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Whitten, Tyson, Stevens, Robert, Ructtinger, Liliana, Tzoumakis, Stacy, Green, Melissa, [Laurens, Kristin](#), Holbrook, Allyson, & Carr, Vaughan (2018)
Connection to the natural environment and well-being in middle childhood. *Ecopsychology*, 10(4), pp. 270-279.

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<https://doi.org/10.1089/eco.2018.0010>

Connection to the natural environment and well-being in middle childhood

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CONNECTION TO NATURE AND CHILD WELL-BEING

Abstract

Though the positive association between a connection to the natural environment and well-being is well established, few studies have examined this association in children, and none have explored whether this relationship remains when accounting for other factors that affect well-being, such as social supports, attention and empathic skills. The current study aims to address this gap. Data are drawn from the New South Wales Child Development Study (NSW-CDS), and comprise a representative sample of 26,848 children who completed a self-report survey of mental health and wellbeing when aged approximately 11 years. Multiple regression analysis indicated that, after adjusting for covariates (i.e., social supports, empathy, attention, socioeconomic status, and sex), connection to nature was positively, albeit weakly, associated with two indicators of well-being: self-satisfaction and prosocial behaviour. Social supports had the strongest relationship with self-satisfaction, while empathy had the strongest relationship with prosocial behaviour. Based on our findings, and that of previous research, we suggest that developing a connection to nature can slightly improve well-being, and may complement or augment other well-being and education-based programs. Future research should examine whether the relationship between connection to nature and well-being is influenced by proximity to greenspaces, experiences of nature, and age.

Keywords: self-satisfaction; prosocial behaviour; empathy; attention; social supports; connection to nature.

CONNECTION TO NATURE AND CHILD WELL-BEING

A growing body of research demonstrates that exposure to the natural environment is associated with a wide array of psychological benefits. For example, experimental studies conducted on undergraduate university students have found that either viewing the natural environment or spending leisure time in nature improves directed attention abilities (Tennessen & Cimprich, 1995; Berman, Jonides, & Kaplan, 2008), promotes positive emotions (Saraglou, Buxant, & Tilquin, 2008), and increases one's ability to reflect on and process problems (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009). Likewise, exposing children to natural environments reduces hyperactivity and impulsiveness (Taylor, Kuo, & Sullivan, 2001), and improves psychological resilience to stress (Wells & Evans, 2003; Corraliza, Collado & Bethelmy, 2012). Community surveys also indicate that residents living in locations with an abundance of green space report better self-perceived general health and lower self-perceived stress (Maas, Verheij, Groenwegen, Vries, & Spreeuwenberg, 2006; Stigsdotter et al., 2010).

Some evidence suggests that a connection to nature, defined as a positive emotional attachment towards the natural environment (Kals, Schumacher, & Montada, 1999; Mayer & Frantz, 2004), amplifies the benefits obtained from experiencing nature (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009). Support for this idea was provided by Nisbet, Zelenski, and Murphy (2011) when they compared the well-being of Canadian university students enrolled in either an environment (e.g., environmental studies, earth sciences, or geography) or psychology-related course during times of academic stress. Students who were undertaking an environment-related course, and therefore were more often exposure to the natural environment, had greater levels of nature connectedness, which bolstered their resilience to academic stress. Another study of university students in New Zealand found that time spent in nature was

CONNECTION TO NATURE AND CHILD WELL-BEING

associated with positive mood, and the quality of the time spent in nature increased this positive effect (Sato & Conner, 2013).

Many studies on connection to nature have focused on its relationship with two overlapping and highly correlated philosophies of well-being; eudaimonic and hedonic (Capaldi, Dopko, & Zelenski, 2014). The eudaimonic school of thought argues that well-being is achieved by functioning well (i.e., sense of autonomy, competence, and resilience) and realising one's full potential (Ryan & Deci, 2001). Alternatively, the hedonic philosophy suggests that well-being is more subjectively achieved by maximising pleasure, happiness, and life-satisfaction (Diener, Lucas, & Scollon, 2006; Huppert & Johnson, 2010). Various studies have demonstrated that connection to nature is positively associated with eudaimonic and hedonic well-being (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009; Cervinka, Roderer, & Hefler, 2011; White, Alcock, Wheeler, & Depledge, 2013). Two recent meta-analyses also confirm that the positive association between connection to nature and both eudaimonic and hedonic well-being is relatively consistent across studies, although the effect size was small (Bowler, Buyung-Ali, Knight, & Pullin, 2010; Capaldi, Dopko, & Zelenski, 2014).

The overwhelming majority of studies on connection to nature and well-being are based on adult samples, many of which are undergraduate university students participating for course credit. For example, Passmore and Howell (2014) found that high levels of nature involvement over a two week study period increased hedonic and eudaimonic well-being in undergraduate psychology students participating in the study for course credit. These findings are supported by two other studies that also used samples of university students (Howell, Dopko, Passmore, & Buro, 2011; Wolsko & Lindberg, 2013). Yet, unlike other research on this topic, these two

CONNECTION TO NATURE AND CHILD WELL-BEING

studies included mindfulness in their analysis, which was positively associated with connection to nature as well as hedonic and eudaimonic well-being.

Mindfulness refers to a state of moment-to-moment awareness and a connection to one's experiences (Davis & Hayes, 2011), or "*an awareness that emerges through paying attention on purpose, in the present, and nonjudgmentally to the unfolding of experience moment by moment*" (Kabat-Zinn, 2003, p.145). Mindfulness may have some influence on the relationship between connection to nature and well-being. Research indicates that mindfulness is associated with better emotional regulation (Hill & Updergraff, 2012), decreased levels of stress and anxiety (Shapiro, Brown, & Biefel, 2007), less hyperactivity and impulsivity (Zylowska et al., 2008), and improved well-being (Carmody & Baer, 2008; Shapiro, Brown, Thoresen, & Plante, 2011). Individuals with higher levels of mindfulness are also more empathetic and attentive (Greason & Cashwell, 2009; Shapiro, Brown, Thoresen, & Plante, 2011), and report a greater degree of connectedness with nature and well-being (Howell, Dopko, Passmore, & Buro, 2011; Wolsko & Lindberg, 2013; Hanley, Derringer, & Hanley, 2017).

Connection to nature's impact on well-being, and the influence mindfulness may have on this relationship, is explained by the biophilia hypothesis (Wilson, 1984). This idea suggests that all humans have, to varying degrees, an evolved inclination to connect with nature and other living systems, and that doing so leads to better well-being. The benefits that accrue from connecting with nature, and being mindful of our surroundings, manifest from an evolutionary disposition that fostered survival. Prior to the agricultural revolution, mankind's survival was dependent on how well one could connect and be mindful with the natural environment so as to identify utilities, such as food and shelter, and avoid predators and other dangers (Capaldi, Dopko, & Zelenski, 2014). Being aware of one's surroundings was a key tool for safety, and

CONNECTION TO NATURE AND CHILD WELL-BEING

offered a discernable evolutionary advantage. Modern humans need not be so cognisant of their environment to survive, yet too short a time has passed for us to evolve out of this innate predisposition to connect with nature.

Human survival was also aided by residing in larger communities that promoted social supports (Isaacs, 1975). As a result, the human brain evolved to thrive in social environments (Dunbar, 2016). Social supports are beneficial for hedonic well-being (Rook, 1985; Buss, 2000) as strong social supports can buffer the adverse effects of negative life events (Cohen & Hoberman, 1983; Armstrong, Birnie-Lefcovitxh, & Ungar, 2005; Diener, Lucas, & Scollon, 2006), while weak social supports can be detrimental to physical and mental health (Stinson et al., 2008). Adequate social supports in childhood and adolescence are also associated with better self-concept, including life and self-satisfaction (Chu, Saucier, & Hafner, 2010; Oberle, Schonert-Reichl, Guhn, Zumbo, & Hertzman, 2014). Note that we define social supports as an *objective* construct that signifies the number of supports, and the degree of assistance from these supports, within the social context (Chy, Saucier, & Hafner, 2010). This is distinct from ‘social connectedness’ and ‘social bonds’, which are *subjective* constructs that denote the strength and quality of one’s attachment to social institutions and agents (Hirschi, 1969; Starzyk, Holden, Fabringar, & MacDonald, 2006).

There are three main limitations facing previous studies that examined the relationship between connection to nature and hedonic and eudaimonic well-being. First, the vast majority of these studies are based on small samples of university students participating for course credit. Not only does this increase the risk of subject bias, but also limits the generalisability of these findings to other demographics. Second, very few studies have examined the association between connection to nature and well-being among children, particularly school students. Childhood is

CONNECTION TO NATURE AND CHILD WELL-BEING

an important time for psychosocial development, and is a period of life where one's connection to nature is formed (Ernst & Theimer, 2011; Braun & Dierkes, 2017). Research on children's well-being and connection to nature may provide important implications and suggestions for education-based programs and early development. Third, research has not examined whether the relationship between connection to nature and well-being is influenced by characteristics associated with mindfulness (i.e., empathy and attention) and social supports. The current study aims to address these gaps and determine whether connection to nature is associated with feeling good (i.e., hedonic well-being) and functioning well (i.e., eudaimonic well-being) while controlling for social supports, empathy, attention, socioeconomic status, and sex in a large sample of Australian children. In line with the previous literature, it is hypothesized that connection to nature will show a small positive association with well-being after controlling for other factors that contribute to well-being.

Methodology

Sample and procedures

Data for this study were drawn from the New South Wales Child Development Study (NSW-CDS; <http://nsw-cds.com.au/>), an Australian state-wide longitudinal population-based record linkage study (Carr et al., 2016). The NSW-CDS consists of a cohort of 87,037 children who started their first year of formal schooling in 2009, among whom 27,792 (32%) completed the Middle Childhood Survey (MCS) at 11 years of age in 2015 (Green et al., 2018). The MCS was an online self-report survey of 116 items on mental health and well-being that was administered to students in Year Six (their final year of primary school in New South Wales) during class time (Laurens et al., 2017). All New South Wales schools (government and non-

CONNECTION TO NATURE AND CHILD WELL-BEING

government) with Year Six enrolments ($n = 2,371$) were targeted for participation. Of the 2,371 eligible schools, 829 administered the MCS (full details regarding the sampling and administration of the MCS is available in Laurens et al., 2017). The representativeness of the MCS to the NSW population was demonstrated on a range of demographic indices (Laurens et al., 2017).

Of the 27,792 children who participated in the MCS, 894 had missing data on the items used in the present study, and were excluded from analysis. The current study is based on the remaining 26,848 children ($n = 13,364$ [49.7%] females) who were, on average, 11.92 years of age ($SD = .38$) at assessment. Ethical approval was obtained from the University of New South Wales Human Research Ethics Committee (UNSW HREC reference HC14307).

Measures

Children reported their age, sex, and residential postcode within the MCS. Using the children's postcode, a percentile score was computed reflecting the child's status on the Socio-Economic Index for Areas (SEIFA; Pink, 2013). SEIFA is derived from census information and measures the average income and employment status for each postcode in Australia; as such, it provides an indicator of relative disadvantage (Pink, 2013). Higher scores on SEIFA signify greater socioeconomic advantage.

Only scales with established reliability and validity for the assessment of children aged 11 years were used in the MCS, but minor modifications were made to the wording of several items, and a standardized three-choice response format was adopted for all items (representing a reduction from the 5-choice response scale used in the original versions of several scales; see Laurens et al. 2017 for further detail of these modifications). This response format was: Not true

CONNECTION TO NATURE AND CHILD WELL-BEING

(scored 0), Somewhat true (scored 1), and Certainly true (scored 2). Similarly, a standard scoring protocol was adopted for each mental health and wellbeing construct measured by the MCS, with the items for each construct summed to produce a total scale score (after the reverse scoring of some items, as indicated in Table S1). Means, standard deviations, minimum and maximum scores are presented in Table 1. All continuous variables were approximately normally distributed, and skewness and kurtosis were within the acceptable range (Tabachnick & Fidel, 2014). As detailed below, the ordinal alpha scores for each of these revised scales from the MCS indicated satisfactory reliability. The six MCS scales included in the current analyses are derived from the following questionnaires (see Table S1 in Supplementary Materials for a list of the items):

- **Connection to nature:** three items (ordinal $\alpha = .88$), two drawn from the Connection to Nature Index (Cheng & Monroe, 2012) and one from the Connectedness to Nature Scale (Mayer & Frantz, 2004), were adapted for use. The wording of one item from the Connection to Nature Index (“Being in the natural environment makes me feel peaceful”) was simplified to “Being in nature makes me feel peaceful”, and one item from the Connectedness to Nature Scale (“I often feel a sense of oneness with the natural world around me”) was simplified to “I feel strongly connected with nature”. The original response format was reduced from a five-point scale (1 = strongly disagree, 2 = somewhat disagree, 3 = neutral, 4 = somewhat agree, 5 = strongly agree) to the standard three-point scale adopted for all items administered within the MCS.
- **Self-satisfaction:** three items (ordinal $\alpha = .70$) from the Multidimensional Student’s Life Satisfaction Scale (Huebner, 1994) were used to measure the outcome variable of hedonic well-being.

CONNECTION TO NATURE AND CHILD WELL-BEING

- **Prosocial Behaviour:** five items (ordinal $\alpha = .78$) from the Strengths and Difficulties Questionnaire (Goodman, 1997; 2001) were used to measure the outcome variable of eudaimonic well-being.
- **Attention:** three items (ordinal $\alpha = .57$) from the Attention scale in the Early Adolescent Temperament Questionnaire (Ellis & Rothbart, 2001).
- **Empathy:** four items (ordinal $\alpha = .60$) from the Feeling and Thinking Instrument (Garton & Gringart, 2005).
- **Social supports:** 12 items (ordinal $\alpha = .87$) measuring supportive relationships in the home, school, and community, from the *Healthy Kids Survey* (Hanson & Kim, 2007).

[INSERT TABLE 1 ABOUT HERE]

Analytical strategy

All analyses were conducted in IBM SPSS 24 (IBM, 2016). A correlation matrix between all of the variables in the analyses was obtained to examine their bivariate interrelationships (Pearson's r for continuous variables, and the point biserial correlation coefficient for sex). Two series of linear regression analyses were conducted to test whether connection to nature predicted self-satisfaction (i.e., hedonic well-being) and prosocial behaviour (i.e., eudaimonic well-being) independent of sex, socioeconomic status, social supports, empathy, and attentiveness. Model 1 in each series of linear regression analyses was unadjusted, providing the association between connection to nature and the outcome variable. Model 2 additionally adjusted for two demographic indicators (child's sex and socioeconomic status). Model 3 adjusted for social supports and the two demographic indicators. Model 4 adjusted for empathy and attention in

CONNECTION TO NATURE AND CHILD WELL-BEING

addition to the two demographic indicators. Model 5 included all of the indicators. Guidelines on multivariate statistics indicate our analyses have sufficient statistical power considering our large sample and cell sizes (Tabachnick & Fidel, 2014).

Results

The correlation matrix in Table 2 indicates that all variables – except for female sex with socioeconomic status – were significantly correlated with one another. Self-satisfaction was positively and moderately correlated with social supports ($r = .44$) and attention ($r = .36$). Empathy ($r = .46$), followed by social supports ($r = .39$), had the strongest positive relationship with prosocial behaviours. Connection to nature had a small to moderate positive relationship with self-satisfaction ($r = .20$) and prosocial behaviours ($r = .30$). Socioeconomic status and female sex were consistently the weakest correlates across all variables. None of the independent variables were highly correlated with one-another ($r < .5$ in all cases), indicating an absence of multicollinearity. Scatterplots also revealed that residuals were normally distributed, were linearly related to the dependent variable, and their variances were homoscedastic. Although some outliers were present in the data, further investigation revealed that these cases had no undue influence on the results, and were retained.

[INSERT TABLE 2 ABOUT HERE]

Connection to nature and self-satisfaction

The results of the linear regression analyses for self-satisfaction are provided in Table 3. The unadjusted model (Model 1) indicated that connection to nature was significantly and

CONNECTION TO NATURE AND CHILD WELL-BEING

positively associated with self-satisfaction ($\beta = .20$). There was a trivial increase in this association when female sex ($\beta = -.05$) and socioeconomic status ($\beta = .09$) were included in the second model. The inclusion of social supports in Model 3 almost halved the contribution of connection to nature to the model ($\beta = .11$), and social supports ($\beta = .41$) become the strongest unique predictor of self-satisfaction. Social supports were exchanged for empathy and attention in Model 4, which had no impact on connection to nature's contribution to the model, while empathy ($\beta = .16$) and attention ($\beta = .32$) had the strongest positive association with self-satisfaction.

Social supports were reintroduced into the full model (Table 3, Model 5), which accounted for 27 percent of the variance in self-satisfaction. Although all variables were significantly associated with self-satisfaction, connection to nature ($\beta = .06$) and socioeconomic status ($\beta = .06$) made the weakest contribution, while social supports ($\beta = .32$) made the strongest. In order of strength, more social supports, attentiveness, higher empathy, being male, socioeconomic advantage, and connectedness to nature, were associated with higher levels of self-satisfaction.

[INSERT TABLE 3 ABOUT HERE]

Connection to nature and prosocial behaviour

The unadjusted model (Table 4, Model 1) indicates that connection to nature ($\beta = .30$) was significantly positively associated with prosocial behaviour. Connection to nature's contribution in Model 2 ($\beta = .29$) remained stable with the inclusion of female sex ($\beta = .18$) and socioeconomic status ($\beta = .09$). Contrary to previous analyses with self-satisfaction as the

CONNECTION TO NATURE AND CHILD WELL-BEING

outcome, being female was positively associated with prosocial behaviour in this model. Social supports were introduced into Model 3, and become the strongest contributor ($\beta = .32$). The disparity between social supports and connection to nature ($\beta = .22$) in Table 4 was not as steep relative to the analyses for self-satisfaction (Table 3, Model 3). Replacing social supports with empathy and attention further decreased connection to nature's ($\beta = .15$) association with prosocial behaviour. The contribution made to the model by female sex ($\beta = .12$) and socioeconomic status ($\beta = .06$) also decreased, while empathy ($\beta = .35$) and attention ($\beta = .21$) became the strongest contributors.

The full model (Table 4, Model 5) explained 34 percent of the variance in prosocial behaviour, and all variables were statistically significant. Empathy ($\beta = .31$) was the strongest positively associated contributor to the full model, while socioeconomic status ($\beta = .06$) was the weakest. Connection to nature ($\beta = .12$) and social support's ($\beta = .21$) contribution also slightly decreased in the full model. In order of strength, higher empathy, attentiveness, more social supports, connectedness to nature, being female, and socioeconomic advantage, were positively associated with prosocial behaviour.

[INSERT TABLE 4 ABOUT HERE]

Discussion

The relationship between connectedness to nature and well-being is a popular topic within the field of ecopsychology, and for good reason. Simple initiatives, such as spending time in greenspaces and developing a connection to the natural world, are consistently associated with higher resilience to stress, increased positive affect, and better general well-being (Mayer,

CONNECTION TO NATURE AND CHILD WELL-BEING

Frantz, Bruehlman-Senecal, & Dolliver, 2009; Nisbet, Zelenski, & Murphy, 2011; Capaldi, Dopko, & Zelenski, 2014). Nonetheless, the majority of research on this topic has focused on adult samples, many of which encompass university students participating for course credit. Few studies have examined the relationship between connectedness to nature and well-being in a representative sample of children, and, to our knowledge, none have explored if this association remains when controlling for social supports, attention, and empathy. The current study aimed to address this gap, and found that despite controlling for social supports, attention, empathy, sex, and socioeconomic status, connection to nature remained significantly and positively associated with self-satisfaction (hedonic well-being) and prosocial behaviour (eudaimonic well-being).

Research consistently demonstrates that connection to nature's relationship with well-being, although significant, is weak. In our full model, connection to nature's influence on hedonic and eudaimonic was substantially weaker than that found in two recent meta-analyses (Bowler, Buyung-Ali, Knight, & Pullin, 2010; Capaldi, Dopko, & Zelenski, 2014). Those meta-analyses only adjusted for demographic covariates, such as age and sex. When we similarly controlled only for demographic variables (sex and socioeconomic status), connection to nature's magnitude of effect aligned more closely with these studies. This leads us to believe that, when taking into account factors other than demographic variables, connection to nature's relationship with well-being may be weaker than previously thought.

Some of the variability in effect size between our findings and that reported in other studies might also relate to the use of different measures of well-being (Tam, 2013; Capaldi, Dopko, & Zelenski, 2014). Hedonic and eudaimonic well-being are philosophical constructs that possess a degree of conceptual ambiguity. Depending on the data available to researchers, these concepts may be inconsistently measured across studies. For example, hedonic well-being has

CONNECTION TO NATURE AND CHILD WELL-BEING

been identified by measures of life satisfaction (Zelenski & Nisbet, 2014), positive affect (Passmore & Howell, 2014), and engagement (Mayer, Frantz, Bruehlman-Senecal, & Dolliver, 2009). Eudaimonic well-being, on the other hand, has been gauged by measures of autonomy and positive relationships (Trigwell, Francis, & Bagot, 2014), sense of meaning (Passmore & Howell, 2014), and perceptions of fulfilment in important domains of life (Wolsko & Lindberg, 2013). It is worth mentioning that, since research has consistently found a positive relationship between connectedness to nature and well-being (regardless of its effect size), the use of different measures between studies is unlikely to be for concern¹.

When adjusting for all covariates, social supports had, by far, the strongest contribution to children's self-satisfaction (hedonic well-being). This is consistent with a recent meta-analysis that found (1) social supports were most strongly associated with positive self-concepts (i.e., self-satisfaction); (2) measures of perceived social support tend to be more strongly associated with well-being, and; (3) support from teachers and school personal tend to have the strongest association with child and adolescent well-being (Chu, Saucier, & Hafner, 2010). Strong social supports in childhood and adolescence are paramount for healthy psychological development and positive self-concept (Danielsen, Samdal, Hetland, & Wold, 2009; Oberle, et al., 2014; Lee, Yoo, 2015; Newland, Lawler, Giger, Roh, & Carr, 2015). Hence, there is little contention that social supports are important for hedonic well-being, and its influence clearly surpasses that of connecting with nature. The relationship between social supports and eudaimonic well-being, on the other hand, does not appear to be as strong.

¹ This point is especially salient considering that, in other fields of research, the use of different measures and operationalisations across studies can lead to drastically different findings (e.g., Whitten, McGee, Homel, Farrington, & Ttofi, 2017).

CONNECTION TO NATURE AND CHILD WELL-BEING

Empathy had the strongest contribution to prosocial behaviour (eudaimonic well-being) when adjusting for all covariates. We also found that our measure of empathy and prosocial behaviour were highly correlated. Although this degree of correlation did not violate any statistical assumptions, it may have inflated our results. Nonetheless, many studies have demonstrated that empathy accounts for much of the variance in children's prosocial behaviour independent of other factors (Malti, Gummerum, Keller, & Buchmann, 2009; Williams, O'Driscoll, & Moore, 2014; Nickerson, Aloe, & Werth, 2015). As Eisenberg, VanSchyndel, and Spinrad (2016) explain, helping behaviours and altruistic motives are, in part, dependent on one's empathetic concern for others.

Connection to nature's influence on hedonic and eudaimonic well-being was reduced, and subsequently overshadowed, when adjusting for empathy and attention. Recall that empathy and attention are highly related to mindfulness (Greason & Cashwell, 2009; Shapiro, Brown, Thoresen, & Plante, 2011), which is also associated with nature connectedness and well-being (Howell, Dopko, Passmore, & Buro, 2011; Wolsko & Lindberg, 2013). There is also much conceptual overlap between mindfulness and connection to nature, as both require connecting with the present experience. This line of reasoning suggests that a proportion of the benefits accrued from connecting with nature may be attributed to our ability to be mindful of our surroundings.

This research has several strengths. Foremost, our study is unique in that it was conducted using a large representative sample of children drawn from a NSW population cohort. This ensured adequate statistical power, and provided a shift in focus from adults and college students to school children. Moreover, this study is distinct as it demonstrates the relationship

CONNECTION TO NATURE AND CHILD WELL-BEING

between children's connection to nature and their self-satisfaction and prosocial behaviour while controlling for other important factors (i.e., social supports, empathy, and attention).

Some limitations to this study must also be acknowledged. First, our study is limited by a lack of detailed and subjective student experiences of the natural environment, and we were unable to measure individual proximity to greenspaces (e.g., home location or time spent outdoors). Likewise, age also appears to influence the strength of one's connection to nature (Braun & Dierkes, 2017), but we were unable to examine potential developmental influences in this cross-sectional study. Future research should examine if proximity to greenspaces, experiences with nature, and age, influence connection to nature's relationship with well-being. Second, the response options and scoring approach for the scales included in our study were modified for administration within the MCS, and therefore our scale data are not directly comparable to the data from previous studies that use these measures. Finally, cultural differences and social constructions of nature have been hypothesised to moderate the relationship between connection to nature and well-being (Cleary, Fielding, Bell, Murray, & Roiko, 2017). Aboriginal Australians reportedly possess a deeper connection to nature and family, which in turn may have more profound effects on their well-being (Redmond et al., 2016), and the question of whether Aboriginal status influences the associations reported here is an avenue of enquiry that future research should explore.

In conclusion, our findings indicate that, in the context of other known influences on child wellbeing, connection to nature has a relatively weak, albeit consistently significant, effect on wellbeing in middle childhood. Enabling children opportunities to develop a connection to nature in school and other programs may be an inexpensive way to improve children's well-being. The findings in this study may also have the potential to re-direct future theorizing about

CONNECTION TO NATURE AND CHILD WELL-BEING

connection to nature and well-being (Cleary et al., 2017), and to underline the benefit of educational interventions and programs with pre-adolescent children (see Braun & Dierkes, 2017) that stimulate connection or relatedness to nature.

Acknowledgments

This research was conducted by the University of New South Wales with financial support from the Australian Research Council (Linkage Project LP110100150, with the NSW Ministry of Health, NSW Department of Education, and the NSW Department of Family and Community Services representing the Linkage Project Partners); the National Health and Medical Research Council (NHMRC Project Grant APP1058652), and; the Australian Rotary Health (Mental Health for Young Australians Research Grant 104090). MJG was supported by an NHMRC Career Development Fellowship (APP1061875) and KRL was supported by funding from an Australian Research Council Future Fellowship (FT170100294).

Ethical approval was obtained from the University of New South Wales Human Research Ethics Committee (UNSW HREC reference HC14307) and the NSW Department of Education State Education Research Applications Process (reference 2015082); the use of opt-out consent procedures (for parents and children) was guided by the Australian National Health and Medical Research Council National Statement of Ethical Conduct in Human Research (chapter 2.3), which specifies conditions under which these procedures are appropriate. Access to publicly available school-level data on enrolment and demographic indices for the 2371 eligible NSW schools (used to estimate the representativeness of participating schools and children) was acquired from the Australian Curriculum, Assessment and Reporting Authority under UNSW HREC approval (reference HC14348).

CONNECTION TO NATURE AND CHILD WELL-BEING

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CONNECTION TO NATURE AND CHILD WELL-BEING

Table 1: Middle Childhood Survey Items.

Scales	Items
Connection to Nature	<ul style="list-style-type: none"> - When I feel sad, I like to go outside and enjoy nature. - Being in nature makes me feel peaceful. - I feel strongly connected with nature.
Self-Satisfaction	<ul style="list-style-type: none"> - There are a lot of things I can do well. - I like myself. - I am a nice person.
Prosocial Behaviours	<ul style="list-style-type: none"> - I try to be nice to other people. I care about their feelings. - I usually share with others (e.g., CDs, games, food). - I am helpful if someone is hurt, upset, or feeling ill. - I am kind to younger children. - I often volunteer to help others (parents, teachers, and children).
Empathy	<ul style="list-style-type: none"> - I want to help people who get treated badly. - I often feel worried about people that are not as lucky as me, and feel sorry for them. - I sometimes try to understand my friends better by pretending I am them. - I think people can have different opinions about the same thing.
Attention	<ul style="list-style-type: none"> - I pay close attention when someone asks me to do something. - It is easy for me to really concentrate on homework problems. - When I am trying to study, I have difficulty tuning out background noise and concentrating (reverse scored)
Social Supports	<p><i>In my home, there is a parent or another adult...</i></p> <ul style="list-style-type: none"> - Who listens to me when I have something to say. - Who I can talk to about my problems. - Who wants me to do my best. - Who believes that I will be a success. <p><i>At my school, there is a teacher or another adult...</i></p> <ul style="list-style-type: none"> - Who really cares about me. - Who listens to me when I have something to say. - Who believes that I will be a success. - Who tells me when I've done a good job. <p><i>In my neighbourhood/community (NOT from your school or family), there is an adult...</i></p> <ul style="list-style-type: none"> - Who really cares about me. - Who listens to me when I have something to say. - Who believes that I will be a success. - Who tells me when I've done a good job.

CONNECTION TO NATURE AND CHILD WELL-BEING

Table 2. Descriptive statistics

MEASURE	MEAN	MEDIAN	SD	MINIMUM	MAXIMUM
Connection to nature	3.72	4.00	1.81	0	6
Self-satisfaction	4.91	5.00	1.19	0	6
Prosocial behaviours	8.03	8.00	1.73	0	10
Empathy	5.74	6.00	1.48	0	8
Attention	3.59	4.00	1.42	0	6
Social supports	18.14	19.00	4.87	0	24
Socioeconomic status ¹	51.56	52.00	28.22	1	100

¹ Higher scores signify greater socioeconomic advantage

CONNECTION TO NATURE AND CHILD WELL-BEING

Table 3. Correlation matrix (n = 26,893)

	Connection to nature	Self-satisfaction	Prosocial behaviours	Empathy	Attention	Social supports	SEIFA	Female
Connection to nature	1							
Self-satisfaction	.20*	1						
Prosocial behaviours	.30*	.39*	1					
Empathy	.33*	.24*	.46*	1				
Attention	.15*	.36*	.31*	.19*	1			
Social supports	.25*	.44*	.39*	.29*	.31*	1		
SEIFA	-.05*	.08*	.07*	.30*	.03*	.04*	1	
Female ²	.09*	-.03*	.20*	.15*	.06*	.08*	-.01	1

² Point biserial correlation reported for sex. * p<.05

CONNECTION TO NATURE AND CHILD WELL-BEING

Table 4. Linear regression models of *self-satisfaction* (n = 26,893)

	MODEL 1			MODEL 2			MODEL 3			MODEL 4			MODEL 5		
	<i>B</i>	<i>SE</i>	β	<i>B</i>	<i>SE</i>	β	<i>B</i>	<i>SE</i>	β	<i>B</i>	<i>SE</i>	β	<i>B</i>	<i>SE</i>	β
Connection to nature	.13	<.01	.20*	.14	<.01	.21*	.07	<.01	.11*	.07	<.01	.11*	.04	<.01	.06*
Female	-	-	-	-.11	.01	-.05*	-.16	.01	-.07*	-.19	.01	-.08*	-.21	.01	-.09*
SEIFA	-	-	-	<.01	<.01	.09*	<.01	<.01	.07*	<.01	<.01	.07*	<.01	<.01	.06*
Social supports	-	-	-	-	-	-	.10	<.01	.41*	-	-	-	.08	<.01	.32*
Empathy	-	-	-	-	-	-	-	-	-	.13	.01	.16*	.08	.01	.10*
Attention	-	-	-	-	-	-	-	-	-	.27	.01	.32*	.20	.01	.24*
ADJUSTED R ²		.04			.05			.21			.18			.27	
<i>F</i>		1116.13			477.40			1762.04			1395.32			1709.25	

* = $p < .001$

Table 5. Linear regression models predicting *prosocial behavior* (n = 26,893)

	MODEL 1			MODEL 2			MODEL 3			MODEL 4			MODEL 5		
	<i>B</i>	<i>SE</i>	β	<i>B</i>	<i>SE</i>	β	<i>B</i>	<i>SE</i>	β	<i>B</i>	<i>SE</i>	β	<i>B</i>	<i>SE</i>	β
Connection to nature	.29	.01	.30*	.28	.01	.29*	.21	.01	.22*	.14	.01	.15*	.11	.01	.12*
Female	-	-	-	.60	.02	.18*	.55	.02	.16*	.42	.02	.12*	.41	.02	.12*
SEIFA	-	-	-	.01	<.01	.09*	<.01	<.01	.07*	<.01	<.01	.06*	<.01	<.01	.06*
Social supports	-	-	-	-	-	-	.11	<.01	.32*	-	-	-	.07	<.01	.21*
Empathy	-	-	-	-	-	-	-	-	-	.41	.01	.35*	.37	.01	.31*
Attention	-	-	-	-	-	-	-	-	-	.26	.01	.21*	.20	.01	.16*
ADJUSTED R ²		.09			.13			.23			.30			.34	
<i>F</i>		2742.10			1346.80			1956.00			2337.54			2291.81	

* = $p < .001$