	0.519 (0.369)	-0.176 (0.496)	0.0311 (0.457)	-0.000824 (0.418)	-0.450 (0.433)
Constant	1.456*** (0.309)	-2.005*** (0.386)	-1.792*** (0.405)	-2.302*** (0.457)	-3.174*** (0.531)	-2.101*** (0.506)	-2.842*** (0.485)
N	2616	2616	2607	2616	2607	2616	2616
Pseudo R-squared	0.154	0.052	0.057	0.240	0.039	0.064	0.050

Note: Regression coefficients shown (standard error in parentheses). Base case is aged over 70, identifies as male, Aboriginal and/or Torres Strait Islander, does not have a disability, speaks only English at home, highest level of education is high school completion (year 12 certificate), employed full time, is in the third income quintile, currently lives in NSW, lives in a major city and grew up in a large/capital city.

*Significant at 10% level. **Significant at 5% level. ***Significant at 1% level.

The findings make an important contribution to the existing evidence base on nature connection both within Australia and globally by examining the key characteristics associated with nature connection and assessing the use of different measurement tools. This section will discuss these results in greater detail by firstly highlighting the population groups who showed greater nature connection and how this compares to studies both within Australia and internationally. We then discuss the structural barriers to nature connection identified in this study, before outlining policy levers to help reduce these barriers and enhance opportunities for all to connect with nature.

Our findings highlighted key socio-demographic correlates of nature connection. These included older Australians, individuals identifying as female, Indigenous Australians, individuals who speak a language other than English, individuals with certain educational qualifications, those who are self-employed or work part-time, those who live in regional areas and those who grew up in a rural/regional area.

Many of these demographic findings align with findings from previous studies. For example, higher levels of nature connection have been found for older Australians in the city of Brisbane and the state of Victoria (Lin et al., 2014; Meis-Harris et al., 2019; Selinske et al., 2023), and in the United Kingdom (Barrable & Booth, 2022; Hughes et al., 2019). Those identifying as females have been found to generally have higher nature connection in both Australia (Meis-Harris et al., 2019; Selinske et al., 2023) and internationally, with an analysis of 23 countries finding that males tend to have lower scores on most measures of nature connection, excluding recent nature experiences for which they tend to score higher (Soga & Gaston, 2025). In Israel, people living or growing up in rural areas were found to have higher levels of connection ('relatedness'); though in that study, age, gender and education level were not important predictors (Bashan et al., 2021). Those with tertiary-level education have been found to have higher nature connection in Australia (Lin et al., 2014) and in the USA (especially those studying environmental fields) (Mayer & Frantz, 2004). At a landscape scale, across 14 European countries, Richardson et al. (2022) found that regions with a higher proportion of older residents and higher levels of biodiversity were associated with populations who had higher connection with nature. Unfortunately, at the national level, global syntheses have revealed both a general decline in nature connection (Soga & Gaston, 2025).

Indigenous Australians were identified in our study to have significantly higher nature connection than non-Indigenous Australians when using the INS. This finding is not surprising, given that Indigenous Australian culture is notable for a deep and profound connection to Country (Altman & Kerins, 2012; Sangha et al., 2015; Yap & Yu, 2016). This is also true of Indigenous communities around the world (Gall et al., 2021; Lines et al., 2019; Reed, 2020). It should be noted, however, that this finding was not evident when using the CN-12 to measure nature connection. Given that the CN-12 was developed on a predominantly Western sample, these conflicting findings may be a result of this tool not accurately representing Indigenous Australians' conceptualisations of nature. Concerns have been raised that nature connection instruments have been

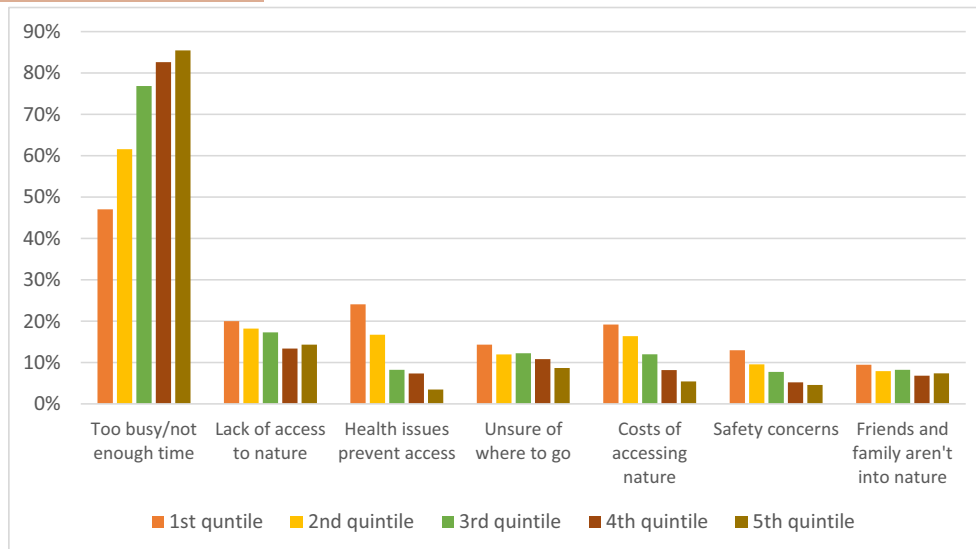


FIGURE 5 Barriers to nature connection by income quintile.

developed primarily based on studies conducted with samples in Western countries and thus may have limited relevance to more diverse ways of knowing and connecting with non-human nature (Keaulana et al., 2021; Sedawi et al., 2021; Taylor, 2018). We recommend that further research consider how and why different scales might be variably relevant to Indigenous communities and culturally and linguistically diverse communities more broadly so that appropriate tools can be used (or developed) to understand the population of interest.

Socio-economic development level, biodiversity level and land use are associated with connection to nature though these associations can be positive or negative depending on the nature connection measure (Soga & Gaston, 2023). Combined, these findings suggest that landscape features such as access to nature are important in predicting connection. However, access to local nature and urban versus rural residence are not always predictors of connection with nature (Meis-Harris et al., 2019; van Eeden et al., 2023); populations are heterogeneous and cultural, demographic and individual factors may drive connection with nature more so than access to nature (Selinske et al., 2023). Our findings accord with this in that while there appeared to be a link between environmental visitation and nature connection for some groups, certain population groups had higher levels of nature connection despite having lower levels of visitation.

In our study, we found that those who speak a language other than English at home have a higher connection to nature. This finding aligns with previous research conducted in Australia (Meis-Harris et al., 2019; Selinske et al., 2023). There are numerous possible explanations for this, one of which is a higher nature connection arising from cultural or way of living influences. Individuals who speak a language other than English are likely to have been born overseas or born in Australia to parents who immigrated from other countries. According to the 2021 census, 51.5% of Australian residents were either born overseas or have a parent who was born overseas

(Department of Home Affairs, 2024). The five most common languages spoken at home after English are Mandarin (2.7%), Arabic (1.4%), Vietnamese (1.3%), Cantonese (1.2%) and Punjabi (0.9%) (Australian Bureau of Statistics, 2022c). Some cultures, particularly those from non-Western contexts, have a worldview that fosters a close relationship between nature and humans (Lengieza et al., 2023). Therefore, it is not surprising that those who are linguistically diverse showed a higher connection to nature across both scales and a higher connection to nature. Given Australia is a highly multicultural country (Department of Home Affairs, 2024), individuals who are migrants or children of migrants are likely to continue practicing their cultural activities, such as speaking their own language at home and celebrating their cultural events or ceremonies.

Despite the higher levels of nature connection reported by those who speak a language other than English at home, there were key barriers for this group to accessing nature. Being unsure of where to go was one. This could be due to unfamiliarity with the local context or due to language barriers in accessing related information. Given that over one fifth of Australia's population speaks a language other than English at home (Australian Bureau of Statistics, 2022b), this is an important barrier to overcome to further enhance nature connection amongst this population.

Our research identified numerous structural barriers to engaging with nature and shows parallels between inequities of nature access and health inequities. It is well established that people on low incomes with lower levels of education experience poorer health outcomes (Brown & Homan, 2023). These same indicators of social determinants of health—the conditions of daily life—are associated with lower levels of nature connection. People experiencing structural barriers to health and well-being are also faced with structural barriers to nature connection: a double bind, in effect. Conversely, if people with high levels of education, income and employment have greater nature connection, they are most likely afforded even greater opportunity for good health (Barragan-Jason et al., 2023).

This finding suggests an important role for public health policies, with great promise for addressing this discriminatory situation. The incorporation of nature connection initiatives and opportunities into health promotion and preventative health strategies, for example, could be a simple step to create positive socio-ecological determinants of health and help to restore health inequities (Jackson, 2017).

Another significant nature connection inequity with policy implications is that accessing nature is prohibitive to some people due to cost. Cost may include the actual price of accessing natural spaces—from ticketed entry to parks, or high-end glamping and guided bush-walking tours. We need parks, wetlands, beaches and wilderness areas that are publicly accessible and free to ensure equitable access. Cost may also refer to the cost of travel to access nature. In many places, the availability of free green space is increasingly diminished (Colding et al., 2020). People who live without 'nearby nature' (nature that is proximal to the places people live (Kaplan, 1992)) can only generate their connection experience by going elsewhere. Compounding this cost is that travel can also be difficult for people with disabilities or health issues, requiring additional supports. The implications for urban planning policies are evident: free and open green spaces within walking distance of everyone's home would be an invaluable strategy for enhancing nature connection. The benefits would not only be for people without a home garden space but also for those for whom transport is difficult or unaffordable—rectifying multiple social and health inequities.

Our findings also indicate that although an embodied experience of nature is important (physically accessing nature), so too is enabling an emotional affinity (Richardson et al., 2022). This means that not only is the quantity and location of accessible green spaces important, so too is the quality of those spaces (Oh et al., 2022). Triguero-Mas et al. (2021) found an unsavoury practice of government and private housing organisations was using the green space branding to sell housing, while not attending to pollution and other environmental degradation at those same sites. Attention to design principles, and incorporating green space and environmental management strategies into local, state and national environment policy areas, is crucial to ensure that the benefits of nature connection are maximised.

6 | CONCLUSION

Our research points to various ways that policy reforms can help enhance nature connection across Australia and globally. Firstly, the significance of the childhood environment highlights the importance of enhancing access to nature, especially for those in urban areas. As around 85% of Australians live in cities (Coffee et al., 2016; Ruming & Baker, 2021) and urban areas are becoming more populated and compact, green space availability is becoming more limited (Haaland & van den Bosch, 2015; Lin et al., 2015). While much of the focus of policy in the past decade has been on increasing the availability of green space in cities (Aronson et al., 2017; Threlfall et al., 2017), a

greater understanding of motivations to be in nature suggests that improving the quality is also important. Increasingly, research is showing that an individual's level of nature connection is associated with how mindfully an individual interacts with nature, which in turn can act as a moderating factor for well-being (Chang et al., 2024; Dean et al., 2018; Pritchard et al., 2020). Therefore, policies that consider how to increase nature contact but also create opportunities for meaningful interactions with nature for people can then increase the benefits accrued.

It has been suggested that increasing opportunities for young people to interact with nature is important, as well as supporting older people's involvement in conservation, plus focusing on the need to target and direct various policies. Our results support these recommendations, showing the importance of the childhood living environment for nature connection and the need to support older people to continue active engagement in conservation and other pro-environmental behaviours.

Our study indicates the need for additional research on nature connection in Australia and internationally. Firstly, our findings indicated some differences across the measurement tool used. Notably, Indigenous Australians were found to have higher nature connection when using the INS, but not the CN-12. Further research is needed to examine the appropriateness of global nature connection measurement tools amongst Indigenous and non-Western communities. Secondly, our analysis identified that the demographic predictors of nature connection and time spent in nature are not always consistent. Further research that examines this complex relationship would help guide policy on how enhancing time nature can better facilitate greater nature connection. Finally, not having enough time was noted as a key barrier to spending more time in nature, with those on higher incomes being significantly more likely to note this compared to those on lower incomes. Qualitative research could help shed light on why this might be the case, and how policy reform can lessen time poverty to enable people to spend more time in nature.

Being connected with nature can enrich the lives of individuals and help support people to develop greater awareness of the importance of our natural environment. Through socio-environmental policy levers such as increasing green space in urban areas, enhancing opportunities for meaningful interactions with nature, and addressing structural inequalities to nature connection for certain groups, we can enhance nature connection to improve both well-being and the health of the planet. With the world facing global environmental and sustainability challenges, enhancing nature connection can help generate positive change for both people and the planet.

AUTHOR CONTRIBUTIONS

Emily J. Flies and Pauline Marsh conceived the ideas and designed the methodology; Emily J. Flies, Pauline Marsh, Kate Lee, Brenda B. Lin and Lily M. van Eeden designed the survey; Emily J. Flies collected the data; Kate Sollis analysed the data and led the writing of the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflict of interest to report.

DATA AVAILABILITY STATEMENT

This study draws on data collected through the 'Benefits of Nature Connection' national survey, enumerated in July 2023. Requests for access to the de-identified data can be made through the University of Tasmania for approval by the project investigators.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Table S1. Sample characteristics.

Table S2. Variance inflation factor analysis.

Table S3. Models identifying relationships between socio-demographic variables and time spent in nature.

Table S4. Associations between socio-demographics and CN-12 dimensions.

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