

# Conservation concern among Australian undergraduates is associated with childhood socio-cultural experiences

Jessica Pinder<sup>1</sup>  | Kelly S. Fielding<sup>2</sup>  | Richard A. Fuller<sup>1</sup> 

<sup>1</sup>School of Biological Sciences, University of Queensland, Brisbane, Qld, Australia

<sup>2</sup>School of Communication and Arts, University of Queensland, Brisbane, Qld, Australia

## Correspondence

Jessica Pinder  
Email: j.pinder@uq.net.au

Handling Editor: Jo Birch

## Abstract

1. Fostering widespread concern for conservation problems requires a robust understanding of the life experiences that positively contribute to an individual's conservation attitudes and behaviours. However, few studies have assessed a comprehensive range of social and experiential predictors of conservation concern.
2. Using survey responses from 391 undergraduate students enrolled in various course disciplines across Australia, we describe the relationships between five major constructs of early-life experiences and two measures of conservation concern: a preference for a conservation career and positive conservation attitudes.
3. We find that conservation career preferences are positively associated with childhood preferences for nature-related books, movies and school subjects, biospheric family value orientations and environmental volunteering. Conservation attitudes were positively associated with biospheric family value orientations and environmental volunteering.
4. Both constructs were negatively associated with egoistic family values and childhood experiences of nature were not a significant factor in either of our models.
5. This suggests that limited nature experiences do not necessarily impede the development of conservation concern in young Australians, and that family values and experiences with environmental organizations, nature-related storylines and school subjects may help to foster greater conservation concern.

## KEYWORDS

childhood, conservation career, conservation psychology, environmental attitudes, environmental education, environmental psychology, significant life experiences, socialization, value orientations

## 1 | INTRODUCTION

For decades, efforts to conserve the earth's biodiversity have relied upon scientific interventions to monitor and restore ecological systems (Soulé, 1985). While this work has critical value, it has limited ability to address the root cause of many conservation problems, which stem from exploitative human attitudes and behaviours

towards the environment (Klößner, 2013; Saunders, 2003; Steg & Vlek, 2009). To develop lasting solutions to this broader issue, we must look to research that informs our understanding of how conservation concern develops. Significant life experience research is one such area of study that investigates the social and environmental factors that operate throughout the lifespan, to identify formative experiences that have influenced the trajectory of a person's

This is an open access article under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2020 The Authors. *People and Nature* published by John Wiley & Sons Ltd on behalf of British Ecological Society

life course (Chawla & Derr, 2012; Wells & Lekies, 2012). This and other social science fields including conservation psychology have significant potential to fill critical gaps in our knowledge of how conservation concern develops (Bennett et al., 2017; Saunders, 2003).

A wealth of prior research has found that environmentalists often recall childhood play experiences in natural environments as an influence on their conservation attitudes and behaviour (Bixler, Floyd, & Hammit, 2002; Chawla, 1999; Easton, Koro-Ljungberg, & Cheng, 2009; Ewert, Place, & Sibthorp, 2005; Palmer, Suggate, Robottom, & Hart, 1999; Prévot, Clayton, & Mathevet, 2018; Tanner, 1980; Vadala, Bixler, & James, 2007). There is some evidence that childhood experiences of wild nature, such as wildland play and exploring, have a positive association with conservation behaviour as an adult (Kahn & Kellert, 2002; Tanner, 1980; Wells & Lekies, 2006). Other research indicates that domesticated nature, including urban parks and gardens, can also have an influential role (Chawla & Derr, 2012; Soga, Gaston, Yamaura, Kurisu, & Hanaki, 2016). In addition, studies have associated childhood nature play with preferences for environmental activities (Bixler et al., 2002), empathy for living things (Chawla, 2009), connectedness to nature (Dutcher, Finley, Luloff, & Johnson, 2007) and have even identified its benefits for human health and wellbeing (Keniger, Gaston, Irvine, & Fuller, 2014; Martyn & Brymer, 2016; Nisbet, Zelenski, & Murphy, 2011; Zelenski & Nisbet, 2014). Some now caution that a decline in outdoors play is having a strong negative impact on young people (Louv, 2008; Miller, 2005; Pergams & Zaradic, 2008; Soga & Gaston, 2016). This is particularly concerning given the widespread and increasing loss of natural environments that is occurring globally, coupled with urbanization trends which may further distance people from nature (UNESA, 2019).

Given this evidence, there is mounting concern that reduced access to play in natural environments is creating a parallel decline in the conservation concern of young people. However, there are several pieces of countervailing evidence, including that children who have grown up in urban environments are in some cases more environmentally concerned (Dietz, Stern, & Guagnano, 1998; Van Liere & Dunlap, 1980) and have greater love for nature (Broom, 2017) than rural children, and that younger generations, who have more limited access to natural areas than any previous generation, have been observed to have greater environmental awareness than older persons (Fransson & Garling, 1999). Therefore, to improve our understanding of how conservation concern relates to experiences of nature, it will be important to consider a comprehensive range of possible alternative influences (Chawla, 2007; Gifford & Chen, 2016) such as interpersonal relationships, influential persons, organizational affiliations, place attachment, education, media, values and norms (Chawla & Derr, 2012; Wells & Lekies, 2012).

In this study, we explore the role of five major life experience dimensions for predicting conservation concern, drawn from the environmental psychology and significant life experience literature. The first of these is *Childhood nature experiences*, which are the physical experiences of play or immersion in nature that are consistently cited as salient influences in an environmentalist's life course (Bixler et al., 2002; Chawla, 1999; Easton et al., 2009; Ewert et al., 2005; Palmer et al., 1999;

Vadala et al., 2007). Second is *Nature-related cultural narratives*, which describe the emotional connections that children develop to storylines communicated through books and media. A childhood connection to cultural narratives that communicate value for, and awareness of, the natural world may be one ingredient in developing conservation concern (Chawla & Cushing, 2007; Deruiter, 2002; Finger, 1994; Hsu, 2009). The third dimension is childhood involvement in *Environmental organizations* (Chawla, 1999; Hsu, 2009; Place, 2004). In adults, membership in environmental groups is associated with readiness to take pro-environmental action (Fielding, McDonald, & Louis, 2008; Olli, Grendstad, & Wollebaek, 2001), and it is possible that childhood memberships could serve a similar function. Fourth, we consider the role of formal *Environmental education* in schools, in particular student perceptions of environmental problems as defined in part two of the 1977 Tbilisi Declaration (McComas, 2014; UNESCO, 1978). Environmental education is an important variable, as it is known to produce measurable increases in nature connectedness and conservation attitudes in children (Ballantyne, Fien, & Packer, 2001; Garner, Taft, & Stevens, 2015; Leisher et al., 2012; Liefländer, Fröhlich, Bogner, & Schultz, 2013).

Lastly, the environmental psychology literature points to the importance of values as predictors of pro-environmental behaviour (Finger, 1994; Fransson & Garling, 1999; Stern, Dietz, Abel, Guagnano, & Kalof, 1998). Value orientations, which are defined as guiding principles in a person's life, fall into one of three categories: biospheric, altruistic and egocentric (Schultz, 2001). Biospheric values are based on the core belief that nature is intrinsically valuable, and prior research has discovered that biospheric value orientations are positively associated with conservation behaviours, beliefs and intentions (De Groot & Steg, 2008; Stern, 2000; Stern & Dietz, 1994), whereas egocentric values are linked to less pro-environmental action (De Groot & Steg, 2008; Munroe, 2003; Stern, 2000; Stern & Dietz, 1994). Although not tested previously, it is possible that *Family value orientations*, which are the value orientations held by an individual's close family, might influence a child to express high levels of conservation concern in adulthood.

Despite the significant research interest in the relationship between early-life experiences and adult environmentalism, no study has yet evaluated the full range of possible predictors of conservation concern, whilst simultaneously accounting for common sources of bias in study design. For example, many significant life experience studies are based on open-ended retrospective reports of persons with a mean age over 30 years (Chawla, 1999; Hsu, 2009; Tanner, 1980; Wells & Lekies, 2006). This is problematic because some researchers strongly caution against the use of retrospective reports (Henry, Moffitt, Caspi, Langley, & Silva, 1994) because people tend to recall their past attitudes as being the same as their current ones, even though they change significantly over time (Koriat, Goldsmith, & Pansky, 2000). To limit the influence of retrospection bias in this study, we have selected a young sample group with a mean age of 21 years. Social desirability bias (Van de Mortel, 2008) can also influence the honesty of responses when participants are aware of the hypothesis of the study (Vining & Ebero, 2002), as is the case when studies sample only environmentalists and ask open questions that reduce the transparency of the research,

such as 'what are the childhood experiences that influenced you to take action for the environment?' (Chawla, 1999; Hsu, 2009; Li & Chen, 2014; Tanner, 1980). In the current study, we attempt to reduce social desirability bias by including distracter questions to reduce study transparency (John, Edwards-Jones, Gibbons, & Jones, 2010). Finally, since many prior studies have limited their samples to environmentalists, we consider it important to consider the life experiences of persons from a variety of career interests who may be engaging in pro-environmental behaviour (Tanner, 1998).

Here we seek to determine the relative contribution of different early-life experiences to predicting (a) conservation concern in early adulthood and (b) intention to follow a conservation related career path. We examine the role of family values, alongside the physical and educational experiences that are more commonly studied. This integrative approach helps unite psychological and phenomenological bodies of literature and explain their relative influence on conservation concern.

## 2 | METHODS

### 2.1 | Participants and procedure

This study was approved in accordance with the National Statement of Ethical conduct in Human Research under the guidelines and processes of the University of Queensland Human Research Ethics Approval (Approval No: 2018/001857). Researchers approached participants through social media by accessing university groups over Facebook<sup>®</sup>. Though this was a convenience sample, we made efforts to represent a broad variety of academic course streams across Australia. This was achieved by tracking responses and actively marketing the questionnaire to a broad range of different university groups. Informed written consent for data use was obtained from all participants prior to commencing the questionnaire.

Between 27 September and 14 October 2018, 500 Australian undergraduate students responded to our questionnaire survey through SurveyMonkey<sup>®</sup>. To minimize the influence of retrospection bias (Sachar & Eckstein, 2007) the sample group was condensed to the 391 participants  $\leq 25$  years of age, reducing the mean respondent age to  $21.0 \pm 1.8$  years. Most respondents (74.7%) identified as female ( $N = 292$ ,  $N = 99$  males), which is a common pattern in volunteer sample groups (Hsu, 2009; Villacorta, Koestner, & Lekes, 2003). Almost a third of all respondents (29.2%;  $N = 114$  students) were enrolled in conservation related courses such as wildlife biology or environmental management, and the remainder (70.8%) were studying in non-conservation fields. Only 15.3% ( $N = 60$ ) of our sample population spent most of their childhood outside Australia.

### 2.2 | Measures

The survey instrument comprised seven sections (Table 1; Table S1). The first section related to demographics and our first dependent

variable: conservation career choice. The subsequent five sections evaluated level of exposure to the life-experience constructs, and the last section concerned our second dependent variable: conservation attitudes (measured by the Nature Relatedness-Perspective sub-scale). Six-point Likert-type scales were chosen to measure the three constructs of early-life experiences: nature experiences, environmental education and family values, for their increased sensitivity, elimination of the neutral point and normal distribution (Leung, 2011). Cultural narratives, environmental organizations and favourite subjects/ teachers were measured either by multiple choice or open-ended questions. To verify the content and face validity of the survey instrument, three experts in survey design were consulted and the instrument was modified according to their suggestions. A pilot test at a local wildlife sanctuary ( $N = 10$ ) helped us assess the length and clarity of the questionnaire and resulted in slight improvements to the wording.

*Preference for conservation career* was determined by manually coding open-ended responses for preferred career choice into two categories; '1 = Conservation related' and '0 = Other'. Career choice was validated against enrolled degree, to clarify any areas of ambiguity (e.g. a career preference for *Research/Academia* was only identified as a conservation career if the student was enrolled in a conservation discipline such as *Bachelor of Wildlife Science*). Keywords that were coded into the conservation category included 'Ecology', 'Environment', 'Conservation', 'Marine Biology', 'Wildlife' and 'Nature'.

*Conservation attitudes* were measured with the Nature Relatedness (NR) perspective sub-scale of the Nature Relatedness scale (Nisbet, Zelenski, & Murphy, 2009). The NR-perspective sub-scale evaluates an eco-centric worldview and is assessed with seven items. The mean of these items had adequate internal consistency (Cronbach's  $\alpha = 0.71$ ).

#### 2.2.1 | Nature and animal play

Firstly, respondents were asked about the frequency of their childhood experiences with ten different urban and natural play environments on a 6-point Likert-type scale (1 = *never*, 6 = *most days*). *Nature play* items were adapted for an Australian audience from an established scale by Bixler et al. (2002), to include relevant landscapes such as backyards, beaches and bushland. Principle axis factoring using the varimax rotation revealed that three nature play items ('Paddock', 'Bush' and 'Pond') positively loaded onto Factor 1, which had an eigenvalue of 2.54 and accounted for 36.3% of the variance. Factor 2 comprised three items representing *Urban play* areas, including 'Skate park', 'Laneway' and 'Park'. 'Indoors' was removed due to lack of variation, and 'Courtyard' excluded because it loaded onto two factors. Since the final *Urban play* scale was discovered to have low internal reliability (Cronbach's  $\alpha = 0.59$ ), we discounted this construct from further analysis.

Although we originally conceptualized nature and animal play as separate variables, the two scales were highly correlated. We therefore combined them to form one scale assessing the extent to which respondents engaged in nature and animal play in their childhood. Factor 1 comprising *Nature play* items was combined with the *Animal*

| Construct                    | Measure                     | Items  | Cronbach's $\alpha$ |
|------------------------------|-----------------------------|--|---------------------|
| Childhood nature experiences | Nature and animal play      | Farm paddock<br>Bush/forest<br>Ponds, rivers or streams<br>Farm animals<br>Animals that could hurt me (snakes etc.)<br>Native wildlife | 0.87                |
|                              | Family nature experiences   | Beaches<br>National parks<br>Mountains<br>Campgrounds<br>Lakes/rivers  | 0.79                |
|                              | Family urban experiences    | Resorts<br>Theme parks<br>Hotels<br>Cruise ships<br>Cities   | 0.77                |
| Cultural narratives          | Nature books                | Books about animals<br>Kids adventuring in nature<br>Other   |                     |
|                              | Nature movies               | Natural world<br>Pets or farm animals<br>Other   |                     |
| Environmental organizations  | Environmental volunteering  | Environmental groups<br>Animal shelters<br>Other   |                     |
|                              | Outdoor clubs and societies | Environment club<br>Wilderness skills<br>Guides and scout groups<br>Other  |                     |
| Environmental education      | School education            | Environmental problems   |                     |
|                              | Favourite subject           | Geography<br>Biology<br>Environment<br>Other   |                     |
|                              | Favourite teacher           | Geography<br>Biology<br>Environment<br>Other   |                     |
| Socialization experiences    | Egoistic family values      | Authority<br>Wealth<br>Being ambitious<br>Power<br>Being influential   | 0.92                |
|                              | Biospheric family values    | Respecting the earth<br>Preventing pollution<br>Unity with nature<br>Protecting the environment  | 0.72                |

**TABLE 1** Summary of the final measures and items used for analysis

*interactions* scale, which measured the frequency of childhood interactions with 5 different types of animals (e.g. native wildlife, farm animals; 1 = *never*, 6 = *most days*). Three items, 'Beach', 'Backyard' and 'Zoos', were removed from this analysis because they either lacked variance, were highly skewed or did not load with other items in the factor analysis (respectively). The mean of the final six items formed our *Nature and animal play* scale, that had adequate internal reliability (Cronbach's  $\alpha = 0.87$ ).

*Family holiday experiences* were measured with ten items, assessing the frequency of family visits to environments that were predominantly urban (e.g. 'City', 'Theme park') and natural (e.g. 'National park', 'Campground'; 1 = *never*, 6 = *always*). Principal axis factoring showed that five nature-based experience items ('Beach', 'National parks', 'Mountains', 'Campgrounds' and 'Lakes or rivers') positively loaded onto Factor one, which had an eigenvalue of 2.87 and accounted for 31.9% of the variance. Four items,

'Resorts', 'Theme parks', 'Cities' and 'Hotels' positively loaded on Factor 2 (eigenvalue 2.37, 26.4% of variance explained). Hence, a *Family nature experiences* scale was created by taking the mean of the five items (Cronbach's  $\alpha = 0.79$ ) and a *Family urban experiences* scale was computed by taking the mean of the four urban items (Cronbach's  $\alpha = 0.77$ ).

*Cultural narratives* were assessed using two measures called *Nature books* and *Nature movies*. The first measure, relating to television shows and movies, requested that respondents identify three categories of media which they watched most frequently prior to 10 years of age. Of ten possible choices, two items related to the environment or wild-life ('*Natural world*' and '*Pets and farm animals*') which were used to assess preferences for nature-related storylines. Using the same format, we assessed favourite books and bedtime stories, using two of eight possible items to identify a preference for nature-based cultural narratives ('*Kids adventuring in nature*' and '*Books about animals*'). For both measures, respondents were free to offer alternatives using the 'Other' response option. All responses were coded so that nature-based preferences were designated as 1 and non-nature-based preferences were coded as 0. We then computed new variables by summing response scores, the final measure therefore ranging from 0 to 4.

*Environmental organizations* were assessed using two items. The first assessed involvement in *Outdoors groups* and asked about clubs and societies that participants were involved in during childhood. Respondents selected all applicable options out of ten possible activities that included three focal items reflecting nature orientation ('*Guides and scout groups*', '*Environment clubs*' and '*Wilderness skills*'). The second question, assessing *Environmental volunteering*, asked respondents to self-report any long-term volunteering they had undertaken across seven categories of organizations, with the focal items being '*Animal shelters*' and '*Environmental groups*'. For both measures, the choice of an 'Other' option was available and these open-ended responses were later coded into appropriate categories. A score of 1 was given to each environmentally related group, yielding a total score that could range from 0 to 3 for *Outdoors groups*, and 0 to 2 for *Environmental volunteering*.

*Environmental education* was assessed by asking respondents to self-assess the quality of their formal school education relating to '*International politics*', '*Humanitarian issues*', '*Environmental problems*' and '*Science & technology*'. These items were measured using a six-point Likert-type scale (1 = *extremely inadequate*, 6 = *extremely adequate*). Of these four categories, '*Environmental problems*' was our key focus (UNESCO, 1978), whilst the remaining three subject areas were included to reduce transparency about the aims of the study. Participants were also asked to report their *Favourite subject* and the subject taught by their *Favourite teacher* (Place, 2004). Open-ended responses that included keywords such as '*Geography*', '*Biology*' and '*Environment*' were recoded into '1 = *Conservation related*' and the remainder into '0 = *Other*'.

*Family value orientations* were assessed by adapting an established scale assessing egoistic, biospheric and altruistic values (De Groot & Steg, 2008). Respondents were asked to rate how important they felt each of thirteen items were to their immediate family members,

on a nine-point scale (-1 = *Goes against my family principles*, 0 = *No importance*, 7 = *Very important*), and mean scores for each value orientation were calculated across items. As pro-environmental beliefs positively relate to biospheric value orientations, and negatively relate to egoistic values (Schultz et al., 2005), only these two value orientations (and not altruistic values) are considered in our analyses. We found that the internal reliability of both the *Biospheric family values* and *Egoistic family values* sub-scale measures were satisfactory (Cronbach's  $\alpha = 0.92$ , 0.72, respectively). In addition to family value orientations, we also measured injunctive and descriptive family social norms in our survey instrument. However, we did not include these measures in the final analyses, as there was a high correlation between the injunctive norm, descriptive norm and biospheric family value orientation measures ( $r(390) = 0.713$ ,  $p < 0.001$ ). We chose to include values rather than norms, since the former are expected to be more stable and more likely to have a formative influence.

Typical demographic control variables such as age, gender and country of childhood residency were collected at the beginning of the survey, since these factors are likely to influence environmental attitudes and behaviour (Fransson & Garling, 1999).

### 2.3 | Statistical analysis

Pearson's correlations were computed to explore bivariate relationships between our dependent variable of conservation attitudes (NR-perspective), and the 16 measures of early-life experiences. This allowed us to correct for any instances of multicollinearity, or high correlations between our independent variables (Pallant, 2013). We used logistic regression to evaluate predictors of our categorical dependent variable, conservation career choice and hierarchical multiple regression to evaluate the influence of the predictors on the continuous dependent variable: conservation attitudes (NR-perspective). The hierarchical method was chosen to identify whether each early life construct uniquely explained a significant proportion of variance in conservation attitudes. Hence the first step of our model included demographic variables, followed by nature experiences, cultural narratives, environmental education, environmental organizations and family value orientations.

Prior to conducting these analyses, we ensured that both models satisfied standard parametric assumptions, including those of normality, linearity and homoscedasticity. We confirmed that the tolerance of all variables was above 0.10, and variance inflation factor was below 10 (Pallant, 2013). Statistical analyses were completed in 2018 using IBM SPSS Statistics 25.

## 3 | RESULTS

Of our predictor variables, only *Urban family experiences* and *Environmental education* in school were not significantly related with conservation attitudes as measured by NR-perspective (Table 2). Predictor variables *Nature and animal play*, *Family nature experiences*,

**TABLE 2** Pearson's correlations between the conservation attitudes of Australian undergraduates (N = 367) as measured by the NR-perspective (Nisbet et al., 2009) and the thirteen possible predictor variables of early-life experiences

|                               | M    | SD   | 1        | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9       | 10       | 11       | 12      | 13 |
|-------------------------------|------|------|----------|---------|---------|---------|---------|---------|---------|---------|---------|----------|----------|---------|----|
| 1. Animal and nature play     | 5.91 | 2.10 | 1        |         |         |         |         |         |         |         |         |          |          |         |    |
| 2. Family nature experiences  | 3.08 | 0.96 | 0.525**  | 1       |         |         |         |         |         |         |         |          |          |         |    |
| 3. Family urban experiences   | 2.74 | 0.87 | -0.242** | 0.065   | 1       |         |         |         |         |         |         |          |          |         |    |
| 4. Nature books               | 0.70 | 0.67 | 0.305**  | 0.278** | -0.126* | 1       |         |         |         |         |         |          |          |         |    |
| 5. Nature movies              | 0.81 | 0.68 | 0.396**  | 0.292** | -0.081  | 0.368** | 1       |         |         |         |         |          |          |         |    |
| 6. Environmental volunteering | 0.29 | 0.55 | 0.156**  | 0.130*  | -0.037  | 0.214** | 0.249** | 1       |         |         |         |          |          |         |    |
| 7. Outdoors groups            | 0.51 | 0.74 | 0.171**  | 0.180** | 0.000   | 0.166** | 0.097   | 0.287** | 1       |         |         |          |          |         |    |
| 8. Environmental education    | 4.77 | 1.04 | 0.071    | 0.064   | 0.110*  | 0.071   | -0.022  | 0.088   | 0.067   | 1       |         |          |          |         |    |
| 9. Favourite subject          | 0.24 | 0.43 | 0.133**  | 0.127*  | -0.003  | 0.181** | 0.164** | 0.193** | 0.058   | 0.133** | 1       |          |          |         |    |
| 10. Favourite teacher         | 0.21 | 0.42 | 0.183**  | 0.112*  | -0.121* | 0.150** | 0.165** | 0.184** | 0.092   | 0.075   | 0.341** | 1        |          |         |    |
| 11. Egoistic family values    | 3.41 | 1.38 | -0.068   | -0.095  | 0.271** | -0.125* | -0.076  | -0.077  | -0.024  | 0.116*  | -0.035  | -0.169** | 1        |         |    |
| 12. Biospheric family values  | 3.91 | 1.87 | 0.431**  | 0.456** | 0.054   | 0.183** | 0.245** | 0.162*  | 0.146** | 0.168** | 0.129*  | 0.104*   | -0.031   | 1       |    |
| 13. NR-perspective            | 4.64 | 0.78 | 0.201**  | 0.248** | 0.022   | 0.173** | 0.178** | 0.285** | 0.121*  | -0.064  | 0.173** | 0.129*   | -0.151** | 0.259** | 1  |

\*p < 0.05; \*\*p < 0.01. Two-tailed.

*Nature books, Nature movies, Outdoors groups, Environmental volunteering, Environmental education, Nature related subjects, Favourite teacher and Biospheric family values* were significantly correlated with NR-perspective, with variables exhibiting varying strengths of positive association, except for *Egoistic family values* which was negatively associated.

### 3.1 | Focal analyses

#### 3.1.1 | Conservation career preference

Direct logistic regression was performed to evaluate the contribution of our independent variables upon preference for conservation career (Table 3). The full model containing 15 predictor variables, was statistically significant,  $\chi^2(15, N = 348) = 160.965, p < 0.001$ , suggesting it was able to distinguish respondents who preferred conservation careers from those attracted to other disciplines. The full model explained between 37.0% (Cox and Snell  $R^2$ ) and 54.1% (Nagelkerke  $R^2$ ) of the total variance in career preferences, and correctly identified 84.5% of cases. Seven of the 15 predictor variables made a significant contribution to the full model. Ranked in order of beta value, they are *Environmental volunteering, Favourite subjects, Favourite teacher, Nature books, Nature movies, Egoistic family values* and *Biospheric family values*. Respondents with conservation career preferences were over five times more likely to have engaged in environmental volunteering ( $\text{Exp}(B) = 5.422$ ), three times more likely to have preferred environment related subjects ( $\text{Exp}(B) = 3.080$ )

and twice as likely to have favourite teachers who taught environment related subjects ( $\text{Exp}(B) = 2.424$ ). *Cultural narratives* were also significant predictors, as undergraduates with conservation career preferences were almost twice as likely to have preferred nature related story lines in early childhood ( $\text{Exp}(B) = 1.967$  for *Nature books*;  $\text{Exp}(B) = 1.937$  for *Nature movies*). Finally, as shown by the odds ratio of 1.264, students with conservation career preferences were more likely to have been exposed to *Biospheric family values* in childhood, and less likely to have experienced *Egoistic family values* ( $\text{Exp}(B) = 0.723$ ).

#### 3.1.2 | Conservation attitudes (NR-perspective)

The results of the hierarchical multiple linear regression are presented in Table 4. Prior to running the model, preliminary analyses were conducted to ensure the data conformed to the assumptions of normality, multicollinearity, linearity and homoscedasticity. Ten residual outliers which exceeded the maximum Mahalanobis distance or Cook's distance were removed in this process.

A summary of the proportion of variance explained at each step is shown in Table 5. *Demographics, Childhood nature experiences, Environmental volunteering* and *Family value orientations* were each statistically significant predictors of the conservation attitudes, after all other variables in the model prior were considered. The final model containing all 15 variables explained 52.5% of the variation in conservation attitudes and was statistically significant ( $F(15, 331) = 8.383, p < 0.001$ ). Of the demographic variables, *Sex*

**TABLE 3** Logistic regression analysis of 15 independent variables used to predict the likelihood of conservation career preferences in Australian undergraduates ( $N = 348$ )

|                             | B      | SE    | Wald   | df | Sig.     | Odds ratio | 95% confidence interval for odds ratio |        |
|-----------------------------|--------|-------|--------|----|----------|------------|--|--------|
|                             |        |       |        |    |          |            | Lower                                  | Upper  |
| Sex                         | -0.70  | 0.376 | 0.034  | 1  | 0.853    | 0.933      | 0.446                                  | 1.948  |
| Age                         | 0.116  | 0.091 | 1.627  | 1  | 0.202    | 1.123      | 0.940                                  | 1.342  |
| Nationality                 | 0.025  | 0.221 | 0.013  | 1  | 0.909    | 1.026      | 0.665                                  | 1.581  |
| Animal and nature play      | 0.122  | 0.101 | 1.460  | 1  | 0.227    | 1.130      | 0.927                                  | 1.378  |
| Family nature experiences   | -0.181 | 0.221 | 0.667  | 1  | 0.414    | 0.835      | 0.541                                  | 1.288  |
| Family urban experiences    | -0.197 | 0.233 | 0.714  | 1  | 0.398    | 0.821      | 0.520                                  | 1.297  |
| Nature books                | 0.676  | 0.268 | 6.380  | 1  | 0.012*   | 1.967      | 1.164                                  | 3.324  |
| Nature movies               | 0.661  | 0.278 | 5.653  | 1  | 0.017*   | 1.937      | 1.123                                  | 3.341  |
| Environmental volunteering  | 1.690  | 0.318 | 28.249 | 1  | 0.000*** | 5.422      | 2.907                                  | 10.112 |
| Outdoor clubs and societies | -0.157 | 0.235 | 0.448  | 1  | 0.503    | 0.855      | 0.539                                  | 1.354  |
| School education            | 0.049  | 0.164 | 0.090  | 1  | 0.765    | 1.050      | 0.761                                  | 1.450  |
| Favourite subject           | 1.125  | 0.369 | 9.295  | 1  | 0.002**  | 3.080      | 1.494                                  | 6.348  |
| Favourite teacher           | 0.885  | 0.369 | 5.768  | 1  | 0.016*   | 2.424      | 1.177                                  | 4.993  |
| Egoistic family values      | -0.324 | 0.133 | 5.960  | 1  | 0.015*   | 0.723      | 0.558                                  | 0.982  |
| Biospheric family values    | 0.234  | 0.113 | 4.273  | 1  | 0.039*   | 1.264      | 1.012                                  | 1.579  |
| Constant                    | -5.594 | 2.386 | 5.498  | 1  | 0.019    | 0.004      |  |        |

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ . Two-tailed.

**TABLE 4** Linear model predictors of conservation attitudes in Australian undergraduates ( $N = 347$ ), measured by NR-Perspective scale, with 95% confidence intervals in parentheses

| Model | Variables                   | Unstandardized coefficients |       | Standardized coefficients ( $\beta$ ) | t      | p        |
|-------|-----------------------------|-----------------------------|-------|---------------------------------------|--------|----------|
|       |                             | B                           | SE    |                                       |        |          |
| 1     | Sex                         | 0.570 (0.406, 0.734)        | 0.083 | 0.346                                 | 6.843  | 0.000*** |
|       | Age                         | 0.053 (0.013, 0.094)        | 0.021 | 0.131                                 | 2.574  | 0.010**  |
|       | Nationality                 | -0.103 (-0.236, 0.029)      | 0.068 | -0.078                                | -1.531 | 0.127    |
| 2     | Sex                         | 0.545 (0.385, 0.706)        | 0.081 | 0.331                                 | 6.702  | 0.000*** |
|       | Age                         | 0.044 (0.003, 0.084)        | 0.020 | 0.107                                 | 2.133  | 0.034*   |
|       | Nationality                 | -0.039 (-0.175, 0.097)      | 0.069 | -0.029                                | 0.575  | 0.575    |
|       | Animal and nature play      | 0.045 (0.002, 0.088)        | 0.022 | 0.125                                 | 2.060  | 0.040*   |
|       | Family nature experiences   | 0.121 (0.030, 0.213)        | 0.046 | 0.154                                 | 2.613  | 0.009*   |
|       | Family urban experiences    | -0.010 (-0.101, 0.082)      | 0.047 | -0.011                                | -0.211 | 0.833    |
| 3     | Sex                         | 0.524 (0.363, 0.684)        | 0.082 | 0.318                                 | 6.406  | 0.000*** |
|       | Age                         | 0.040 (0.000, 0.080)        | 0.020 | 0.098                                 | 1.947  | 0.052    |
|       | Nationality                 | -0.049 (-0.185, 0.087)      | 0.069 | -0.037                                | -0.715 | 0.475    |
|       | Animal and nature play      | 0.032 (-0.013, 0.077)       | 0.023 | 0.089                                 | 1.397  | 0.163    |
|       | Family nature experiences   | 0.106 (0.014, 0.198)        | 0.047 | 0.135                                 | 2.271  | 0.024*   |
|       | Family urban experiences    | -0.004 (-0.095, 0.088)      | 0.047 | -0.004                                | -0.078 | 0.938    |
|       | Nature books                | 0.083 (-0.035, 0.201)       | 0.060 | 0.074                                 | 1.384  | 0.167    |
|       | Nature movies               | 0.078 (-0.043, 0.199)       | 0.062 | 0.069                                 | 1.265  | 0.207    |
| 4     | Sex                         | 0.534 (0.377, 0.691)        | 0.080 | 0.324                                 | 6.698  | 0.000*** |
|       | Age                         | 0.032 (0.007, 0.072)        | 0.020 | 0.080                                 | 1.619  | 0.106    |
|       | Nationality                 | -0.049 (-0.181, 0.084)      | 0.067 | -0.037                                | -0.726 | 0.469    |
|       | Animal and nature play      | 0.030 (-0.013, 0.074)       | 0.022 | 0.082                                 | 1.326  | 0.186    |
|       | Family nature experiences   | 0.105 (0.015, 0.195)        | 0.046 | 0.133                                 | 2.294  | 0.022*   |
|       | Family urban experiences    | -0.015 (-0.104, 0.075)      | 0.045 | -0.017                                | -0.326 | 0.744    |
|       | Nature books                | 0.044 (-0.072, 0.160)       | 0.059 | 0.039                                 | 0.743  | 0.458    |
|       | Nature movies               | -0.012 (-0.109, 0.134)      | 0.062 | 0.011                                 | 0.200  | 0.842    |
|       | Environmental volunteering  | 0.309 (0.162, 0.456)        | 0.075 | 0.213                                 | 4.141  | 0.000*** |
|       | Outdoor clubs and societies | 0.063 (-0.041, 0.167)       | 0.053 | 0.058                                 | 1.189  | 0.235    |
| 5     | Sex                         | 0.524 (0.366, 0.681)        | 0.080 | 0.318                                 | -6.538 | 0.000*** |
|       | Age                         | 0.029 (-0.010, 0.069)       | 0.020 | 0.072                                 | 1.455  | 0.147    |
|       | Nationality                 | -0.147 (-0.180, 0.086)      | 0.067 | -0.035                                | -0.697 | 0.486    |
|       | Animal and nature play      | 0.031 (-0.013, 0.076)       | 0.023 | 0.087                                 | 1.394  | 0.164    |
|       | Family nature experiences   | 0.103 (0.013, 0.193)        | 0.046 | 0.131                                 | 2.252  | 0.025*   |
|       | Family urban experiences    | -0.008 (-0.099, 0.083)      | 0.046 | -0.009                                | -0.175 | 0.861    |
|       | Nature books                | 0.042 (-0.075, 0.159)       | 0.060 | 0.038                                 | 0.711  | 0.477    |
|       | Nature movies               | 0.001 (-0.121, 0.124)       | 0.062 | -0.001                                | -0.023 | 0.981    |
|       | Environmental volunteering  | 0.303 (0.153, 0.453)        | 0.076 | 0.209                                 | 3.969  | 0.000*** |
|       | Outdoor clubs and societies | 0.066 (-0.038, 0.171)       | 0.053 | 0.062                                 | 1.251  | 0.212    |
|       | School education            | -0.049 (-0.120, 0.023)      | 0.036 | -0.066                                | -1.340 | 0.181    |
|       | Favourite subject           | 0.086 (-0.094, 0.266)       | 0.092 | 0.049                                 | 0.934  | 0.349    |
|       | Favourite teacher           | 0.002 (-0.187, 0.190)       | 0.096 | 0.001                                 | 0.020  | 0.984    |
| 6     | Sex                         | 0.539 (0.383, 0.695)        | 0.079 | 0.327                                 | 6.785  | 0.000*** |
|       | Age                         | 0.023 (-0.016, 0.062)       | 0.020 | 0.057                                 | 1.157  | 0.248    |
|       | Nationality                 | -0.048 (-0.180, 0.083)      | 0.067 | -0.036                                | -0.725 | 0.469    |

(Continues)

TABLE 4 (Continued)

| Model | Variables                   | Unstandardized coefficients |       | Standardized coefficients ( $\beta$ ) | t      | p        |
|-------|-----------------------------|-----------------------------|-------|---------------------------------------|--------|----------|
|       |                             | B                           | SE    |                                       |        |          |
|       | Animal and nature play      | 0.023 (-0.022, 0.069)       | 0.023 | 0.065                                 | 1.016  | 0.311    |
|       | Family nature experiences   | 0.052 (-0.042, 0.146)       | 0.048 | 0.066                                 | 1.083  | 0.279    |
|       | Family urban experiences    | 0.008 (-0.084, 0.100)       | 0.047 | 0.009                                 | 0.167  | 0.867    |
|       | Nature books                | 0.034 (-0.082, 0.150)       | 0.059 | 0.031                                 | 0.581  | 0.562    |
|       | Nature movies               | -0.005 (-0.126, 0.116)      | 0.062 | -0.005                                | -0.083 | 0.934    |
|       | Environmental volunteering  | 0.283 (0.134, 0.431)        | 0.076 | 0.195                                 | 3.740  | 0.000*** |
|       | Outdoor clubs and societies | 0.065 (-0.038, 0.168)       | 0.052 | 0.060                                 | 1.238  | 0.217    |
|       | School education            | -0.055 (-0.127, 0.017)      | 0.037 | -0.074                                | -1.512 | 0.131    |
|       | Favourite subject           | 0.096 (-0.082, 0.274)       | 0.090 | 0.055                                 | 1.060  | 0.290    |
|       | Favourite teacher           | -0.028 (-0.216, 0.159)      | 0.095 | -0.016                                | -0.298 | 0.766    |
|       | Egoistic family values      | -0.062 (-0.117, -0.007)     | 0.028 | -0.112                                | -2.215 | 0.027*   |
|       | Biospheric family values    | 0.058 (0.012, 0.104)        | 0.023 | 0.142                                 | 2.504  | 0.013*   |

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ . Two-tailed.

| Model | R     | R <sup>2</sup> | SE    | Change statistics     |          |        |          |
|-------|-------|----------------|-------|-----------------------|----------|--------|----------|
|       |       |                |       | R <sup>2</sup> change | F change | df     | p        |
| 1     | 0.362 | 0.131          | 0.709 | 0.131                 | 17.248   | 3, 343 | 0.000*** |
| 2     | 0.434 | 0.188          | 0.688 | 0.057                 | 7.975    | 3, 340 | 0.000*** |
| 3     | 0.446 | 0.199          | 0.685 | 0.011                 | 2.322    | 2, 338 | 0.100    |
| 4     | 0.495 | 0.245          | 0.667 | 0.046                 | 10.299   | 2, 336 | 0.000*** |
| 5     | 0.501 | 0.251          | 0.668 | 0.006                 | 0.823    | 3, 333 | 0.482    |
| 6     | 0.525 | 0.275          | 0.659 | 0.024                 | 5.549    | 2, 331 | 0.004**  |

Note: Please refer to Table 3 for the full list of predictor variables in each model.

\* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ . Two-tailed.

TABLE 5 The model fit summary of the hierarchical linear regression model

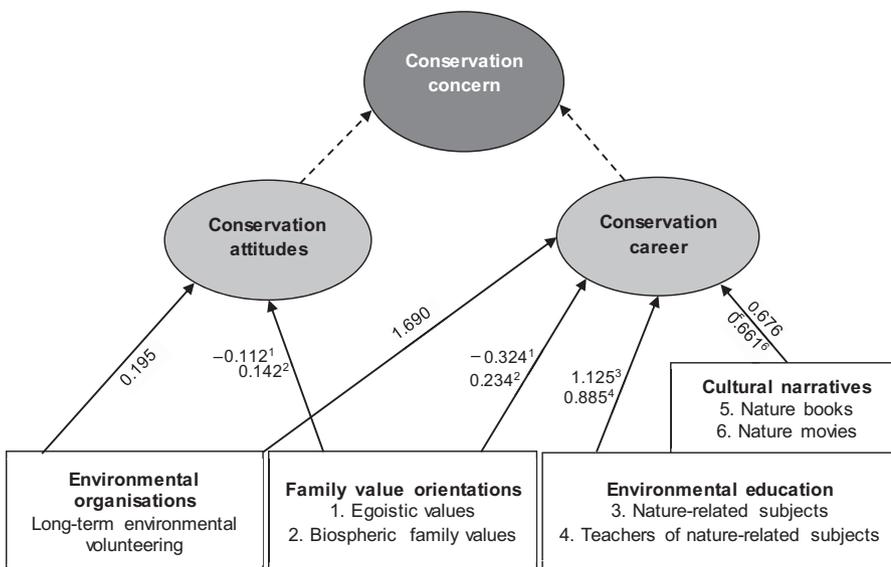


FIGURE 1 A summary model of the early-life experiences associated with the two aspects of conservation concern, with unstandardized beta coefficients (B)

was the only significant predictor, showing that females had more positive conservation attitudes than males ( $b = 0.327, p < 0.001$ ). *Environmental volunteering* ( $b = 0.195, p < 0.001$ ) and *Biospheric*

*family values* ( $b = 0.142, p = 0.013$ ) had significant positive associations with conservation attitudes whereas egoistic values were negatively related ( $b = -0.112, p = 0.027$ ).

Figure 1 summarizes the significant findings of our models and provides a visual representation of the inter-relationship between early-life factors and conservation attitudes and career preferences of Australian undergraduates.

## 4 | DISCUSSION

Our summary model indicates that childhood socialization experiences, namely involvement in environmental volunteering and experiences of biospheric family values, are important predictors of conservation career preferences and attitudes among Australian undergraduates. Conservation attitudes were positively associated with being female, engaging in environmental volunteering and having biospheric family values, but were negatively associated with egoistic family values. Preference for conservation careers, a strong indicator of environmental behaviour, was significantly positively associated with environmental volunteering, favourite school subjects and teachers, cultural narratives (nature books and nature movies), biospheric family values (positively) and egoistic family values (negatively). Notably, we found that social experiences had a far stronger relationship with conservation concern than childhood nature and animal play and family nature experiences.

Prior research has reported that physical experiences in nature predict adult environmentalism (Chawla, 1999; Wells & Lekies, 2006), pro-environmental behaviour (Li & Chen, 2014; Palmer et al., 1999; Tanner, 1980) awareness (Palmer et al., 1998), and career choice (James, Bixler, & Vadala, 2010; Place, 2004; Sward, 1999). However, among the comprehensive range of variables we considered, the frequency of physical experiences with animals and nature, including family nature holidays, were not significant predictors of either measure of conservation concern. This finding is reflected in some previous studies (Olli et al., 2001; Reibelt, Richter, Rendigs, & Mantilla-Contrearas, 2017), including a comprehensive examination of over a thousand young Americans, which found that growing up surrounded by nature did not foster stronger environmental attitudes or intellectual interests (Bixler et al., 2002). A recent and comparable study of French undergraduates ( $N = 919$ ; Prévot et al., 2018) found that childhood experiences in natural environments were only a significant factor before all other variables in their model were considered. Similarly in a Taiwanese study, Hsu (2009) demonstrated that childhood nature experiences were one of the most significant factors in *t* test comparisons, but not in regression analysis alongside a range of other variables. In mediation analyses performed on German university students ( $N = 131$ ), Pensini, Horn, and Caltabiano (2016) likewise showed that childhood nature exposure was only indirectly related to ecological behaviour and connectedness to nature, through its relationship to other variables. This evidence suggests that relationships between childhood nature exposure and adult conservation concern might actually be rather small, and perhaps indirectly mediated by other factors.

If childhood experiences of nature are not a critical factor in the development of conservation concern, this would be a promising

finding, given that 91% of the Australian population and 68% of the world's populace are predicted to reside in highly urbanized areas by 2050 (UNESA, 2019). However, further research with different populations and in different settings is needed to confirm this possibility. Although we attempted to measure childhood interactions with urban nature including backyards, parks and beaches, we found that frequency was not a strong indicator as our responses on these items were highly skewed towards 'most days', suggesting that most children passively experience these environments on a regular basis. This is a considerable limitation in our current study, given the growing body of literature highlighting that a lasting love and affinity for nature can develop from childhood interactions in public green spaces and private gardens (Soga et al., 2016; Whitburn, Linklater, & Milfont, 2019). In future, it will be important to go beyond measuring the *frequency* of nature experiences by also measuring the *quality* of a diverse range of nature experiences, including active nature experiences such as gardening, tree planting and observing wildlife.

In our analysis, the strongest predictor of conservation concern (represented by both career choice and environmental attitudes) was environmental volunteering with animal shelters and environmental groups. Intriguingly, childhood membership in clubs and societies, specifically environmental clubs, scouts and other wilderness groups, was not a significant factor in either analysis. Given this, we hypothesize that the duration of involvement could be a defining factor, as our question specified 'long-term' involvement in environmental volunteering, but not for clubs and societies. A strong association between conservation concern and environmental volunteering was anticipated, as involvement in environmental organizations has been previously identified as an important driver of conservation concern (Fielding et al., 2008; Olli et al., 2001). Several mechanisms explain the positive effects of membership in environmental organizations, including the increased sense of normative support (Gockeritz et al., 2010), personal efficacy (Lubell, 2002) and connectedness to nature (Guiney & Oberhauser, 2009) that it provides. Given the distinction between childhood nature experiences and outdoors groups in our study, it is important to note organizational experiences can also provide opportunities to physically interact with and experience nature. That is perhaps why a significant relationship exists between these constructs in our Pearson's correlation analysis ( $R < 0.18$ ,  $p < 0.01$ ). Additionally, it should be noted that volunteers can be motivated to join conservation organizations because of existing values and beliefs that developed earlier in life (Ryan, Kaplan, & Grese, 2001). Nevertheless, our findings hint at the strong association between environmental volunteering and conservation concern, suggesting that the combination of outdoors experiences, environmental education and social opportunities these organizations provide could be important.

Cultural narratives were significantly linked to career choice, since Australian undergraduates that preferred conservation careers were almost twice as likely to have favoured storylines that feature animals and nature as children. This was expected, as environmental educators are known to be strongly influenced by their childhood preferences for fictional nature stories (Freestone & O'Toole, 2016). However, cultural narratives did not significantly contribute to

conservation attitudes in our study. This is an intriguing result, as prior research has found that watching nature films and reading about the environment is strongly associated with the development of biospheric values (Eagles & Demare, 1999) and pro-environmental beliefs (Ewert et al., 2005). Our findings instead reflected those of Hsu (2009), who showed that books and authors only exerted a significant effect when environmental activists were compared to an apathetic group. Although the current evidence base lacks satisfactory explanations for this nuance, we hypothesize that while conservation attitudes are likely to develop from complex socialization experiences and understanding of environmental problems, career choices may be motivated by desires to emulate a character or setting that was prominently featured in a treasured childhood storyline.

Preference for conservation career, but not conservation attitudes, was significantly associated with the subjects and teachers our undergraduate study group preferred in school. As it has been previously shown that students have greater aptitude in their favourite subjects (Raza & Shah, 2011), it is logical that students may choose careers based upon disciplines they excel in, or that they might be inspired by a favourite teacher to follow a certain career path. However, it is harder to explain why adult conservation attitudes were not associated with quality of formal school education on environmental problems, since previous studies have reported strong effects of environmental education (Ballantyne et al., 2001; Leisher et al., 2012). One potential explanation of this finding is that our measure assessed formal environment education in school, which is standardized through the curriculum. Future studies could consider less formal sources of environmental education such as social media or television (Deruiter, 2002; Lee, 2011; Vadala et al., 2007), to better reflect the variety of ways young people receive environmental education.

Our findings also showed that the conservation attitudes and career preferences of Australian undergraduates were strongly influenced by the value orientations of their immediate family. As previously demonstrated by Schultz et al. (2005), we found that biospheric values positively predicted conservation concern, while egoistic values was negatively related. The strength of this relationship was unsurprising given the known importance of parental attitudes and behaviours on conservation concern (Evans et al., 2007), which has also been confirmed by one of the few longitudinal studies in this field (Evans, Otto, & Kaiser, 2018). This evidence supports the idea that biospheric ethics may develop in childhood from socialization experiences within the immediate family unit. Likely, these are experiences that deepen connection, understanding and appreciation of nature, as opposed to simply increasing the proportion of time of spent in nature (Martin & Czellar, 2017). Our findings complement the widely accepted theory that conservation concern is driven by values (Fransson & Garling, 1999), and that families demonstrating biospheric values will increase their child's likelihood of developing conservation concern (Broom, 2017; Deruiter, 2002).

Our research suggests that conservation concern may develop during childhood, from a varied and interrelated sequence of social, audio-visual and educational experiences of nature. We find that

childhood play experiences with animals and in nature were not significant predictors of conservation concern in Australian undergraduates. We consider that these results may reflect the issue of generational change in significant life experience research, likely driven by global declines in the amount of time that children spend outdoors (Louv, 2008; Pergams & Zaradic, 2008). In Australia, there is strong evidence of a generational shift away from unstructured outdoor play (Laird, McFarland, & Allen, 2014), but despite this, levels of environmental concern in Australia appear to have grown over time (Markus, 2019). Based on our findings, we attribute this growth to the critical role of socio-cultural experiences, and increased use of innovative audio-visual tools to promote conservation concern.

#### 4.1 | Limitations and future research

While we cannot demonstrate causality in this correlational study, we have attempted to shed light upon the underlying predictors of conservation concern measured through career choice and environmental attitudes. In this study we considered a comprehensive range of psychological and phenomenological predictor variables in our analysis, which explained a greater proportion of variance in conservation attitudes (52.5%) and career preferences (37%–54%) than many other published studies (e.g. 14% in Ewert et al., 2005, 13% in Wells & Lekies, 2006). By selecting a younger sample group and masking the intent of our research, our survey methodology also minimized the issues of retrospection and social desirability biases, which may have improved the reliability of our findings considerably. Importantly, we note that our research remains subject to two primary limitations, which are limited generalizability and the scope of our measures.

One limitation of our research stems from our narrow sample group, which is a significantly female biased Australian undergraduate cohort. Though female bias is common in the life course literature (Arnold, Cohen, & Warner, 2009; Hsu, 2009; Nisbet et al., 2009; Pensini et al., 2016; Villacorta et al., 2003), it has potential to affect the external validity of our results, as women are known to have more positive environmental beliefs than men (Broom, 2017; Dietz et al., 1998; Leppänen, Haahla, Lensu, & Kuitunen, 2012; Prévot et al., 2018). It is also possible that the views and values of the undergraduate cohort may differ from the wider youth population, particularly socioeconomically disadvantaged cohorts. Finally, some studies have shown that the factors implicated in conservation concern are similar but not identical across cultures (Palmer et al., 1998, 1999), and so it is unlikely that the physical and cultural context of our study will generalize to the global population at large. Consequently, we identify cross-cultural comparison as a fruitful opportunity for future study.

In addition to replicating our study with a more diverse sample, we also recommend that researchers adapt our survey instrument to include a broader scope of nature experiences and environmental education experiences. As our survey participants frequently experienced urban nature as children, some of our measures lacked response variance, resulting in our final *Nature and animal play* scale comprising a particular and limited set of experiences

in natural environments (Table 1). Though our *Family nature experiences* scale was considerably broader, a key limitation of our study is that it could not adequately capture nature play experiences that occur in environments such as backyards, urban parks and zoos. In future, we recommend assessing active nature experiences (Lohr & Pearson-Mims, 2005) that may occur in these common environments, for example gardening, bird-watching or bug-spotting, which may reflect a higher quality of nature interaction than passive nature exposure alone. In addition, we suggest expanding the environmental education measures beyond the core curriculum, to include alternative mediums such as social media. Finally, we recommend the addition of a dependent variable measuring pro-environmental behaviours (PEBs) in childhood and later life. This is important as conservation behaviours are not always strongly aligned with conservation attitudes (Broom, 2017), and understanding of how we can better promote desirable behaviours will greatly assist us in alleviating conservation problems (Nilsson, Fielding, & Dean, 2020).

## 4.2 | Conclusion

We have shown that among Australian undergraduates, conservation attitudes and career preferences are linked to a varied and interrelated sequence of experiences in early life. Among the dimensions of childhood experiences we explored, socio-cultural experiences of nature, namely biospheric family values and long-term environmental volunteering, were the strongest determinants of conservation attitudes and careers. Limited childhood experiences of natural environments and animals did not prevent participants from having high levels of conservation concern. Our findings suggest that limited access to nature experiences might not necessarily reduce the level of conservation concern in a population, so long as we continue to promote biospheric values and engage young people in an alternative range of educational, organizational and audio-visual nature encounters.

## CONFLICT OF INTEREST

Nothing to declare.

## AUTHORS' CONTRIBUTIONS

All authors conceived the ideas and designed methodology. J.P. collected and analysed data and led the writing of the manuscript. All authors contributed critically to the drafts and gave final approval for publication.

## DATA AVAILABILITY STATEMENT

Data are deposited in the Dryad Digital Repository <https://doi.org/10.5061/dryad.wdbrv15kn> (Pinder, Fielding, & Fuller, 2020).

## ORCID

Jessica Pinder  <https://orcid.org/0000-0001-5104-5338>

Kelly S. Fielding  <https://orcid.org/0000-0001-5301-0331>

Richard A. Fuller  <https://orcid.org/0000-0001-9468-9678>

## REFERENCES

- Arnold, H., Cohen, F., & Warner, A. (2009). Youth and environmental action: Perspectives of young environmental leaders on their formative influences. *The Journal of Environmental Education*, 40(3), 27–36. <https://doi.org/10.3200/JOEE.40.3.27-36>
- Ballantyne, R., Fien, J., & Packer, J. (2001). Program effectiveness in facilitating intergenerational influence in environmental education: Lessons from the field. *The Journal of Environmental Education*, 32(4), 8–15. <https://doi.org/10.1080/00958960109598657>
- Bennett, N., Roth, R., Klain, S., Chan, K., Clark, D., Cullman, G., & Thomas, R. (2017). Mainstreaming the social sciences in conservation. *Conservation Biology*, 31(1), 56–66. <https://doi.org/10.1111/cobi.12788>
- Bixler, R. D., Floyd, M. F., & Hammitt, W. E. (2002). Environmental socialization: Quantitative tests of the childhood play hypothesis. *Environment and Behaviour*, 34(6), 795–818. <https://doi.org/10.1177/2F001391602237248>
- Broom, C. (2017). Exploring the relations between childhood experiences in nature and young adults' environmental attitudes and behaviour. *Australian Journal of Environmental Education*, 33(1), 34–47. <https://doi.org/10.1017/aee.2017.1>
- Chawla, L. (1999). Life paths into effective environmental action. *The Journal of Environmental Education*, 31(1), 15–26.
- Chawla, L. (2007). Childhood experiences associated with care for the natural world: A theoretical framework for empirical results. *Children, Youth and Environments*, 17(4), 144–170.
- Chawla, L. (2009). Growing up green: Becoming an agent of care for the natural world. *The Journal of Developmental Processes*, 4(1), 6–23.
- Chawla, L., & Cushing, D. (2007). Education for strategic environmental behaviour. *Environmental Education Research*, 13(4), 437–452. <https://doi.org/10.1080/13504620701581539>
- Chawla, L., & Derr, V. (2012). The development of conservation behaviours in childhood and youth. In S. Clayton (Ed.), *Oxford handbook of environmental and conservation psychology* (pp. 526–555). New York, NY: Oxford University Press.
- De Groot, J., & Steg, L. (2008). Value orientations to explain environmental attitudes and beliefs: How to measure egoistic, altruistic and biospheric value orientations. *Environment and Behaviour*, 40(3), 330–354. <https://doi.org/10.1177/0013916506297831>
- Deruiter, D. (2002). A qualitative approach to measuring determinants of wildlife value orientations. *Human Dimensions of Wildlife*, 7(4), 251–271. <https://doi.org/10.1080/10871200214754>
- Dietz, T., Stern, P., & Guagnano, G. (1998). Social structural and psychological bases of environmental concern. *Environment and Behaviour*, 30(4), 450–471. <https://doi.org/10.1177/001391659803000402>
- Dutcher, D. D., Finley, J. C., Luloff, A., & Johnson, J. B. (2007). Connectivity with nature as a measure of environmental values. *Environment and Behaviour*, 39(4), 474–493. <https://doi.org/10.1177/0013916506298794>
- Eagles, P. F., & Demare, R. (1999). Factors influencing children's environmental attitudes. *The Journal of Environmental Education*, 30(4), 33–37. <https://doi.org/10.1080/00958969909601882>
- Easton, J., Koro-Ljungberg, M., & Cheng, J. (2009). Discourses of pro-environmental behaviour: Experiences of graduate students in conservation-related disciplines. *Applied Environmental Education and Communication*, 8(2), 126–134. <https://doi.org/10.1080/15330150903135830>
- Evans, G., Brauchle, G., Haq, A., Steckher, R., Wong, K., & Shapiro, E. (2007). Young children's environmental attitudes and behaviours. *Environment and Behaviour*, 39, 635–671. <https://doi.org/10.1177/0013916506294252>
- Evans, G., Otto, S., & Kaiser, F. (2018). Early origins of young adult environmental behaviour. *Psychological Science*, 29(5), 679–687. <https://doi.org/10.1177/0956797617741894>
- Ewert, A., Place, G., & Sibthorp, J. (2005). Early-life outdoor experiences and environmental attitudes in early adulthood attitudes. *Leisure*

- Sciences, 27(3), 225–239. <https://doi.org/10.1080/01490400590930853>
- Fielding, K., McDonald, R., & Louis, W. (2008). Theory of planned behaviour, identity and intentions to engage in environmental activism. *Journal of Environmental Psychology, 28*(4), 318–326. <https://doi.org/10.1016/j.jenvp.2008.03.003>
- Finger, M. (1994). From knowledge to action? Exploring the relationships between environmental experiences, learning and behaviour. *Journal of Social Issues, 50*(3), 141–160. <https://doi.org/10.1111/j.1540-4560.1994.tb02424.x>
- Fransson, N., & Garling, T. (1999). Environmental concern: Conceptual definitions, measurements methods, and research findings. *Journal of Environmental Psychology, 19*(4), 369–382.
- Freestone, M., & O'Toole, J. (2016). The impact of childhood reading on the development of environmental values. *Environmental Education Research, 22*(4), 504–517. <https://doi.org/10.1080/13504622.2014.989962>
- Garner, M., Taft, E., & Stevens, C. (2015). Do children increase their environmental consciousness during summer camp? A comparison of two programs. *Journal of Outdoor Recreation, Education, and Leadership, 7*(1), 20–34. <https://doi.org/10.7768/1948-5123.1238>
- Gifford, R., & Chen, A. (2016). *Children and nature: What we know and what we do not*. Victoria, Canada: University of Victoria.
- Gockeritz, S., Schultz, P., Rendon, T., Cialdini, R., Goldstein, N., & Griskevicius, V. (2010). Descriptive normative beliefs and conservation behaviour: The moderating roles of personal involvement and injunctive normative beliefs. *European Journal of Social Psychology, 40*, 514–523. <https://doi.org/10.1002/ejsp.643>
- Guiney, M. S., & Oberhauser, K. S. (2009). Conservation volunteers' connection to nature. *Ecopsychology, 1*(4), 187–197. <https://doi.org/10.1089/eco.2009.0030>
- Henry, B., Moffitt, T., Caspi, A., Langley, J., & Silva, P. (1994). On the 'remembrance of things past': A longitudinal evaluation of the retrospective method. *Psychological Assessment, 6*(2), 92–101. <https://doi.org/10.1037/1040-3590.6.2.92>
- Hsu, S. (2009). Significant life experiences affect environmental action: A confirmation study in eastern Taiwan. *Environmental Education Research, 15*(4), 497–517. <https://doi.org/10.1080/13504620903076973>
- James, J. J., Bixler, R. D., & Vadala, C. E. (2010). From play in nature, to recreation then vocation: A developmental model for natural history-oriented environmental professionals. *Children, Youth and Environments, 20*(1), 231–256. <https://doi.org/10.7721/chilyoutenvi.20.1.0231>
- John, F. A., Edwards-Jones, G., Gibbons, J. M., & Jones, J. P. G. (2010). Testing novel methods for assessing rule breaking in conservation. *Biological Conservation, 143*(4), 1025–1030. <https://doi.org/10.1016/j.biocon.2010.01.018>
- Kahn, P. H., & Kellert, S. R. (Eds.). (2002). *Children and nature: Psychological, sociocultural, and evolutionary investigations*. Cambridge, MA: MIT Press.
- Keniger, L. E., Gaston, K. J., Irvine, K. N., & Fuller, R. A. (2014). What are the benefits of interacting with nature? *International Journal of Environmental Research and Public Health, 10*(3), 913–935. <https://doi.org/10.3390/ijerph10030913>
- Klöckner, C. A. (2013). A comprehensive model of the psychology of environmental behaviour—A meta-analysis. *Global Environmental Change, 23*(5), 1028–1038. <https://doi.org/10.1016/j.gloenvcha.2013.05.014>
- Koriat, A., Goldsmith, M., & Pansky, A. (2000). Toward a psychology of memory accuracy. *Annual Review of Psychology, 51*, 481–537. <https://doi.org/10.1146/annurev.psych.51.1.481>
- Laird, S. G., McFarland, L., & Allen, S. (2014). Young children's opportunities for unstructured environmental exploration of nature: Links to adults' experiences in childhood. *International Journal of Early Childhood Environmental Education, 2*(1), 58–75.
- Lee, K. (2011). The role of media exposure, social exposure and biospheric value orientation in the environmental attitude-intention-behaviour model in adolescents. *Journal of Environmental Psychology, 31*(4), 301–308. <https://doi.org/10.1016/j.jenvp.2011.08.004>
- Leisher, C., Mangubhai, S., Hess, S., Widodo, H., Soekirman, T., Tjoe, S., ... Sanjayan, M. (2012). Measuring the benefits and costs of community education and outreach in marine protected areas. *Marine Policy, 36*, 1005–1011. <https://doi.org/10.1016/j.marpol.2012.02.022>
- Leppänen, J., Haahla, A., Lensu, A., & Kuitunen, M. (2012). Parent-child similarity in environmental attitudes: A pairwise comparison. *The Journal of Environmental Education, 43*(3), 162–176. <https://doi.org/10.1080/00958964.2011.634449>
- Leung, S. (2011). A comparison of psychometric properties and normality in 4-, 5-, 6-, and 11-point Likert scales. *Journal of Social Service Research, 37*, 412–421. <https://doi.org/10.1080/01488376.2011.580697>
- Li, D., & Chen, J. (2014). Significant life experiences on the formation of environmental action among Chinese college students. *Environmental Education Research, 21*(4), 612–630. <https://doi.org/10.1080/13504622.2014.927830>
- Liefänder, A. K., Fröhlich, G., Bogner, F. X., & Schultz, P. W. (2013). Promoting connectedness with nature through environmental education. *Environmental Education Research, 19*(3), 370–384. <https://doi.org/10.1080/13504622.2012.697545>
- Lohr, V., & Pearson-Mims, C. (2005). Children's active and passive interactions with plants influence their attitudes and actions toward trees and gardening as adults. *HortTechnology, 15*(3), 472–476. <https://doi.org/10.21273/HORTTECH.15.3.0472>
- Louv, R. (2008). *Last child in the woods: Saving our children from nature-deficit disorder*. Chapel Hill, NC: Algonquin Books.
- Lubell, M. (2002). Environmental activism as collective action. *Environment and Behaviour, 34*(4), 431–454. <https://doi.org/10.1177/00116502034004002>
- Markus, A. (2019). *Mapping social cohesion*. Caulfield East, Australia: Monash University.
- Martin, C., & Czellar, S. (2017). Where do biospheric values come from? A connectedness to nature perspective. *Journal of Environmental Psychology, 52*, 56–68. <https://doi.org/10.1016/j.jenvp.2017.04.009>
- Martyn, P., & Brymer, E. (2016). The relationship between nature relatedness and anxiety. *Journal of Health Psychology, 21*(7), 1436–1445. <https://doi.org/10.1177/1359105314555169>
- McComas, W. F. (2014). *Environmental education (EE). The language of science education*. Rotterdam, The Netherlands: SensePublishers.
- Miller, J. R. (2005). Biodiversity conservation and the extinction of experience. *Trends in Ecology & Evolution, 20*(8), 430–434. <https://doi.org/10.1016/j.tree.2005.05.013>
- Munroe, M. (2003). Two avenues for encouraging conservation behaviours. *Human Ecology Review, 10*(2), 113–125.
- Nilsson, D., Fielding, K., & Dean, A. (2020). Achieving conservation impact by shifting focus from human attitudes to behaviours. *Conservation Biology, 34*(1), 93–102. <https://doi.org/10.1111/cobi.13363>
- Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2009). The Nature relatedness scale: Linking individual's connection with nature to environmental concern and behaviour. *Environment and Behaviour, 41*(5), 715–740. <https://doi.org/10.1177/0013916508318748>
- Nisbet, E. K., Zelenski, J. M., & Murphy, S. A. (2011). Happiness is in our nature: Exploring nature relatedness as a contributor to subjective well-being. *Environment and Behaviour, 12*, 303–322. <https://doi.org/10.1007/s10902-010-9197-7>
- Olli, E., Grendstad, G., & Wollebaek, D. (2001). Correlates of environmental behaviours: Bringing back social context. *Environment and Behaviour, 33*(2), 181–208. <https://doi.org/10.1177/0013916501332002>
- Pallant, J. (2013). *SPSS survival manual*. Berkshire, UK: McGraw-Hill Education.
- Palmer, J. A., Suggate, J., Bajd, B., Hart, P., Roger, K., Ho, J., ... Van Staden, C. (1998). An overview of significant influences and formative experiences on the development of adults' environmental awareness in nine countries. *Environmental Education Research, 4*(4), 445–464. <https://doi.org/10.1080/1350462980040408>

- Palmer, J., Suggate, J., Robottom, I., & Hart, P. (1999). Significant life experience and formative influences on the development of adults' environmental awareness in the UK, Australia and Canada. *Environmental Education Research*, 5(2), 181–200. <https://doi.org/10.1080/1350462980040408>
- Pensini, P., Horn, E., & Caltabiano, N. (2016). An exploration of the relationships between adults' childhood and current nature exposure and their mental well-being. *Childhood, Youth and Environments*, 26(1), 125–147. <https://doi.org/10.7721/chilyoutenvi.26.1.0125>
- Pergams, O. R., & Zaradic, P. A. (2008). Evidence for a fundamental and pervasive shift away from nature-based recreation. *Proceedings of the National Academy of Sciences of the United States of America*, 105(7), 2295–2300. <https://doi.org/10.1073/pnas.0709893105>
- Pinder, J., Fielding, K. S., & Fuller, R. A. (2020). Data from: Conservation concern among Australian undergraduates is associated with childhood socio-cultural experiences. *Dryad Digital Repository*, <https://doi.org/10.5061/dryad.wdbrv15kn>
- Place, G. (2004). Youth recreation leads to adult conservation. *Parks & Recreation*, 39(2), 29–36.
- Prévo, A., Clayton, S., & Mathevet, R. (2018). The relationship of childhood upbringing and university degree program to environmental identity: Experience in nature matters. *Environmental Education Research*, 24(2), 263–279. <https://doi.org/10.1080/13504622.2016.1249456>
- Raza, M. A., & Shah, A. F. (2011). Impact of favourite subject towards the scientific aptitude of the students at elementary level. *Pakistan Journal of Social Sciences (PJSS)*, 31(1), 135–143.
- Reibelt, L., Richter, T., Rendigs, A., & Mantilla-Contrearras, J. (2017). Malagasy conservationists and environmental educators: Life paths into conservation. *Sustainability*, 9, 227–241. <https://doi.org/10.3390/su9030337>
- Ryan, R., Kaplan, R., & Grese, R. (2001). Predicting volunteer commitment in environmental stewardship programmes. *Journal of Environmental Planning and Management*, 44(5), 629–648. <https://doi.org/10.1080/09640560120079948>
- Sachar, R., & Eckstein, Z. (2007). Correcting for bias in retrospective data. *Journal of Applied Econometrics*, 22, 657–675. <https://doi.org/10.1002/jae.939>
- Saunders, C. (2003). The emerging field of conservation psychology. *Human Ecology Review*, 10(20), 137–149.
- Schultz, P. W. (2001). The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of Environmental Psychology*, 21(4), 327–339. <https://doi.org/10.1006/jenvp.2001.0227>
- Schultz, P. W., Gouveia, V. V., Cameron, L. D., Tankha, G., Schmuck, P., & Franěk, M. (2005). Values and their relationship to environmental concern and conservation behaviour. *Journal of Cross-Cultural Psychology*, 36(4), 457–475. <https://doi.org/10.1177/2F0022022105275962>
- Soga, M., & Gaston, K. J. (2016). Extinction of experience: The loss of human-nature interactions. *Frontiers in Ecology and the Environment*, 14(2), 94–101. <https://doi.org/10.1002/fee.1225>
- Soga, M., Gaston, K., Yamaura, Y., Kurisu, K., & Hanaki, H. (2016). Both direct and vicarious experiences of nature affect children's willingness to conserve biodiversity. *International Journal of Environmental Research and Public Health*, 13(6), 529–541. <https://doi.org/10.3390/ijerph13060529>
- Soulé, M. (1985). What is conservation biology? *BioScience*, 35(11), 727–734.
- Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology*, 29(3), 309–317. <https://doi.org/10.1016/j.jenvp.2008.10.004>
- Stern, P. (2000). New environmental theories: Toward a coherent theory of environmentally significant behaviour. *Journal of Social Issues*, 56(3), 407–424. <https://doi.org/10.1111/0022-4537.00175>
- Stern, P., & Dietz, T. (1994). The value basis of environmental concern. *Journal of Social Issues*, 50, 65–84. <https://doi.org/10.1111/j.1540-4560.1994.tb02420.x>
- Stern, P., Dietz, T., Abel, T., Guagnano, G., & Kalof, L. (1998). A value-belief-norm theory of support for social movements: The case of environmentalism. *Human Ecology Review*, 6(2), 81–97.
- Sward, L. (1999). Significant life experiences affecting the environmental sensitivity of El Salvadoran environmental professionals. *Environmental Education Research*, 5(2), 201–206. <https://doi.org/10.1080/13504620903076973>
- Tanner, T. (1980). Significant life experiences: A new research area in environmental education. *The Journal of Environmental Education*, 11(4), 20–24. <https://doi.org/10.1080/00958964.1980.9941386>
- Tanner, T. (1998). Choosing the right subjects in significant life experiences research. *Environmental Education Research*, 4(4), 399–417. <https://doi.org/10.1080/1350462980040404>
- UNESA. (2019). United Nations Department of Economic and Social Affairs, Population Division. *World Urbanisation Prospects: The 2018 Revision (ST/ESA/SER.A/420)*. New York, NY: United Nations.
- UNESCO. (1978). *Final Report - UNESCO Digital Library*. Final report, Intergovernmental Conference on Environmental Education, Tbilisi, USSR, 14–26 October 1977.
- Vadala, C., Bixler, R., & James, J. (2007). Childhood play and environmental interests: Panacea or snake oil? *The Journal of Environmental Education*, 39(1), 3–17. <https://doi.org/10.1080/1350462980040404>
- Van de Mortel, T. F. (2008). Faking it: Social desirability response bias in self-report research. *Australian Journal of Advanced Nursing*, 25(4), 40–48.
- Van Liere, K., & Dunlap, R. (1980). The social bases of environmental concern: A review of hypotheses, explanations and empirical evidence. *The Public Opinion Quarterly*, 44(2), 181–197. <https://doi.org/10.1086/268583>
- Villacorta, M., Koestner, R., & Lekes, N. (2003). Further validation of the motivation toward the environment scale. *Environment and Behaviour*, 35, 486–505. <https://doi.org/10.1177/2F0013916503035004003>
- Vining, J., & Ebero, A. (2002). Emerging theoretical and methodological perspectives on conservation behaviour. In R. B. Bechtel & A. Churchman (Eds.), *Handbook of environmental psychology* (Vol. 2, 541–558). New York, NY: Wiley.
- Wells, N., & Lekies, K. (2006). Nature and the life course: Pathways from childhood nature experiences to adult environmentalism. *Children, Youth and Environments*, 16(1), 1–24. <https://doi.org/10.1177/0956797617741894>
- Wells, N., & Lekies, K. (2012). Children and nature: The trail to environmental attitudes and behaviour. In J. L. Dickinson & R. Bonney (Eds.), *Citizen science: Public participation in environmental research* (pp. 201–213). Ithica, NY: Comstock Publishing Associates.
- Whitburn, J., Linklater, W. L., & Milfont, T. L. (2019). Exposure to urban nature and tree planting are related to pro-environmental behaviour via connection to nature, the use of nature for psychological restoration, and environmental attitudes. *Environment and Behavior*, 51(7), 787–810. <https://doi.org/10.1177/2F0013916517751009>
- Zelenski, J., & Nisbet, E. (2014). Happiness and feeling connected: The distinct role of nature relatedness. *Environment and Behavior*, 46(1), 3–23. <https://doi.org/10.1177/0013916512451901>

## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

**How to cite this article:** Pinder J, Fielding KS, Fuller RA.

Conservation concern among Australian undergraduates is associated with childhood socio-cultural experiences. *People Nat*. 2020;2:1158–1171. <https://doi.org/10.1002/pan3.10145>