



Self-nature representations: On the unique consequences of nature-self size on pro-environmental action

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ABSTRACT

In three studies, we investigated the consequences of self-nature representations for pro-environmental action, focusing on the role of viewing nature as relatively larger than the self (i.e., nature-self size; NSS). Drawing on theories from the self, prosocial behavior, and emotions literatures, we anticipated that NSS would make unique contributions above and beyond inclusion of nature in self (INS) in predicting behaviors, beliefs, and emotions associated with conservation outcomes. In Study 1, greater INS and greater NSS uniquely predicted greater biospheric concern, performing more conservation behaviors, and holding more pro-environmental beliefs. However, only seeing nature as relatively larger than the self (NSS) uniquely predicted greater self-transcendence, stronger beliefs in anthropogenic climate change, and holding more liberal ideologies. Study 2 manipulated NSS without altering INS, consistent with a distinction between these two self-nature representations, and it found that increasing NSS inspired stronger prosocial emotions. Finally, Study 3 explored whether these size effects might be driven by views of nature size, self size, or their relative differences, and nature size provided the best account. In addition to suggesting a unique role for nature-self size and discussing how particular facets of nature-self size might matter in different contexts, the current work builds conceptual bridges with several psychological literatures and suggests new avenues for pro-environmental interventions.

The self is critical for motivation and social change, playing a key role in why ingroups are treated more favorably than outgroups (e.g., Brewer, 1999; Levine, Prosser, Evans, & Reicher, 2005; Tajfel & Turner, 1986) and in how people pursue their goals (e.g., Carver, 2001; Higgins, 1997; McConnell, 2011). Further, when others are more included in self-concepts, commitment to those people is greater (e.g., Aron, Aron, & Smollan, 1992) and fewer differences are seen between the self and those individuals (e.g., Andersen, Chen, & Miranda, 2002).

In the context of encouraging pro-environmental behavior, the centrality of the self has also been established. Researchers have explored the extent to which people include nature in their self-concepts (INS; Schultz, 2001, 2002). Borrowing from research in the psychology literature on relationships (e.g., Aron et al., 1992), people report the extent to which nature (represented by one circle) is included in one's self-concept (represented by a second circle), with greater INS being revealed as the two circles have greater *overlap* (see top panel, Fig. 1). Greater nature-self overlap predicts stronger endorsements of pro-environmental beliefs and holding more prosocial values (e.g., Martin & Czellar, 2016; Schultz, 2001, 2002).

Although nature-self overlap has been shown to predict many outcomes related to conservation practices, the current work considered the possible unique contribution of a second form of self-nature representation: nature-self size (NSS; Fig. 1, bottom panel). Specifically, we explored the extent to which NSS might uniquely predict pro-environmental beliefs, emotions, and behaviors. Although some research has suggested that size should be combined with other measures such as overlap to produce a single index of inclusion of nature in self (see Martin & Czellar, 2016), we propose that considering the contributions of nature-self size above and beyond nature-self overlap may shed important light on understanding pro-environmental action. In other words, although overlap and size may be related, there are theoretical reasons derived from the psychology literature for why size might uniquely predict conservation-related outcomes. In the current work, we report three studies examining this reasoning. Specifically, Study 1 provided a correlational investigation showing how NSS predicts pro-environmental outcomes above and beyond INS. In Study 2, we manipulated NSS experimentally in a way that did not alter INS, providing causal evidence that increasing people's views of nature as

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being relatively larger than themselves can trigger more prosocial emotions. Finally, Study 3 explored whether NSS outcomes might be best explained by views of self size, views of nature size, or relative differences between the two elements.

1. Why nature-self size should matter

Our reasoning that nature-self size might matter for environmental action is grounded in three different psychology literatures where sense of size has been emphasized. First, an increased sense of self underlies many harmful outcomes, ranging from performing antisocial behaviors to experiencing entitlement to possessing narcissistic personalities (e.g., Morf & Rhodewalt, 2001; Piff, 2014). Narcissistic views of the self and of one’s ingroups also predict less pro-environmental action (e.g., Cislak, Wojcik, & Cichocka, 2018; Naderi, 2018). In short, viewing the self as psychologically larger than other entities promotes selfish actions and antisocial tendencies, which can undercut self-sacrificing behaviors that are essential for responding effectively to environmental challenges (e.g., Hardin, 1968; Van Vugt, 2009).

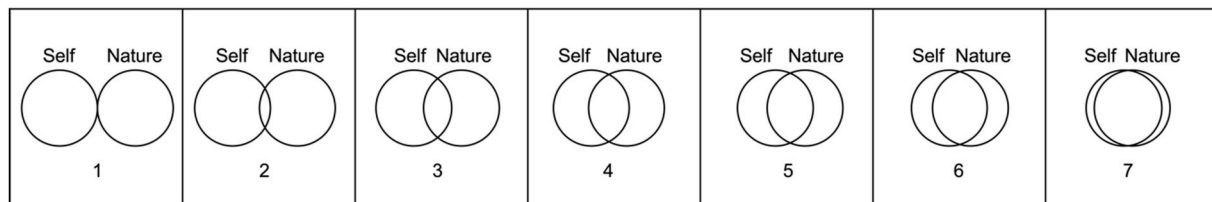
Second, research examining personal values has shown that self-transcendence (i.e., valuing others’ welfare over one’s own interests) diminishes selfish concerns and promotes pro-environmental action (e.g., de Groot & Steg, 2008; Schwartz, 1992, 1994; Stern & Dietz, 1994). People are more self-transcendent when they value benevolence (e.g., helpfulness, honesty) and universalism (e.g., equality, social justice) to a greater degree than they value achievement (e.g., influence, success) and power (e.g., social recognition, wealth), and those greater in self-transcendence engage in more pro-environmental behavior (Evans et al., 2013; Steg & Vlek, 2009). Further, people who experience greater self-transcendence value empathy more and power over others less, which facilitates prosocial behavior (Boer & Fischer, 2013; Caprara, Alessandri, & Eisenberg, 2012). Thus, people who view nature as relatively larger than themselves should be more self-transcendent and more

natural, compared to built, environments they experience greater awe, report a smaller sense of self, and perform more prosocial acts (Piff et al., 2015). Similarly, Shiota et al. (2007) found that experiencing awe diminishes one’s sense of self, and that exposure to nature enhances prosocial emotions (e.g., love) and reduces self-centered emotions (e.g., pride). This body of work shows that being in nature triggers prosocial emotions, decreases self-centeredness, improves prosocial behavior, and it appears that seeing the self as smaller is implicated in these outcomes. Thus, this third line of work suggests that being in nature affects NSS, which relates to prosocial emotional experiences and behaviors.

2. The current work

Three distinct bodies of psychology research (i.e., narcissism and entitlement, self-transcendence, awe) anticipate that size should play a meaningful role in conservation action. Indeed, past scholarship points to an important role for size, and thus we anticipated that size would provide unique predictive utility above and beyond overlap for environmental action and prosocial emotions.¹ It is important to note that past work has used different conceptualizations of size, and at times these approaches may have resulted in conflated measures. For example, although some work has explained its findings are reflecting size of self (e.g., Piff et al., 2015; Shiota et al., 2007), these studies have often conflated size concepts (e.g., asking people to report about the extent to which they feel small, feel the presence of something greater than themselves, feel connected to the world around them), leaving unanswered whether observed findings are actually driven by size of self. In a different vein, Martin and Czellar (2016) asked people to select different depictions of nature size without assessing self size at all. The current work first sought to establish that nature-self size could be distinguished from overlap (Study 1) and could be manipulated independently of overlap (Study 2) before turning to the question of how different components of size (e.g., self size, nature size, relative difference) might

INS (Inclusion of Nature in Self)



NSS (Nature-Self Size)

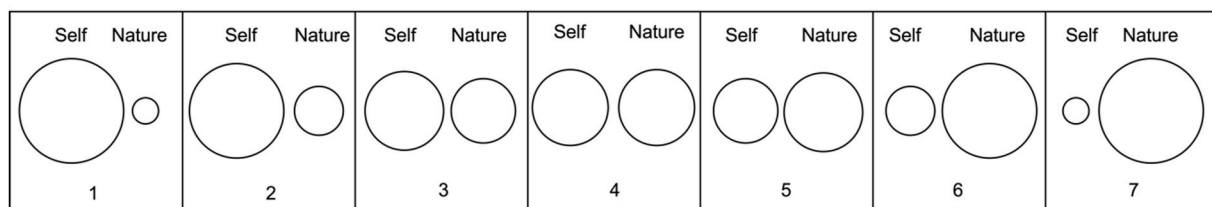


Fig. 1. Inclusion of Nature in Self (INS, top panel) and Nature-Self Size (NSS, bottom panel) depictions.

committed to protecting the environment.

Finally, there is good evidence that exposing people to nature not only triggers prosocial action (Piff, Dietze, Feinberg, Stancato, & Keltner, 2015) but alters self-concept representations (Shiota, Keltner, & Mossman, 2007). Both of these studies focused on the prosocial emotion of awe, which is an affective state triggered by experiencing something as vaster and more powerful than oneself. When people are exposed to

¹ In the current work, we borrow the term “predictive utility” from the multiple regression literature (e.g., Cohen, Cohen, West, & Aiken, 2003), where one tests whether a variable shows meaningful (i.e., significant) correspondence to the criterion variable while partialling out the shared variance between other variables and the criterion variable. When using “predictor” and “predictive utility” in this sense, no causality is implied.

predict pro-environmental outcomes (Study 3).

Study 1 provided a correlational exploration examining environmental beliefs, self-reported behaviors, political ideology, self-transcendence, and prosocial emotions. We anticipated that INS would replicate past findings (e.g., Martin & Czellar, 2016; Schultz, 2001; Zelenski, Dopko, & Capaldi, 2015), showing greater self-nature overlap predicts more pro-environmental outcomes. In addition, we sought to document whether NSS would (1) show similar positive relations with pro-environmental outcomes, (2) show unique predictive utility for these outcomes above and beyond INS, and (3) might show interactions with INS (e.g., the strongest pro-environmental outcomes might be seen among those with the greatest INS and NSS). Based on the psychology literatures suggesting a meaningful role for nature-self size, we expected unique predictivity utility for NSS above and beyond INS and viewed interaction possibilities as exploratory.

Next, Study 2 manipulated NSS with two goals. First, we sought to manipulate nature-self size without altering INS to provide evidence that NSS is different from INS. In addition to showing differences between these two measures, Study 2 provided causal evidence for the role of size in triggering beneficial outcomes, focusing on prosocial emotions. Finally, Study 3 explored the extent to which nature-self size effects might reflect views of self size, views of nature size, or relative differences between them. This final study, for the first time, provides a simultaneous test of the predictive utility of different size measures (cf., Cislak et al., 2018; Martin & Czellar, 2016; Piff et al., 2015; Shiota et al., 2007).

3. Ethics statement

All studies complied with APA ethical standards in the treatment of human subjects, including IRB approval (Miami University Institutional Review Board protocol #01495r), informed consent, and debriefing.

4. Study 1: Predictive utility of INS and NSS for pro-environmental outcomes

Our initial study examined how nature-self overlap (INS) and size (NSS) related to many outcomes of interest to conservation scholars: self-transcendence, environmental concerns and attitudes, dispositional positive emotions, pro-environmental behaviors, belief in anthropogenic climate change, and political ideology. First, we included a measure of self-transcendent values, modeled after Schwartz (1992). As noted previously, self-transcendence predicts a number of pro-environmental outcomes (e.g., Caprara et al., 2012; Evans et al., 2013; Hansla, Gamble, Juliusson, & Gärling, 2008; Steg & Vlek, 2009), and thus it would be valuable to see if NSS predicts greater transcendence.

To assess environmental concerns, we used Schultz's (2001) measure of environmental concern, which examines the extent to which people are motivated to protect the environment for biospheric (e.g., plants, animals), altruistic (e.g., other people, future generations), and egoistic (e.g., my health, my lifestyle) reasons. People greater in biospheric concern exhibit more self-transcendence, greater INS, more pro-environmental behaviors, and stronger associations between the self and nature (e.g., Hansla, Gamble, Juliusson, & Garling, 2008; Schultz, 2001; Schultz, Shriver, Tabanico, & Khazian, 2004). Further, some work finds that greater egoistic concern predicts significantly less pro-environmental behavior while altruistic concern is often unrelated to pro-environmental behavior (Schultz et al., 2004). Because of the strong relations between biospheric concern and pro-environmental outcomes, we were primarily interested in how INS and NSS would predict biospheric concern.

We also had participants complete the New Ecological Paradigm scale (NEP; Dunlap, Van Liere, Mertig, & Jones, 2000), a widely-used measure that predicts self-reported pro-environmental behavior and support for conservation policies (for a discussion, Hawcroft & Milfont,

2010). Schultz (2001) reported significant correlations between the NEP and biospheric concern ($r = 0.48$), suggesting that the measures relate to each other (although the NEP was unrelated to egoistic and altruistic concern, $r_s < .06$).

Next, we included an individual difference measure of discrete positive emotions (Shiota, Keltner, & John, 2006). Because past research focused on experiencing prosocial emotions in nature (e.g., Piff et al., 2015; Shiota et al., 2007), we were interested in whether people who are more predisposed to feel love, compassion, and awe were greater in INS and NSS. These prosocial emotions, also known as self-transcendent emotions, are believed to foster cooperation by increasing feelings of interconnectedness (Haidt, 2003; Stellar et al., 2017). Although prior research has mainly examined them in terms of connectedness with other people, recent evidence suggests prosocial emotions increase nature connectedness and pro-environmental behavior. For example, feeling compassion increases support for climate change mitigation (Lu & Schuldt, 2016) and for purchasing sustainable products (Geiger & Keller, 2018). Similarly, connections to nature based on emotional love predict pro-environmental behavioral intentions and inclusion of nature in the self-concept (Perkins, 2010). And as noted previously, awe has been implicated with being in nature and feeling smaller than nature (e.g., Piff et al., 2015; Shiota et al., 2007). We explored these three prosocial emotions and compared them to positive emotions not associated with prosocial behavior (i.e., joy, contentment, pride, amusement) using the dispositional positive emotions scale (DPES; Shiota et al., 2006) that has been used in past relevant work (e.g., Piff et al., 2015; Shiota et al., 2007). These non-prosocial emotions are not considered to be self-transcendent because they result from self-relevant (as opposed to other-relevant) appraisals. For example, joy is based on feeling safe in one's environment, whereas pride is based on appraisals of one's status and success (Stellar et al., 2017).

Finally, we assessed participants' reports of performing pro-environmental behaviors, believing that anthropogenic global warming is real, and endorsing relatively liberal social and political positions. We anticipated that all these outcomes would be predicted by greater INS and greater NSS.²

4.1. Method

4.1.1. Participants

202 undergraduates ($M_{\text{age}} = 18.83$, $SD = 1.11$; 132 females, 70 males) participated in individual lab rooms each equipped with a computer. Sample size was determined using an a priori sample size analysis ($\alpha = 0.05$, desired power = .80) conducted in G*Power (Faul, Erdfelder, Lang, & Buchler, 2007), assuming small-to-medium correlations ($r = 0.20$) observed in pilot data.

² We assessed political ideology because there may be cases where greater INS may not always encourage environmental protection. For example, some people (e.g., hunters, all-terrain vehicle owners) may view their connection with nature as strong yet desire to dominate it (e.g., kill animals, drive on trails with reckless abandon). Pilot testing in our lab showed that as people reported stronger endorsements of conservative ideologies, they reported performing more activities in nature that reflect domination (e.g., hunting, off-roading in 4-wheel drive vehicles), $r(69) = 0.29$, $p = .015$. Indeed, a meta-analysis of 69 studies found that more conservative, as opposed to liberal, political beliefs predicted less environmental concern (Cruz, 2017). Conservative political beliefs are also one of the strongest predictors of climate change skepticism (McCright & Dunlap, 2011; Whitmarsh, 2011), and our pilot testing found that as people endorsed stronger conservative beliefs, they were less likely to believe in anthropogenic global warming, $r(69) = -0.55$, $p < .001$. Thus, two groups of individuals might show sizable nature-self overlap (i.e., relatively greater INS) yet differ considerably in their views of nature-self size, with implications for pro-environmental action.

4.1.2. Measures

Self-transcendence. First, participants completed a measure of self-transcendence, adapted from Schwartz's (1992) basic values framework (see Hansla et al., 2008, for a similar approach). Specifically, they reported on the extent to which each of 16 values was important to them on a scale ranging from 1 (not at all important) to 9 (extremely important). Eight of them reflected other-oriented values for benevolence (i.e., honesty, helpfulness, meaning in life, spiritual life) and for universalism (i.e., social justice, equality, world at peace, inner harmony). The other eight items reflected self-oriented values for power (i.e., wealth, authority, social power, social recognition) and for achievement (i.e., ambition, influential, success, capability). Participants' mean response to the eight self-oriented items was subtracted from the mean of the other-oriented items, producing a measure of self-transcendence ($M = 1.44$, $SD = 2.66$; $\alpha = 0.83$).

Self-nature representations. Next, participants completed two measures of self-nature representations (Fig. 1). First, they completed the INS measure, where participants were asked how strongly they view nature as included in their sense of self, indicating the degree of overlap using two circles ranging from 1 (no overlap) to 7 (almost complete overlap; $M = 3.65$, $SD = 1.46$). Next, they indicated how they view their sense of self relative to nature by selecting a diagram between 1 (self is much larger than nature) and 7 (nature is much larger than self; $M = 3.98$, $SD = 1.90$) that best captures their sense of self relative to nature without worrying about the overlap between the two circles.

Environmental concern. Afterwards, participants completed Schultz's (2001) environmental concern scale, which assessed the degree to which they endorsed the importance, ranging from 1 (not important) to 7 (supreme importance), of environmental problems because of their consequences for egoistic (e.g., my lifestyle, my health; $M = 5.66$, $SD = 1.15$; $\alpha = 0.90$), altruistic (e.g., people in the community, future generations; $M = 6.05$, $SD = 0.84$; $\alpha = 0.80$), and biospheric (e.g., animals, plants; $M = 5.31$, $SD = 1.06$; $\alpha = 0.86$) reasons.

Dispositional positive emotions. Next, they completed the DPES (Shiota et al., 2006), indicating their agreement with 38 statements reflecting individual differences in experiencing discrete positive emotions on a scale ranging from 1 (strongly disagree) to 7 (strongly agree). The DPES assesses tendencies to experience several positive emotions. Three of these emotions reflect prosocial emotions: awe ($M = 5.04$, $SD = 0.85$; $\alpha = 0.72$), love ($M = 4.86$, $SD = 1.08$; $\alpha = 0.80$), compassion ($M = 5.76$, $SD = 0.94$; $\alpha = 0.86$). Four other emotions not associated with prosocial outcomes are also assessed by the DPES: joy ($M = 4.94$, $SD = 1.00$; $\alpha = 0.83$), contentment ($M = 4.96$, $SD = 1.11$; $\alpha = 0.89$), pride ($M = 5.07$, $SD = 0.94$; $\alpha = 0.76$), and amusement ($M = 5.15$, $SD = 1.06$; $\alpha = 0.79$).

Pro-environmental behavior. They then completed a measure of how often they perform 12 common pro-environmental behaviors (e.g., I use a reusable water bottle, I walk to my destinations instead of driving a car) on a scale ranging from 1 (never) to 5 (always). The mean response was computed ($M = 3.17$; $SD = 0.59$; $\alpha = 0.80$), with larger scores reflecting performing more pro-environmental behaviors.³

Beliefs. Afterwards, participants indicated their agreement with several belief statements on slider scales ranging from 0 (no basis whatsoever) to 100 (absolutely true). Although most statements were fillers (e.g., people have little ability to affect important outcomes in their life), we were interested in responses to two statements. One

³ Our measure of pro-environmental behavior was developed based on pilot testing that identified behaviors frequently performed by participants in our sample population. This measure of pro-environmental behavior correlates with other measures, such as the Davis et al. (2009) general ecological behavior scale, $r(72) = 0.43$, $p < .001$, the Gärbling, Fujii, Gärbling, and Jakobsson (2003) measure of pro-environmental behavioral intentions, $r(72) = 0.56$, $p < .001$, and the Pan, Chou, Morrison, Huang, and Lin (2018) measure of behavioral intentions, $r(72) = 0.64$, $p < .001$.

statement read, "global warming is real and is caused by human behavior and activities." Most students agreed with the statement, but there was variability on the item ($M = 78.14$, $SD = 28.21$). Also, because of the interest in how conservatives often are ideologically opposed to pro-environmental policies, participants responded to the statement, "Conservative political and social values are better than liberal political and social values." Moderate but varied beliefs were observed ($M = 42.88$, $SD = 33.08$).

NEP scale. Finally, participants completed the New Ecological Paradigm scale (NEP; Dunlap et al., 2000) to assess pro-environmental beliefs. The NEP has 15-items where participants responded on a scale ranging from 1 (strongly disagree) to 5 (strongly agree). Eight of the items reflect viewing human-nature balance as sensitive and precarious (e.g., plants and animals have as much right as humans to exist) and seven items reflect viewing humans as dominant over nature (e.g., humans were meant to rule over the rest of nature). We computed the mean for the 15 items (reverse scoring dominant items) such that larger NEP belief scores ($M = 3.58$, $SD = 0.55$; $\alpha = 0.81$) reflected greater support for protecting the environment.

4.2. Results

4.2.1. Zero-order correlations

Zero-order correlations were conducted across all of the measures (see Table 1). First, INS and NSS were only moderately related (i.e., medium size; Cohen, 1992), consistent with relative independence of the measures. In general, greater INS and greater NSS predicted more pro-environmental outcomes (e.g., greater biospheric concern, more pro-environmental NEP beliefs, more pro-environmental behaviors, stronger endorsement of anthropogenic global warming). However, only NSS predicted greater endorsement of a liberal ideology while INS was unrelated to it. Similarly, NSS but not INS predicted self-transcendence, with people reporting relatively larger size of nature than self showing relatively more other-oriented values (i.e., universalism and benevolence) than self-oriented values (i.e., power and achievement).

When examining dispositional positive emotions associated with prosocial behavior (i.e., awe, love, and compassion), those with greater INS and NSS reported more dispositional awe, and people greater in NSS reported more compassion. People greater in awe, love, and compassion also showed greater biospheric concern, greater altruistic concern, and more pro-environmental behaviors (in addition, people greater in dispositional love showed more egoistic concern and people greater in dispositional compassion believed more in anthropogenic global warming). Overall, stronger dispositional prosocial emotions were positively related to many pro-environmental motivations, behaviors, and beliefs.

Many of the other relations for non-prosocial emotions showed different outcomes than did prosocial emotions, with people greater in joy, contentment, and pride showing less endorsement of anthropogenic global warming and stronger conservative beliefs. Greater joy and contentment also predicted less progressive environmental NEP beliefs. In addition, greater joy and pride was associated with performing fewer pro-environmental behaviors. Thus, stronger dispositional non-prosocial emotions were negatively related to many key pro-environmental outcomes.

4.2.2. Multiple regression analyses

Although these correlations indicate that NSS may be a useful measure in predicting pro-environmental outcomes, it is possible that NSS and INS are redundant (although as Table 1 shows, their correlation does not suggest it), and thus, there might be no unique predictive utility for either variable. To evaluate the unique ability of NSS and INS to predict pro-environmental outcomes, we conducted multiple regressions where we regressed each outcome variable on centered measures of INS, NSS, and their interaction (product term), and these analyses are presented in Table 2. Greater INS and greater NSS each predicted more

Table 1

Zero-order correlations in Study 1 among nature-self representations, environmental concern, NEP beliefs, pro-environmental behaviors (PEBs), belief in anthropogenic global warming, endorsement of greater conservatism, greater self-transcendence, and dispositional positive emotions.

	Nature-self		Environmental Concern						
	INS	NSS	Bio	Ego	Alt	NEP	PEBs	Anthropogn.	Consv.
NSS	.40**	–							
Biospheric concern	.38**	.29**	–						
Egoistic concern	.01	-.40**	.01	–					
Altruistic concern	.18*	.06	.34**	.34**	–				
NEP beliefs	.25**	.32**	.30**	-.28**	.00	–			
Proenviron. behaviors	.31**	.34**	.37**	-.17*	.13†	.28**	–		
Anthropogenic warm.	.19**	.20**	.19**	-.17*	-.05	.63**	.35**	–	
Conservatism	-.03	-.25**	-.19*	.27**	.05	-.53**	-.26**	-.55**	–
Self-transcendence	.13	.25**	.22**	-.24**	.29**	.22**	.22**	.02	-.20**
Awe	.27**	.19**	.27**	.03	.27**	.02	.37**	-.01	.03
Love	.13†	.03	.15*	.24**	.40**	-.03	.15*	-.06	.06
Compassion	.08	.15*	.21**	-.04	.53**	.21**	.27**	.14*	-.10
Joy	.08	-.03	.12†	.33**	.33**	-.19**	-.20**	-.19**	.21**
Contentment	.12†	.00	.15*	.27**	.28**	-.16*	-.11	-.21**	.23**
Pride	.09	-.08	.10	.28**	.25**	-.12†	-.17*	-.14*	.19**
Amusement	-.04	.04	.04	.12†	.24**	-.08	-.04	-.11	.10

Note. N = 202; †p < .10, *p < .05, **p < .01.

Table 2

Multiple regressions betas and 95% CIs (in brackets) for INS, NSS, their interaction, and regression model variance accounted for in Study 1.

	Betas and confidence intervals			R ²
	INS	NSS	INS x NSS	
Biospheric concern	.34** [.19, .48]	.17* [.02, .31]	-.06 [-.19, .07]	.17
Egoistic concern	.20** [.07, .39]	-.47** [-.70, -.39]	-.03 [-.18, .10]	.19
Altruistic concern	.18* [.03, .28]	-.02 [-.14, .11]	-.03 [-.14, .08]	.03
NEP beliefs	.15* [.00, .16]	.26** [.06, .22]	-.03 [-.08, .05]	.12
Pro-environmental behavior	.20** [.04, .20]	.26** [.07, .24]	.08 [-.03, .12]	.16
Anthropogenic warming	.12 [-.03, .28]	.16* [.01, .31]	.08 [-.06, .20]	.06
Conservatism	.06 [-.09, .21]	-.29** [-.44, -.14]	-.19* [-.33, -.05]	.10
Self-transcendence	.04 [-.27, .51]	.22** [.20, .98]	-.11 [-.62, .07]	.07
Awe	.22** [.07, .32]	.11 [-.03, .22]	.15* [.01, .23]	.10
Love	.13† [-.02, .31]	-.02 [-.19, .14]	.03 [-.12, .17]	.02
Compassion	.03 [-.12, .17]	.13 [-.02, .27]	-.05 [-.17, .09]	.02
Joy	.10 [-.05, .25]	-.06 [-.21, .09]	.10 [-.04, .23]	.02
Contentment	.14† [-.01, .33]	-.05 [-.23, .11]	.06 [-.09, .21]	.02
Pride	.14† [-.01, .27]	-.13† [-.26, .02]	.06 [-.08, .17]	.03
Amusement	-.07 [-.23, .09]	.06 [-.09, .23]	.03 [-.12, .17]	.01

Note. N = 202; †p < .10, *p < .05, **p < .01.

biospheric concern. Interestingly, although greater INS predicted more egoistic concern, greater NSS predicted *less* egoistic concern. Those greater in INS reported more altruistic concern. Also, greater INS and greater NSS each predicted more pro-environmental beliefs on the NEP and performing more pro-environmental behavior.

In examining the other measures, only NSS but not INS reliably predicted belief in anthropogenic global warming, with people viewing nature as relatively larger than the self showing stronger belief in human-made climate change. Similarly, NSS but not INS uniquely predicted greater endorsements of political ideology, with those viewing nature as relatively larger than the self reporting stronger endorsements of more liberal ideologies, but this effect was qualified by an interaction with NSS (discussed below). In addition, NSS but not INS uniquely predicted self-transcendence, with those viewing nature as relatively larger than the self endorsing relatively more other-centered values than self-centered values. When considering the regression analyses involving the discrete positive emotions, greater INS predicted greater dispositional awe, though this direct effect was qualified by an interaction with NSS (also discussed below).

As noted above, there were two overlap by size interactions involving political ideology and dispositional awe. To explore these effects, we graphed the interactions (illustrated at ±1 SD) for each outcome (y-axis), using NSS along the x-axis (larger scores reflecting viewing nature as relatively larger than the self) and plotting two INS

lines, one (solid line) indicating relatively greater self-nature overlap and the other line (dotted) indicating relatively little self-nature overlap. Interactions were also depicted using the Johnson-Neyman region of significance technique, which provides the exact value of one moderator (NSS in this case) at which the relationship between the other predictor (INS) and the outcome (each dependent measure on the y-axis) shifts from non-significance to significance (Bauer & Curran, 2005).

As Fig. 2a shows, although the relation between NSS and political ideology was relatively nonexistent among those with little nature-self overlap, those participants with greater nature-self overlap showed a negative relation between NSS and endorsements of more conservative ideology. Alternatively, greater nature-self overlap significantly predicted greater conservatism when people viewed nature as relatively smaller than the self. Finally, Fig. 2b examined the INS x NSS interaction in predicting dispositional awe, revealing that awe was not experienced differently as a function of nature-self overlap among those who viewed the self as relatively larger than nature. However, among those who viewed nature as relatively larger than the self, people who reported greater nature-self overlap reported significantly more awe. Thus, nature-self size moderated how nature-self overlap predicts a prosocial emotional experience strongly associated with pro-environmental and prosocial behaviors (i.e., dispositional awe).

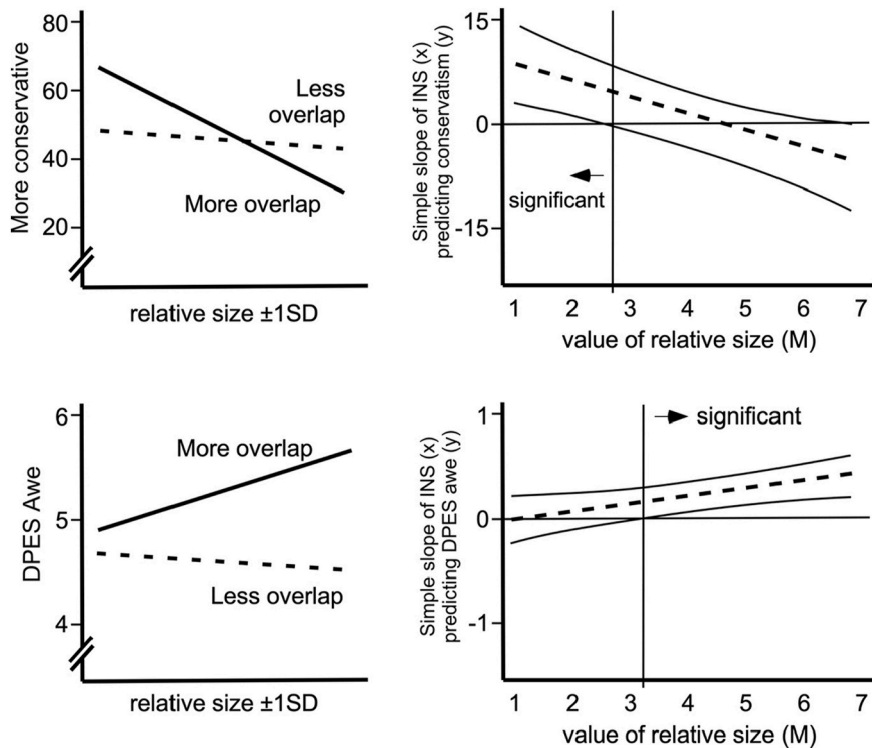


Fig. 2. Interactions regressions plots between relative size (NSS, x-axis) and self-nature overlap (INS) and Johnson-Neyman confidence limits for conservatism (top panel) and DPES awe (bottom panel) in Study 1.

4.3. Discussion

From the multiple regression analyses, there is good evidence that nature-self size uniquely predicts many pro-environmental outcomes, such as pro-nature environmental concern (i.e., greater biospheric but lower egoistic concern), more progressive beliefs about nature, and more pro-environmental behaviors. Although these outcomes were uniquely predicted by nature-self overlap (e.g., Martin & Czellar, 2016; Schultz, 2001, 2002; Schultz et al., 2004; Zelenski et al., 2015), nature-self size made unique contributions in predicting these outcomes as well.

Moreover, viewing nature as relatively larger than the self uniquely predicted stronger beliefs in anthropogenic global warming, holding a more liberal ideology, and greater self-transcendence (i.e., endorsing other-centered values relatively more than self-centered values), whereas nature-self overlap did not uniquely predict any of these outcomes. Additional evidence consistent with a meaningful role for nature-self size was observed in two other ways. First, it was interesting to observe that NSS and INS each uniquely predicted egoistic concern but in opposite directions. Second, the significant interactions observed between NSS and INS on conservative beliefs and on dispositional awe indicate that measures of nature-self size and nature-self overlap are meaningfully different. Although observing statistical independence of measures does not conclusively establish distinct psychological constructs (i.e., all measures are imperfect instantiations of the concepts they capture), these findings provide initial evidence that measures of nature-self size and nature-self overlap each provide unique predictive utility.

Study 1 showed that nature-self size uniquely predicted factors related to climate change acceptance (e.g., liberal ideologies, belief in anthropogenic global warming, self-transcendent values), unlike nature-self overlap. Past work established a strong connection between climate change denial and holding more conservative beliefs (McCright & Dunlap, 2011; Whitmarsh, 2011), and conservatives are more likely to adopt individualistic interpersonal orientations (Van Lange, Bekkers,

Chirumbolo, & Leone, 2012), which should reduce their commitment to prosocial action. Thus, the current findings suggest that nature-self size may shed light on the intersection of conservative ideology and global warming skepticism.

Although not the focus of this study, two interactions between INS and NSS were observed. First, among those who reported greater self-nature overlap, those who viewed the self as relatively larger than nature endorsed more conservative values while those who viewed nature as relatively larger than the self endorsed more liberal values, reiterating the value of examining nature-self size for an outcome (i.e., ideological beliefs) tied to pro-environmental beliefs and behaviors (e.g., de Groot & Steg, 2008; Evans et al., 2013; Steg & Vlek, 2009). Finally, the INS by NSS interaction for awe showed the strongest dispositional experience of awe among those with greater nature-self overlap and greater nature-self size, which contributes to past findings examining awe (e.g., Piff et al., 2015; Shiota et al., 2007). However, we urge caution in interpreting these interactions and view them as interesting but tentative.

In addition to examining the predictive utility of INS and NSS for prosocial emotions, the current work found that dispositional prosocial emotions (i.e., awe, love, compassion) each predicted greater biospheric concern and performing more pro-environmental behaviors. Further, being predisposed to feel compassion predicted more progressive conservation beliefs and greater endorsement of anthropogenic global warming. On the other hand, dispositional non-prosocial emotions often predicted anti-environmental outcomes (e.g., having less progressive conservation beliefs, performing fewer pro-environmental behaviors, believing less in anthropogenic global warming, and endorsing more conservative ideologies). These differential patterns between prosocial and non-prosocial emotions contribute to our growing understanding about the different functions of discrete emotions (e.g., Piff et al., 2015; Stellar et al., 2017).

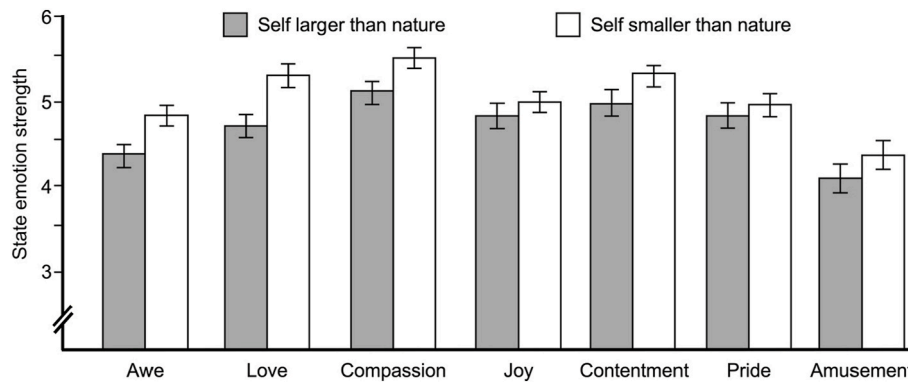


Fig. 3. Effect of nature-self size manipulation on prosocial emotions (awe, love, compassion) and non-prosocial emotions (joy, contentment, pride, amusement) in Study 2. Error bars are standard errors.

5. Study 2: Nature-self size manipulation

Although Study 1 provided many findings supporting the value of assessing nature-self size to predict pro-environmental outcomes, its correlational nature leaves open the question of whether nature-self size has a causal effect on pro-environmental outcomes. Thus, in Study 2, we experimentally manipulated nature-self size. In addition to examining the consequences of this manipulation, we wanted to observe if we could reliably alter NSS without significantly affecting INS, providing additional evidence for the value of assessing nature-self size.

Therefore, we measured INS and NSS after our manipulation of nature-self size. We expected to see differences on NSS, confirming the success of the manipulation. However, we expected to not observe a significant effect of the manipulation on INS, consistent with nature-self size being a meaningful measure in its own right. Study 2 was also designed to provide causal evidence that NSS affects pro-environmental outcomes. Specifically, we measured state positive emotions after the manipulation, focusing on the prosocial emotions of awe, compassion, and love. Because Study 1 found that NSS was correlated with the prosocial emotions of awe and compassion and was unrelated to the four non-prosocial emotions, we were interested in whether a manipulation of NSS might affect prosocial emotions. It is important to understand whether NSS also predicts state emotions because state and trait emotions occur at different levels-of-analysis and do not always predict outcomes in identical ways (Rosenberg, 1998). Lastly, we collected an individual difference covariate of environmental beliefs before our experimental induction to control for pre-existing pro-environmental individual differences.

5.1. Method

5.1.1. Participants

184 undergraduates ($M_{\text{age}} = 19.21$, $SD = 1.23$; 104 females, 79 males, 1 gender unknown) participated in the same laboratory used in Study 1 for research credit. G*Power was used to determine an a priori sample size analysis ($\alpha = 0.05$, desired power = .80) for ANCOVA (Faul, Erdfelder, Lang, & Buchner, 2007), assuming a small-to-medium effect size ($\eta_p^2 = 0.04$) based on the relations between self-nature representations and prosocial emotions found in Study 1. Participants were randomly assigned to either the self-larger-than-nature ($n = 90$) or self-smaller-than-nature ($n = 94$) conditions.

5.1.2. Procedure

Covariate. First, participants completed the NEP scale (Dunlap et al., 2000) to provide a baseline measure of individual differences in pro-environmental beliefs. Using the same approach as Study 1, an overall mean score was computed ($M = 3.54$, $SD = .56$, $\alpha = 0.84$) with larger scores indicating more progressive pro-environmental beliefs.

NSS manipulation. Next, participants completed a writing task to manipulate nature-self size. Specifically, they were randomly assigned to write one of two essays about a time they either felt larger or smaller than nature. Participants read the following prompt: "Please take a few minutes to think about a time in your life when you were outside in nature when you felt smaller [larger] than nature. Please remember this time in as detailed and vivid of a fashion in possible." Participants wrote about their memory for 5 min.

Self-nature representations. After the writing task manipulation, participants completed the INS ($M = 3.91$, $SD = 1.45$) and NSS ($M = 4.27$, $SD = 2.06$) measures used in Study 1.

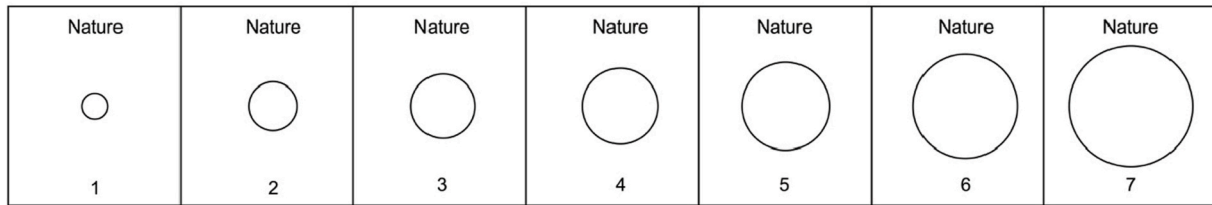
State positive emotions. Next, they completed a measure of state positive emotions, where they indicated the degree to which they were feeling each emotion at the very moment on a scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). We adapted the DPES (Shiota et al., 2006) to assess seven emotions, with two items for each one (the mean response for each pair was calculated). Specifically, participants responded to items to assess prosocial emotions: awe (awe, wonder; $M = 4.55$, $SD = 1.47$, $\alpha = 0.84$), love (love for others, trust in others; $M = 4.98$, $SD = 1.30$, $\alpha = 0.72$), compassion (compassion, empathetic; $M = 5.30$, $SD = 1.21$, $\alpha = 0.81$). In addition, they responded to items to assess non-prosocial emotions: joy (joy, happiness; $M = 4.90$, $SD = 1.35$, $\alpha = 0.89$), contentment (contentment, peace; $M = 5.13$, $SD = 1.21$, $\alpha = 0.72$), pride (pride, self-respect; $M = 4.91$, $SD = 1.35$, $\alpha = 0.72$), amusement (amusement, humorness; $M = 4.25$, $SD = 1.52$, $\alpha = 0.80$).

5.2. Results

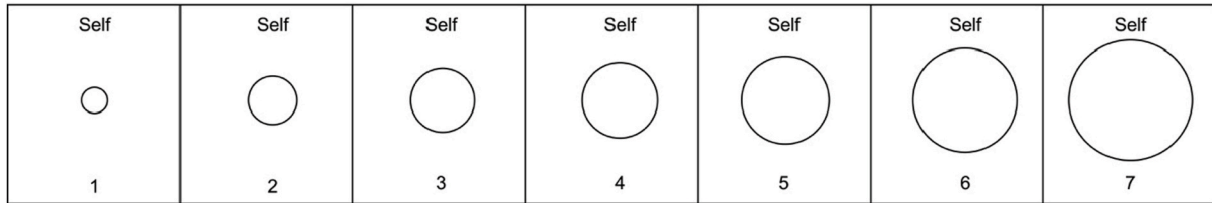
An Analysis of Covariance (ANCOVA) examined whether the experimental manipulation shifted participants' nature-self size (NSS), using NEP score as a covariate. NEP score did not vary between conditions, $t(182) = 0.67$, $p = .501$, establishing its suitability as a covariate. Participants who wrote about a time when they felt smaller than nature reported greater NSS ($M = 4.54$, $SD = 2.09$) than did participants who wrote about a time when they felt larger than nature ($M = 3.99$, $SD = 2.00$), $F(1,181) = 6.07$, $p = .015$, CI 95% [0.13, 1.18], $\eta_p^2 = 0.03$. Without the covariate included, the manipulation had the same descriptive effect on NSS, $F(1,182) = 1.83$, $p = .069$, CI 95% [-0.04, 1.15], $\eta_p^2 = 0.02$, though the effect without the covariate did not achieve statistical significance.

To the extent that NSS and INS may be distinct, the experimental manipulation should not affect INS scores. Indeed, an ANCOVA examining if experimental condition affected INS scores while controlling for NEP beliefs showed no effect of condition, $F(1,181) = 2.19$, $p = .140$, CI 95% [-0.10, 0.70], $\eta_p^2 = 0.01$. An ANOVA conducted on INS scores without the covariate included also showed no effect of condition, $F(1,182) = 1.44$, $p = .231$, CI 95% [-0.16, 0.67], $\eta_p^2 = 0.01$. Similar to Study 1, the correlation between NSS and INS was significant, $r = 0.396$,

Nature Size



Self Size



Relative Size

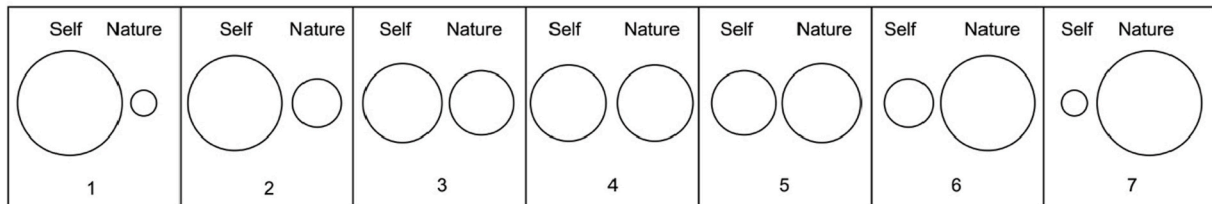


Fig. 4. Measures of nature-self-size used in Study 3 (i.e., nature size, self size, and relative size).

$p < .001$, but the medium size of this relation (Cohen, 1992) indicates that the measures were not redundant.

Next, we explored whether the manipulation affected feeling prosocial emotions (i.e., awe, love, and compassion) with ANCOVAs using NEP as the covariate. As Fig. 3 shows, participants in the self-smaller-than-nature condition reported greater feelings of love, $F(1,181) = 9.60$, $p = .002$, CI 95% [0.21, 0.95], $\eta_p^2 = 0.05$, and greater feelings of compassion, $F(1,181) = 4.38$, $p = .038$, CI 95% [0.02, 0.72], $\eta_p^2 = 0.03$. The effect for awe did not reach statistical significance, $F(1,181) = 3.08$, $p = .081$, CI 95% [-0.05, 0.81], $\eta_p^2 = 0.02$. There were no differences between conditions for the non-prosocial emotions of joy, $F(1,181) = 1.99$, $p = .161$, CI 95% [-0.11, 0.67], $\eta_p^2 = 0.01$, pride, $F(1,181) = 0.50$, $p = .482$, CI 95% [-0.25, 0.53], $\eta_p^2 = 0.00$, or amusement, $F(1,181) = 1.35$, $p = .247$, CI 95% [-0.18, 0.70], $\eta_p^2 = 0.01$. For contentment, there was descriptively more contentment in the self-smaller-than-nature condition, $F(1,181) = 3.43$, $p = .066$, CI 95% [-0.02, 0.68], $\eta_p^2 = 0.02$, though the effect did not achieve statistical significance.⁴

5.3. Discussion

Study 2 manipulated perceptions of the size of nature compared to the self and examined its effects on NSS, INS, and state prosocial emotions. As expected, those who wrote about a time when they felt smaller than nature reported greater NSS compared to those who wrote about a

⁴ For interested readers, ANOVAs without the covariate included showed the following outcomes for each of the seven emotions: awe, $F(1,182) = 3.21$, $p = .075$, CI 95% [-0.04, 0.81], $\eta_p^2 = 0.02$; love, $F(1,182) = 9.69$, $p = .002$, CI 95% [0.21, 0.95], $\eta_p^2 = 0.05$; compassion, $F(1,182) = 4.04$, $p = .046$, CI 95% [0.01, 0.71], $\eta_p^2 = 0.02$; joy, $F(1,182) = 2.18$, $p = .141$, CI 95% [0.10, 0.68], $\eta_p^2 = 0.01$; pride, $F(1,182) = 0.32$, $p = .572$, CI 95% [-0.28, 0.51], $\eta_p^2 = 0.00$; amusement, $F(1,182) = 1.30$, $p = .256$, CI 95% [0.01, 0.71], $\eta_p^2 = 0.02$; contentment, $F(1,182) = 2.04$, $p = .088$, CI 95% = [-0.05, 0.65], $\eta_p^2 = 0.02$.

time they felt smaller than nature, suggesting that NSS can be experimentally manipulated. Yet at the same time, there were no reliable differences of the manipulation observed on INS, indicating that nature-self size can be systematically altered without affecting nature-self overlap.

Inducing participants to feel relatively smaller than nature led to greater feelings of the prosocial emotions love and compassion. Because feeling prosocial emotions can instigate pro-environmental action (e.g., Geiger & Keller, 2018; Lu & Schuldt, 2016; Perkins, 2010; Piff et al., 2015), this study provides a demonstration of a mechanism by which greater NSS can be triggered, which has been shown to be related to more pro-environmental outcomes in Study 1. On the other hand, we did not observe significant effects of the nature-self size manipulation on non-prosocial emotions (e.g., joy, pride), consistent with the distinction in the literature between prosocial and non-prosocial emotions (e.g., Haidt, 2003; Stellar et al., 2017).

Caution should be taken comparing the results of state emotions in this study and the results of Study 1 due to differences between state emotions and emotion dispositions (Rosenberg, 1998). In addition, although we observed that experimentally-induced shifts in nature-self size altered state prosocial emotions, the current study did not measure pro-environmental behavior, and thus future work should explore a broader array of conservation-related outcomes.

Also, one might wonder whether the “recall a time” manipulation triggered demand characteristics that could have driven the observed effects. Although it is possible that this manipulation might influence people’s self-reports of nature-self size, it seems unlikely that participants would also possess naïve theories about how “being smaller than nature” should trigger more prosocial emotions yet not produce effects on other positive emotions. This pattern of specific effects (i.e., differences on prosocial emotions but not on positive non-prosocial emotions) replicates the correlations observed in Study 1. Further, “recall a time” manipulations are commonly used in research domains ranging from

interpersonal power (e.g., Galinsky, Gruenfeld, & Magee, 2003) to social rejection (e.g., McConnell, Brown, Shoda, Stayton, & Martin, 2011), and they have been used in the environmental literature as well (e.g., Piff et al., 2015). Thus, demand characteristics do not provide a likely account for the current findings.

6. Study 3: Examining elements of nature-self size

Studies 1–2 indicated, using correlational and experimental approaches respectively, that nature-self size revealed unique relations to and consequences for pro-environmental outcomes (e.g., prosocial emotions, environmental concern, conservation behaviors). Yet, the size-related effects might be driven by a variety of factors, including viewing nature as large, viewing the self as small, or both factors in concert (i.e., viewing nature as relatively larger than the self). Our final study examined these possibilities.

As noted previously, past work has not systematically tested the relative contributions of self size and nature size on conservation outcomes, and some instantiations of size constructs seem conflated. For example, Piff et al. (2015, Studies 2–4) asked participants to answer questions about the self (e.g., “I feel small or insignificant”), about something else (e.g., “the presence of something greater than myself”), about the self relative to something else (e.g., “I feel small relative to something more powerful than myself”), and about self-other integration (e.g., “I feel part of some greater entity”). Although Piff et al. (2015) characterized their findings as reflecting “small self,” their measures conflated self size, other size, self-relative-to-other size, and self-other integration.⁵ Similarly, Shiota et al. (2007) asked participants to respond to items involving self size (e.g., “I felt small or insignificant”), something else (e.g., “I felt the presence of something greater than myself”), and self-other integration (e.g., “I felt closely connected to the world around me”). These studies leave open whether observed findings were driven by views of the self, by views of something else, by views of the self relative to something else, or by self-other inclusion (i.e., INS). Finally, Martin and Czellar (2016) examined overlap (INS) and nature size only, with the latter presenting different depictions of a “nature” circle without a “self” circle shown, thus it is unclear how their findings might compare to work that has focused more on an account involving self size (e.g., Piff et al., 2015). In sum, past work considering size has measured it differently or has conflated its measures, and previous work has not evaluated different nature-self size measures simultaneously. Thus, exploring the predictive utility of different nature-self size measures would not only shed light on the findings of Studies 1–2 but speak to published findings (e.g., Martin & Czellar, 2016; Piff et al., 2015; Shiota et al., 2007).

In Study 3, we explored four instantiations of self-nature representations to examine their predictive utility for pro-environmental outcomes. In addition to assessing INS with the common overlap measure, we explored size in three different ways. As Fig. 4 shows, we examined perceptions of nature size (top panel; similar to Martin & Czellar, 2016), self size (middle panel), and relative size (bottom panel, as used in Study 1), allowing us to evaluate how nature-self size effects might reflect views of nature size, self size, or relative size. In terms of outcomes, we assessed dispositional positive emotions using the DPES (Shiota et al., 2006), and we explored two different outcome measures to broaden the generalizability of our findings using the environmental value orientations scale (de Groot & Steg, 2008) and an adapted version of the general

ecological behavior scale (Kaiser, Doka, Hofstetter, & Ranney, 2003). The former provided a broader approach to measuring biospheric, altruistic, and egoistic values (de Groot & Steg, 2008, 2010), whereas the latter provided one of the most commonly used behavioral measures in environmental psychology (Lange & Dewitte, 2019).

Our focus was to explore the extent to which these measures of nature-self size (i.e., nature size, self size, relative size) along with nature-self overlap (INS) might predict pro-environmental outcomes and positive dispositional emotions. Because of power issues (i.e., with four different predictor variables, there would be 14 distinct direct, two-way, three-way, and four-way effects), we did not conduct interaction multiple regressions in the current study.

6.1. Method

6.1.1. Participants

310 undergraduates ($M_{\text{age}} = 18.70$, $SD = 1.00$; 232 female, 76 male, 2 unreported) completed a number of questionnaires at the beginning of the semester during a mass survey administration, including several measures of interest in the current work. Because mass survey was open to all 582 students in the human subject pool (53% completed the mass survey) with a fixed administration window, there was no way to constrain data collection in the current study, and thus we did not conduct an a priori sample size analysis.

6.1.2. Measures

Size and inclusion measures. Near the start of the mass survey, participants were shown seven circles (Fig. 4) of increasing size from smallest to largest, were told that each circle represented “nature,” and asked to indicate which one best describes how they feel ($M = 5.64$; $SD = 1.29$). After completing two surveys unrelated to the current study, they were shown seven circles of identical sizes that represented “the self” and were asked to select which circle best describes how they feel ($M = 4.45$; $SD = 1.83$). Then, after completing two more unrelated surveys, they completed the INS measure used in the previous studies ($M = 3.98$; $SD = 1.48$) followed by the relative size measure used in previous studies ($M = 4.43$; $SD = 1.83$). These measures were distributed throughout the mass survey to reduce the likelihood of demand and anchoring effects.

Environmental value orientations. Later in the mass survey, participants responded to 13 items that assess environmental value orientations (de Groot & Steg, 2008), providing responses on a scale ranging from 0 (not important) to 7 (very important) along with a response option of –1 (opposed to my values). This measure assesses more abstract values that capture biospheric (e.g., respecting the earth, unity with nature), egoistic (e.g., social power, wealth), and altruistic (e.g., equality, helpful) values. Following past work, we computed the mean response for each subscale to assess biospheric ($M = 5.04$, $SD = 1.49$, $\alpha = 0.87$), egoistic ($M = 3.89$, $SD = 1.19$, $\alpha = 0.66$), and altruistic ($M = 5.47$, $SD = 1.19$, $\alpha = 0.72$) value orientations.

Dispositional positive emotions. Next, participants completed the DPES (Shiota et al., 2006), which assesses individual differences in the tendency to experience several positive emotions. Three of the emotions reflect prosocial affective experiences: awe ($M = 4.91$, $SD = 0.97$; $\alpha = 0.76$), love ($M = 4.81$, $SD = 1.10$; $\alpha = 0.81$), and compassion ($M = 5.92$, $SD = 0.80$; $\alpha = 0.81$). Four other positive emotions not associated with prosocial outcomes were also assessed: joy ($M = 4.91$, $SD = 1.04$; $\alpha = 0.83$), contentment ($M = 4.76$, $SD = 1.22$; $\alpha = 0.90$), pride ($M = 4.93$, $SD = 1.01$; $\alpha = 0.78$), and amusement ($M = 5.09$, $SD = 1.01$; $\alpha = 0.72$).

GEB. Participants completed an adapted version of the General Ecological Behavior scale (Kaiser et al., 2003) developed by Davis, Green, and Reed (2009). Participants indicated the frequency with which they perform 28 pro-environmental behaviors (e.g., recycling paper, not throwing away dead batteries in the trash) on a scale ranging from 1 (never) to 5 (always). Mean response scores were calculated, with larger values reflecting more pro-environmental behavior ($M =$

⁵ In Piff et al.’s (2015) Study 5, participants endorsed one of seven diagrams that had a “Me” circle and three “Other” circles where the “Me” circle varied in size, adapting Campbell, Bonacci, Shelton, Exline, and Bushman’s (2004) entitlement measure. This is the only study reported by Piff et al. that assessed self size in a way that did not conflate it with other elements (e.g., nature size, self-nature integration), and at no point did Piff et al. test the relative contributions of these approaches in predicting outcomes such as awe.

Table 3

Zero-order correlations in Study 3 among nature-self representations, environmental value orientations, self-reported pro-environmental behaviors, and dispositional positive emotions.

	Nature-self representations				Environmental Value Orientations			
	INS	RelSize	NatSize	SelfSize	BioVO	EgoVO	AltVO	GEB
Relative size	.31**	–						
Nature size	.27**	.35**	–					
Self Size	-.04	-.53**	-.18**	–				
Biospheric VO	.30**	.20**	.23**	-.04	–			
Egoistic VO	-.02	-.11†	-.06	.15**	.13*	–		
Altruistic VO	.05	.08	.00	.07	.48**	-.01	–	
Gen Eco Behaviors	.28**	.18**	.28**	-.07	.36**	-.19**	.22**	–
Awe	.31**	.09	.25**	.07	.30**	.02	.15**	.17**
Love	.07	-.07	.03	.11	-.01	.07	.06	-.02
Compassion	.03	.09	.04	-.02	.19**	.01	.47**	.08
Joy	.23**	-.06	.12*	.20**	.17**	.22**	.12**	.03
Contentment	.19**	-.12*	.05	.23**	.14*	.21**	.09	.05
Pride	.18**	-.17**	.08	.30**	.12*	.34**	.08	.02
Amusement	.19**	.02	.07	.01	.18**	.08	.06	.15*

Note. N = 310; †p < .10, *p < .05, **p < .01.

Table 4

Multiple regressions betas and 95% CIs (in brackets) for self-nature overlap (INS), relative size, nature size, self size, and model variance accounted for in Study 3.

	Betas and confidence intervals				R ²
	INS	Relative Size	Nature Size	Self Size	
Biospheric VO	.23** [.17, .52]	.12† [-.03, .37]	.14* [.04, .40]	.06 [-.09, .27]	.12
Egoistic VO	.01 [-.14, .15]	-.04 [-.22, .12]	-.02 [-.17, .13]	.13† [.00, .31]	.03
Altruistic VO	.01 [-.13, .16]	.17* [.04, .38]	-.03 [-.19, .11]	.16* [.03, .34]	.03
General eco behavior	.20** [.03, .12]	.04 [-.03, .06]	.22** [.04, .12]	.00 [-.05, .04]	.13
Awe	.26** [.14, .37]	.00 [-.13, .13]	.20** [.09, .32]	.12† [-.01, .23]	.14
Love	.09 [-.04, .23]	-.08 [-.24, .08]	.05 [-.08, .20]	.08 [-.06, .23]	.02
Compassion	.00 [-.10, .10]	.11 [-.02, .21]	.02 [-.09, .12]	.04 [-.07, .14]	.01
Joy	.22** [.11, .35]	-.07 [-.21, .07]	.13* [.01, .26]	.20** [.08, .34]	.11
Contentment	.26** [.12, .41]	-.13 [-.30, .03]	.07 [-.05, .24]	.20** [.08, .39]	.10
Pride	.19** [.09, .32]	-.14* [-.27, -.01]	.12* [.01, .25]	.26** [.13, .38]	.15
Amusement	.20** [.09, .33]	-.06 [-.20, .08]	.04 [-.09, .17]	-.01 [-.14, .12]	.04

Note. N = 310; †p < .10, *p < .05, **p < .01.

3.35, SD = 0.36, α = 0.68).

6.2. Results

6.2.1. Zero-order correlations

Zero-order correlations are presented in Table 3. The four nature-self representation measures showed reliable albeit small relations with each other with the exception of INS and self size, which showed no correspondence.⁶ Consistent with Study 1, Study 3 found that greater INS and greater relative size (the nature-self size measure from Study 1) predicted more biospheric value orientation and more pro-environmental behaviors, though with different measures of both constructs in the current study. Greater INS predicted more awe, whereas relative size did not show the same relation. Finally, greater INS predicted more of each of the four non-prosocial positive emotions, while greater relative size predicted less contentment and less pride.

When examining the two new nature-self size measures (i.e., nature size, self size), viewing nature as larger predicted more biospheric value orientation, more pro-environmental behaviors, more awe, and more joy. Greater self size predicted more egoistic value orientation, more joy, more contentment, and more pride (the latter three being non-prosocial positive emotions). Other correlations reported in Table 3 showed some

⁶ Some readers might wonder whether these nature-self measures represent one underlying psychological construct. A confirmatory factor analysis on these four measures found that a one-factor solution provided poor fit, $\chi^2(2, N = 310) = 17.21, p < .001, TLI = 0.75, RMSEA = 0.16, SRMR = 0.06$, indicating that these measures do not reflect one underlying psychological construct.

interesting relations involving value orientations, such that greater biospheric value orientation predicted more pro-environmental behaviors, more awe and compassion (two prosocial emotions), and greater amounts of positive emotions not associated with prosocial outcomes as well. Egoistic value orientation, on the other hand, predicted less pro-environmental behavior and three of the non-prosocial emotions. Altruistic value orientation predicted more pro-environmental behaviors, more awe and compassion (both prosocial emotions), and more joy. Finally, people who reported performing more pro-environmental behaviors also reported more awe and more amusement.

6.2.2. Multiple regression analyses

To explore which nature-self measures made unique contributions in predicting the outcomes assessed, we conducted multiple regressions where each outcome measure was regressed on centered measures of INS, relative size, nature size, and self size. As Table 4 shows, greater INS and greater nature size uniquely predicted biospheric value orientations. For altruistic value orientation, greater relative size and greater self size were unique predictors.

Turning to ecological behaviors, greater INS and greater nature size were unique predictors of performing more pro-environmental actions. When examining prosocial emotions, greater awe was uniquely predicted by greater INS and by greater nature size. For the positive emotions not associated with prosocial outcomes, greater INS predicted more joy, contentment, pride, and amusement, and greater self size predicted more joy, contentment, and pride. Pride was also uniquely predicted by less relative size and by more nature size.

6.3. Discussion

Study 3 examined how pro-environmental outcomes might be explained by nature-self overlap as well as by three different nature-self size measures: relative size, nature size, and self size. The correlational analyses replicated many effects observed in Study 1, showing that greater self-nature overlap and relative size predicted stronger biospheric motivations and performing more conservation behaviors. Moreover, viewing nature as larger also predicted these outcomes, and it also predicted a greater predisposition to feel awe. Self size, on the other hand, was unrelated to these outcomes, and instead, it predicted egoistic value orientation and non-prosocial emotions (i.e., larger self was related to more joy, contentment, and pride).

However, the key findings of Study 3 involved the multiple regression analyses. For key pro-environmental outcomes, greater self-nature overlap uniquely predicted greater biospheric value orientation, performing more pro-environmental behaviors, and experiencing greater awe, reflecting the importance placed on INS in past work (e.g., Schultz, 2001). Most important, greater nature size uniquely predicted key pro-environmental outcomes (i.e., biospheric value orientation, performing more ecological behaviors, feeling awe). Neither relative size nor self size was a strong unique predictor of pro-environmental outcomes in the same way that INS and nature size were. These findings suggest that nature size may play a considerable role in the nature-size effects observed in Studies 1 and 2. Moreover, these findings suggest that the conflation of size observed in past work (e.g., Piff et al., 2015, Studies 1–4; Shiota et al., 2007) and interpretation of these effects as implicating self size merit additional consideration. However, it is important to note that relative size and self size did reveal unique predictive utility in some cases. Further, self size uniquely predicted non-prosocial emotions such as joy, contentment, and pride (all new findings). Interestingly, greater INS, greater nature size, and greater self size, and less relative size uniquely predicted more pride.

We are not proposing that past work should be wholly reinterpreted in light of these findings, but the data suggest additional work is warranted to more conclusively identify the nature-self size elements at work in past research. For example, the current work found that greater self size did not uniquely predict biospheric value orientation or pro-environmental behaviors, whereas nature size did uniquely predict these outcomes. We hope the current findings spur investigators to revisit past findings attributed to self size to better document the elements of nature-self size that underlie pro-environmental outcomes.

Similarly, the findings that nature size was a unique predictor of biospheric value orientation, pro-environmental behaviors, and awe seem more consonant with the size measurement used by Martin and Czellar (2016). However, those authors also proposed that various nature-self measures should be combined (with others) into a single measure, yet the current findings suggest more work is needed in this area as well (e.g., the lack of a single-factor structure in the current data, small-to-moderate correlations among nature-self measures across all studies in the current work, evidence that INS and nature size each provide unique predictive utility in accounting for pro-environmental outcomes).

Admittedly, the findings involving positive emotions are less clear. For example, no unique predictors were observed with dispositional love and dispositional compassion in the current study, whereas the experimental manipulation of Study 2 produced shifts in state positive emotions on these prosocial emotions. Caution should be used when interpreting these results due to differences between state emotions and emotion dispositions. Although dispositions and state emotions tend to be related (Rosenberg, 1998), they can diverge or interact when predicting other factors such as mood, behavior, and physiological changes (e.g. McCullough, Tsang, & Emmons, 2004; Rosenberg et al., 2001).

7. General discussion

Across three studies, there was good evidence that nature-self size provided unique predictive utility for a range of pro-environmental outcomes above and beyond self-nature overlap. In Study 1, greater nature-self size predicted the same pro-environmental outcomes as greater inclusion of nature in self (e.g., greater biospheric concern, more pro-environmental beliefs and behaviors, belief in anthropogenic global warming). When looking at the *unique* ability of nature-self overlap and size to predict these outcomes, only size uniquely predicted more self-transcendent values, believing more strongly in anthropogenic global warming, and espousing more liberal ideologies (the latter two concepts being implicated in climate change acceptance; McCright & Dunlap, 2011; Whitmarsh, 2011).

In Study 2, we experimentally manipulated nature-self size, observing significant changes in measures of nature-self size but not in nature-self overlap. This dissociation provides additional support for a meaningful distinction between measures of nature-self size and overlap. Moreover, because of the experimental nature of Study 2, we established that increasing nature-self size led to experiencing more prosocial emotions in the moment, which are related to pro-environmental action (e.g., Geiger & Keller, 2018; Lu & Schuldt, 2016; Perkins, 2010; Piff et al., 2015). This nature-self size manipulation, however, did not produce reliable shifts in non-prosocial emotions.

Study 3 explored how different measures of nature-self size (i.e., nature size, self size, relative size) predicted conservation outcomes (e.g., biospheric value orientation, environmental behaviors, awe). Past work has conflated these different instantiations of nature-self size (e.g., Piff et al., 2015; Shiota et al., 2007) or only measured one of them (e.g., Martin & Czellar, 2016), and no past work has evaluated their unique effects simultaneously. Overall, Study 3 found good evidence that self-nature overlap and nature size were important and unique predictors of conservation outcomes (i.e., biospheric values, pro-environmental behaviors, awe). Self size did not uniquely predict pro-environmental outcomes, but it uniquely predicted altruistic value orientation and non-prosocial positive emotions (e.g., joy, pride). Relative size also uniquely predicted greater altruistic value orientation and it predicted less pride.

Overall, these findings suggest that nature size may be the strongest component of nature-self size effects reported in Studies 1–2 and perhaps in past work as well (e.g., Piff et al., 2015; Shiota et al., 2007). The current work should not be viewed as a conclusive test of which components of nature-self size are essential or irrelevant. Indeed, these findings illustrate the need for greater precision in self-nature size assessment and consideration for how self-nature representations correspond to particular conservation contexts. For instance, viewing an expansive mountain range might trigger effects based on nature size (see Martin & Czellar, 2016), having people engage in meditation might trigger effects based on self size, or directing people to compare themselves to the vastness of an ocean might trigger effects based on relative size. Thus, there are probably meaningful roles for nature size, self size, and relative size, and future work should adopt a more comprehensive approach to the role of nature-self size and what features are presumed to underlie pro-environmental action.

As noted previously, viewing the self as relatively small reduces people's sense of entitlement and exaggerated self-worth (e.g., Morf & Rhodewalt, 2001; Piff, 2014), which can reduce selfish impulses that undercut prosocial action (e.g., Dietz et al., 2003; Hardin, 1968; Van Vugt, 2009). However, there may be ways to leverage self focus for environmental benefits. For example, there may be situations where appealing to ego can encourage pro-environmental action, such as people driving a hybrid car because it projects a positive self-image (e.g., McLeay, Yoganathan, Osburg, & Pandit, 2018), and in such cases, self size may be a positive predictor of conservation behavior. On the other hand, viewing the self as relatively less important than others is critical for self-transcendence (Schwartz, 1992), which enhances prosocial

emotions that increase interconnectedness (e.g., Haidt, 2003; Stellar et al., 2017) and promotes pro-environmental beliefs and behaviors (e.g., de Groot & Steg, 2008; Evans et al., 2013; Steg & Vlek, 2009). Thus, in situations where conservation behavior reflects a trade-off between self-interest and nature, such as people who make their living off fishing but who risk overharvesting (e.g., Penn, 2003), relative size may matter most. Although Study 3 may suggest that nature size is the most important element of nature-self size relations, we believe drawing such a conclusion would be too simplistic, and as noted above, we anticipate that different nature-self size components will matter in particular contexts.

In addition to examining aspects of nature-self size in pro-environmental outcomes, the current work explored other constructs of interest, such as the role of discrete emotions and anthropogenic global warming skepticism. Although past work focused on general affective processes such as emotional investment in conservation and emotional reactions to environmental degradation as being critical for pro-environmental action (e.g., Kollmuss & Agyeman, 2002; Pooley & O'Connor, 2000), more recent work (e.g., Geiger & Keller, 2018; Lu & Schuldt, 2016; Perkins, 2010; Piff et al., 2015) highlights the role of discrete prosocial emotions. Indeed, the current work found that nature-self size (either based on existing individual differences or experimental manipulations) was tied to prosocial emotions such as love, compassion, and awe. This latter emotion, in particular, has been the focus of research involving self-nature connection (e.g., Piff et al., 2015; Shiota et al., 2007). Relatedly, the current work found that awe was related to greater biospheric motivations and more pro-environmental behavior, and that awe was uniquely predicted by self-nature overlap and by seeing nature as relatively large. Future work should continue to investigate the role of discrete emotional experiences in pro-environmental action. Also, because of research showing connections between conservatism and climate change denial (e.g., Cruz, 2017; McCright & Dunlap, 2011; Whitmarsh, 2011), the current work explored and found evidence that viewing nature as relatively larger than the self uniquely predicted greater agreement with liberal (vs. conservative) ideologies and stronger belief in anthropogenic global warming. Thus, future work exploring ideologies and climate change denial should also consider nature-self representations.

Moreover, the current study examined different forms of environmental motivation (e.g., de Groot & Steg, 2008; Schultz, 2001). Consistent with past work, we were primarily interested in how nature-self overlap and size would predict biospheric motivations because concern for the biosphere is most strongly associated with pro-environmental action (e.g., Schultz et al., 2004). Study 1 found that greater biospheric concern predicted more pro-environmental outcomes (e.g., greater nature-self size, more pro-environmental behaviors, stronger belief in anthropogenic global warming, greater self-transcendence), whereas egoistic concern predicted less of these same outcomes (the patterns for altruistic concern were less consistent), replicating Schultz et al. (2004). Study 3 assessed environmental value orientation (de Groot & Steg, 2008), and similar findings were observed. That is, greater biospheric value orientation predicted more pro-environmental outcomes (e.g., greater nature-self size, more ecological behaviors) whereas egoistic value orientation predicted less of these same outcomes (altruistic value orientation showed a less consistent pattern). Thus, across two different frameworks (i.e., environmental concern and environmental value orientation), we observed that people whose motivations are more biospheric showed greater pro-environmental engagement and reported that nature is relatively larger than the self, whereas people more motivated by egoistic concerns showed the opposite relations. These connections reflect broader connections with self-transcendence, where concern for the planet and its species are more important than one's personal influence and power (e.g., Boer & Fischer, 2013; Caprara et al., 2012; Schwartz, 1992).

Although the current findings highlight the value of assessing nature-self size, several caveats apply to this work. For example, we only

examined undergraduate participants, and future work should examine more heterogeneous populations for better generalizability and to reduce biases involving college student samples such as being relatively more liberal or greater in social desirability (for overviews, Henrich, Heine, & Norenzayan, 2010; Peterson, 2001). Also, some readers might wonder if the number of regressions conducted in Studies 1 and 3 could lead to erroneous conclusions because of Type I errors. Although such concerns are understandable, we did not adjust alpha levels for several reasons. First, approaches such as Bonferroni corrections have been criticized by scholars (e.g., Nakagawa, 2004; O'Keefe, 2003) for being too conservative, increasing Type II errors, contributing to publication bias, and having no consensus for when they should be applied. Further, it has been argued that familywise corrections may only be necessary when hypotheses are not stated in advance (Perneger, 1998), but our predictions were a priori and derived from three established psychology literatures. We also used a diverse set of outcomes (e.g., conservation attitudes, pro-environmental behaviors, values, emotions) that vary in interdependence, making it unclear what would constitute families in need of correction. Finally, the general pattern of findings is supported by multiple, high-powered studies, making errant conclusions based on Type I errors unlikely.

A third limitation is that although we had appropriate statistical power to observe direct effects, we urge readers to interpret the interactions presented in Study 1 with caution and as, at best, suggestive evidence. In addition, we only assessed reports of pro-environmental behaviors, and future work should document how nature-self representations predict actually performing conservation-related behaviors. Also, although Study 2 provided good evidence for manipulating relative nature-self size orthogonally in the lab, we believe that nature-self size should be able to be altered naturalistically (e.g., exposure to natural landscapes) and in ways that lend themselves to everyday interventions, and we look forward to seeing such applications in future work.

In sum, three studies showed that nature-self size offers unique predictive utility for pro-environmental motivations, behaviors, and prosocial positive emotions. Our intention is not to dilute the importance of past work, but rather, to suggest that a more comprehensive approach to self-nature representations can shed important light on instigating pro-environmental action (see also, McConnell et al., 2013; McConnell et al., 2009). We propose that nature-self size provides conservation science scholars with important bridges to many relevant literatures, including the self, emotions, and political ideology. Finally, we believe that enhancing our understanding of how the self-concept can be related to nature is one of the best ways to unlock the motivational processes necessary to produce sustained and meaningful action to protect the environment.

CRedit authorship contribution statement

Allen R. McConnell: Conceptualization, Methodology, Validation, Formal analysis, Resources, Writing - original draft, Writing - review & editing, Visualization, Supervision, Project administration. **Tyler P. Jacobs:** Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing, Visualization.

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