Received: 5 April 2022 | Revised: 12 November 2022 | Accepted: 16 November 2022

DOI: 10.1111/jopy.12795

ORIGINAL ARTICLE

WILEY

Personality aspects and proenvironmental attitudes

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Abstract

Objective: Climate change is a serious threat. Personality psychologists can help address this threat by understanding what kind of people tend to endorse proenvironmental attitudes and engage in sustainable behavior. Previous research supports reliable associations between proenvironmental attitudes and personality traits. However, this research has generally aggregated different kinds of attitudes into a single composite and has focused on the domain level of personality traits.

Method: This study explored how 10 lower-order aspects of the Big Five personality traits were related to eight different proenvironmental attitudes in three convenience samples from the United States (N = 1234; 1000) and the United Kingdom (N = 538).

Results: All five trait domains were related to at least one proenvironmental attitude across all three samples. Seven of eight proenvironmental attitudes could be predicted by one or more traits in all three samples. We also found evidence that the Openness aspect of Openness to Experience was a more consistent predictor of proenvironmental attitudes than the Intellect aspect. In contrast, there was little benefit in distinguishing between the aspects of other trait domains. We did not find evidence that age or political orientation moderated the associations between proenvironmental attitudes and personality.

Conclusion: Results point to the need for more fine-grained research on individual differences in proenvironmental attitudes and behavior.

KEYWORDS

aspects, attitudes, Big Five, climate change, environment, personality, values

1 | INTRODUCTION

Climate change poses a serious threat to human and nonhuman welfare. Personality psychology can help society meet this threat by generating knowledge about individual differences characteristics associated with sustainable behavior (Clayton et al., 2015; Swim et al., 2011). The most robust psychological predictors of sustainable behaviors are proenvironmental attitudes such as valuing planetary health or being concerned about climate change (Balderjahn et al., 2013; Bleidorn et al., 2021; Dunlap et al., 2000; Grob, 1995; Hines et al., 1987; Kaiser et al., 1999).

There is a growing literature supporting links between broad personality traits and proenvironmental attitudes and behaviors (Milfont, 2021). This link was implicit in early work that endeavored to describe the environmental personality in a way that blurred distinctions

between individual differences in personality traits and environmental attitudes (e.g., Blaikie, 1992; Wiseman & Bogner, 2003). Subsequent to the ascendance of the Big Five (Goldberg, 1993) and later HEXACO (Ashton & Lee, 2007) trait models and parallel scholarship in personality psychology that distinguished between personality traits and related but different "characteristic adaptations" that could be thought of as validating criteria for personality models such as values, beliefs, and attitudes (McAdams & Pals, 2006), researchers began focusing on how general trait models were associated with proenvironmental attitudes, beliefs, and behaviors. Early studies provided evidence for such links, and in particular implicated traits involving Agreeableness and Openness as predictors of environmental concerns (e.g., Hirsh & Dolderman, 2007). This literature expanded, mostly during the last decade, until it was sufficiently large to merit a recent meta-analytic synthesis by Soutter et al. (2020). These authors found significant correlations between proenvironmental attitudes and all major Big Five/HEXACO personality traits except Neuroticism. Estimates were = .22 for Openness to Experience, .21 for Honesty/Humility, .15 for Agreeableness, .12 for Conscientiousness, and .09 for Extraversion.

Evidence about the role of personality traits in proenvironmental attitudes is important for both basic and applied reasons. The relevance of this work for basic psychology lies in the potential utility of comprehensive trait models as a general framework for individual differences in a wide range of moral behaviors (Andrejević et al., 2022; Smillie et al., 2019; Thielmann et al., 2020). Such a framework can bring order to the literature on prosocial behavior and provide a firm basis for hypotheses about why different kinds of people are more or less likely to behave in more prosocial ways, including behaviors that support climate health. Concerning application, evidence that personality can be used to predict moral behaviors could be used to inform tailored interventions. For instance, interventions designed to promote certain kinds of personality changes in the general population could have the effect of increasing specific moral behaviors (e.g., proenvironmental behavior; Bleidorn et al., 2019; Sun & Goodwin, 2020). Alternatively, interventions aimed at increasing proenvironmental or other moral behaviors could be tailored or targeted by taking individual personality profiles into account (Chapman et al., 2014; Lee et al., 2015; Lokhorst et al., 2010; Matz et al., 2017).

However, most research in this area has been limited in two ways that are addressed in this study. First, previous studies have focused primarily on relatively broad personality traits, and thus may have missed the nuance provided by narrower features of personality. Second, previous studies have tended to focus on either general or isolated proenvironmental attitudes. Thus, there is little knowledge about how personality traits are related to different kinds of proenvironmental attitudes. The goal of this study was to go beyond these general levels of analysis to explore how specific aspects of personality are related to different kinds of proenvironmental attitudes in three large and diverse samples from the United States and the United Kingdom. In doing so, we aim to provide a more fine-grained examination of how personality differences are linked with proenvironmental attitudes.

1.1 | Personality aspects

The Big Five traits commonly used in personality research can be further divided into two aspects per Big Five domain (DeYoung et al., 2007), several narrower facets (McCrae & Costa, 1999; Schwaba et al., 2020), and even narrower nuances (Mõttus et al., 2017). In this study, we focused on the aspect model, in which Neuroticism is divided into Withdrawal (i.e., doubt, fear, and anxiety) and Volatility (anger and irritability), Extraversion into Enthusiasm (positive emotions and social confidence) and Assertiveness (leadership and forcefulness), Openness to Experience into Intellect (complexity and cognitive fluency) and Openness (aesthetic interest and fantasy proneness), Agreeableness into Compassion (interest in others and empathy) and Politeness (conformity and respect for others), and Conscientiousness into Industriousness (planfulness and persistence) and Orderliness (tidiness and detail orientation).

We focused on aspects for two reasons. First, unlike most other lower-order trait models, the aspects were developed based on empirical techniques that went beyond factor analyses of domain scales and thus arguably represent a more evidence-based model of lower-order traits than other possible models. Specifically, DeYoung et al. (2007) not only developed the aspect model on the basis of factor analyses of relatively comprehensive sets of facets, they also showed that the resulting scales have differential associations with genetic factors from previous research, indicating separable biological substrates within personality domains. Second, a number of previous studies have used the BFAS to explore prosocial behaviors (Ferguson et al., 2019; Fong et al., 2021; Zhao et al., 2017a, 2017b), and this provides a useful benchmark against which to compare our results. However, the more important point is that there is potential value in examining lower-order traits because there are reasons to expect different patterns of association with proenvironmental attitudes.

For instance, associations with Conscientiousness may be primarily driven by industrious people who proactively

find effective solutions, as opposed to those who prefer order. As another example, to the extent that climate change is a concerning issue that could trigger anxiety and worry for some people (Hopwood, Schwaba, et al., 2022), we might expect it to be more strongly related to features of Neuroticism that involve anxiety (i.e., Withdrawal) rather than Volatility.

Previous research has demonstrated the value of considering lower-order elements of personality trait models for depicting associations with external content in a finer grain. For instance, Stewart et al. (2021) found that lower-order traits consistently outperformed broad domains in predicting various outcome variables, including mental disorders, identity variables, well-being, and political attitudes. It is intuitive that trait models with greater specificity would outperform broad, high bandwidth models for specific outcomes, although some previous research has challenged this intuition (Grucza & Goldberg, 2007; Morey et al., 2007). In this study, we expected that some aspects of trait domains would be more strongly linked to proenvironmental attitudes and behaviors than others within the same trait domain (Gibbon & Douglas, 2021; Markowitz et al., 2012; Soutter & Mõttus, 2021).

This expectation was based on a growing body of research that has indicated differential associations between personality aspects within the same domain and moral or prosocial variables. For instance, Hirsh et al. (2010) found that Compassion but not Politeness was related to egalitarian concerns within the Agreeableness domain, whereas Orderliness but not Industriousness was related to concerns about loyalty and respect for authority within the Conscientiousness domain. Rengifo and Laham (2022) reported that the Assertiveness aspect of Extraversion was positively correlated with moral disengagement, or the tendency to withdraw from one's ethical responsibilities, whereas the Enthusiasm aspect had a mild negative correlation with this tendency. On the other hand, Ferguson et al. (2019) found that Assertiveness but not Enthusiasm was related to prosocial behaviors that come with personal costs, such as charity or volunteering. Zhao et al. (2017a, 2017b) found that adhering to social norms was associated with Politeness, whereas behaviors involving punishment and reward of others were associated with Compassion. Fong et al. (2021) reported that Assertiveness but not Enthusiasm was related to self-reported and behavioral competitiveness, and that whereas polite people reported being less competitive compassionate people were less competitive in behavioral games. Within the Agreeableness domain, Stahlmann et al. (in preparation) reported that Compassion was more strongly linked to charitable giving than Politeness. Hopwood, Stahlmann, et al. (2022) found stronger associations with positive attitudes toward nonhuman animals for Compassion relative to Politeness within Agreeableness and Openness relative to Intellect within Openness to Experience.

With regard to proenvironmental behaviors specifically, Gibbon and Douglas (2021) found that the Openness aspect of Openness to Experience was a stronger correlate of proenvironmental attitudes than Intellect, whereas Hopwood, Lenhausen, et al. (2022) found that Compassion was a stronger correlate of proenvironmental attitudes and engagement behaviors than Politeness within Agreeableness. Soutter and Mõttus (2021) reported that the Altruism, Morality, and Sympathy facets of Agreeableness were stronger predictors of proenvironmental attitudes than the Trust, Cooperation, and Modesty facets.

Overall, these findings indicate that it is likely that lower-order aspects add nuance to our understanding of how personality traits are related to prosocial attitudes and behaviors in general and proenvironmental attitudes and behaviors in particular. An initial summary of this work suggests that Compassion is more strongly related than Politeness and Openness is more strongly related than Intellect to most classes of moral behavior, and that Assertiveness has a complex association with prosociality. However, findings thus far are mixed and inconsistent, and work on how lower-order elements of personality are related to proenvironmental attitudes is still emerging. One potential factor in these mixed findings is that personality traits may have different associations with different kinds of proenvironmental attitudes.

1.2 | Proenvironmental attitudes

Although proenvironmental attitudes tend to be highly correlated, justifying their aggregation into a single composite in many studies (e.g., Dunlap et al., 2000; Soutter et al., 2020), there are also reasons to distinguish between different kinds of proenvironmental attitudes. For instance, some attitudes relate to deeply held values about the importance of caring for the planet, supporting future generations, and maintaining a connection to nature. Others may have to do with specific reasons for supporting the environment, such as those related to doing what feels right personally instead of the fact that it is socially rewarded. Still others involve beliefs about how the environment can be supported, for instance, by reducing consumption or via market-based solutions.

As of yet, there is no widely accepted comprehensive model of variation in proenvironmental attitudes. Our approach was to sample relevant attitudes that may potentially be associated with different personality attributes to provide a general test of whether personality correlates vary across proenvironmental attitude, and to provide an

initial basis for articulating a comprehensive theoretical model. In this study, we distinguished eight proenvironmental attitudes.

The first involved general values favoring *social justice and environmental protection* (Pepper et al., 2009). Previous work on personality and values suggests that Agreeableness and Openness are likely to be the strongest predictors of such values (e.g., Roccas et al., 2002). Second, we measured *connectedness to nature* (Mayer & Frantz, 2004), a construct commonly used in the sustainability literature to capture a general proenvironmental orientation. Previous studies have linked high Agreeableness and Openness to this proenvironmental construct as well (Di Fabio & Kenny, 2021). Third, we assessed *motives to adopt a vegetarian diet to protect the environment* (Hopwood et al., 2020) as a relatively specific application of proenvironmental attitudes that has been found to be correlated most consistently with Agreeableness. Fourth, we measured *extrinsic motives for proenvironmental behavior* related to gaining rewards and avoiding punishments such as taxes or fines. Fifth, we assessed *intrinsic motives related to internal desires to protect the environment*. Previous research suggests that Conscientiousness and Extraversion are the strongest predictors of extrinsic motivation for academic performance, whereas Conscientiousness and Openness are the strongest predictors of intrinsic motivation (Komarraju et al., 2009; Sung & Choi, 2009), although it is not clear if this pattern would generalize to proenvironmental attitudes. Sixth, we assessed *social motives related to being approved of by others or avoiding public judgment*. Some previous research suggests that Neuroticism is related to sensitivity to social pressure (Oyibo & Vassileva, 2019). Seventh, we assessed *faith in growth*, or the belief that environmental issues will be effectively dealt with if we continue to rely on technology and human development (Gilg et al., 2005). Eighth, we assessed *biospherism*, or the contrary belief that the balance of nature must be actively protected. Thus far, Big Five personality correlates of faith in growth and biospherism have not been examined.

These proenvironmental attitudes are sufficiently different from one another that we expected them to show different patterns of association with personality trait domains and aspects. For example, Compassion reflects an intrinsic interest in and empathy for others (DeYoung et al., 2007) that may translate to an intrinsic desire to help the environment. In contrast, Politeness reflects conformity to social norms to avoid hurting, disrespecting, or antagonizing others. Polite people may be more motivated to help the environment in order to fit in, avoid offending others, or appear virtuous. Based on this difference, we might expect Compassion to show differential correlations to attitudes that are more costly, more normative, or less likely to be noticed by others. In contrast, we might expect Politeness to be more strongly related to proenvironmental behaviors motivated by potential for social or material loss.

Likewise, within the Openness to Experience domain, people high in the Openness aspect tend to reflect upon their feelings and the world. In contrast, people high in Intellect tend to engage with ideas and act competently on their decisions. We might expect people high in Openness to be more likely to have affect-based attitudes about the importance of the environment and their connection to the natural world, whereas people high in Intellect might have a more cognitive, problem-solving approach to environmental issues (Ferguson et al., 2019).

1.3 | Moderation by age and political orientation

Perceptions toward and outlooks on climate change are complex in ways that may affect how personality is associated with proenvironmental attitudes across sectors of the population. For instance, views about climate change, and the degree to which personality traits may be related to those views, may depend in part on how old people are (Hopwood, Schwaba, et al., 2022; Hopwood et al., in press). Aging is generally associated with increasing levels of generativity, agency, and mastery (Best & Freund, 2021; Heckhausen, 1997; Hutteman et al., 2014), and this could have the effect of heightening concerns about climate change and proenvironmental attitudes (Bleidorn et al., 2021; Milfont & Sibley, 2011). To that extent, personality may be a particularly strong predictor of proenvironmental attitudes among younger people, for whom normative pressures to hold such attitudes are weaker (Milfont et al., 2020). On the other hand, it is also possible that proenvironmental attitudes are pervasive among younger people who are more likely to learn about climate change in school and are more prone to experience its consequences during their own lifetimes. In this case, personality might be a stronger predictor in older people, for whom there is more variability in environmental attitudes.

Proenvironmental positions are generally associated with the political left to the degree that this has become a universal platform difference between left and right-leaning political parties in the West (Feinberg & Willer, 2013; Kim et al., 2013, 2021; but see also Sparks et al., 2022). Insofar as most individuals with left-leaning political views can be expected to hold proenvironmental positions, individual personality traits may play a more prominent role in attitudes about the environment among

conservatives. With these considerations in mind, we aimed to explore how age and political orientation moderate personality-proenvironmental attitude associations.

1.4 | Summary

The general goal of this study was to identify associations between personality domains aspects and eight distinct proenvironmental attitudes in three large samples. The first sample came from a dataset whose original purpose was to establish a model of different types of sustainable behaviors (https://osf.io/5r9ac/?view_only=9de49cc0e5544be7ab11cafae594f653). None of the hypotheses or analytic methods from the first sample were pre-registered. We pre-registered hypotheses in a subset of environmental variables in the second and third samples based on the results from the first (https://osf.io/x6ku3/?view_only=553761e424d944338ee4b1d551ab2ec3).

We had three specific aims. First, we tested whether there was additional utility in distinguishing between the different aspects of Big Five traits for predicting individual differences in proenvironmental attitudes. Second, we examined whether specific proenvironmental attitudes had different patterns of association with personality traits. Third, we tested whether age or political ideology moderate personality-proenvironmental attitude associations.

2 | METHOD

For sample 1, we recruited 1247 US participants through the survey platform Prolific, with a target sample of at least 1100. We removed people if they failed more than two attention checks and completed the study in <5 min, resulting in a sample size of 1234. We paid participants $7.50 for participating. The sample were 49.84% women, 48.46% men, and 1.70% non-binary; M_{age} = 46.27, SD_{age} = 16.05. All materials, data, and scripts can be found at https://osf.io/5r9ac/?view_only=9de49cc0e5544be7ab11cafae594f653.

Samples 2 and 3 were also collected via Prolific. For sample 2 (US; N = 1000), participants were 48.70% women, 51% men, and 0.30% non-binary; M_{age} = 47.00, SD_{age} = 18.74. For sample 3 (UK; N = 598), participants were 49.50% women, 50.33% men, and 0.17% non-binary; M_{age} = 36.29, SD_{age} = 10.47. Preregistration as well as materials, data, and script can be found at https://osf.io/x6ku3/?view_only=553761e424d944338ee4b1d551ab2ec3. Data from samples 2 and 3 will also be used for a separate study focused on how personality traits are related to civic engagement variables (see https://doi.org/10.17605/OSF.IO/MQ2N5).

2.1 | Measures

2.1.1 | Personality

The *Big Five Aspect Scale* (BFAS; DeYoung et al., 2007) is a measure of personality traits with 100 items answered on a 5-point Likert scale. It measures two aspects of each of the Big Five domains of personality: Neuroticism (Volatility ω_t = .92 [sample 1], .94 [sample 2], .92 [sample 3] and Withdrawal ω_t = .91, .94, .90), Extraversion (Enthusiasm ω_t = .89, .90, .88 and Assertiveness ω_t = .91, .90, .89), Openness (Intellect ω_t = .84, .90, .88 and Openness ω_t = .84, .84, .83), Agreeableness (Compassion ω_t = .92, .91, .92 and Politeness ω_t = .82, .81, .79), and Conscientiousness (Industriousness ω_t = .90, .91, .90 and Orderliness ω_t = .87, .87, .85).

2.1.2 | Attitudes

We measured *Proenvironmental and Social Justice Values* with a single item asking about the perceived importance of social justice and environmental protection rated on an 11-point scale, based on Pepper et al. (2009).

The *Connectedness to Nature Scale* (CNS; Mayer & Frantz, 2004; ω_t = .91, .90, .88) is a 14-item measure of one's positive and connected feelings toward nature and the environment with items rated on a 5-point Likert scale.

The *Vegetarian Motives Inventory* (VEMI; 15; Hopwood et al., 2020) was used to measure Environmental motives to adopt or consider a vegetarian/vegan (veg*n) diet (ω_t = .94, .95, .94). Its five items are responded to on a 7-point Likert scale.

We measured *Environmental Motives* with items assessing Extrinsic (3 items, ω_t = .87 [sample 1])[1]; 4 items, .87, .85, Intrinsic (4 items, ω_t = .92, .71, .86), and Social (4 items, ω_t = .93, .87, .86) motives for sustainable behaviors (Hopwood, Lenhausen, et al., 2022). Items were responded to on a 5-point Likert response scale.

Environmental values were measured with 10 items from Gilg et al. (2005). These items were separated into Faith in Growth (i.e., the belief that humans should do with nature what they please, five items, ω_t = .75, .70, .75), and Biospherism (i.e., the belief that the balance of nature should be protected, five items, ω_t = .79, .76, .74) scales.

The *Social and Economic Conservatism Scale* (12; Everett, 2013; ω_t = .92, .92, .83) is a 12-item measure of liberalism-conservatism with attitudes about different

political issues rated on a 0 (liberal) to 100 (conservative) scale.

2.2 | Analyses

Analyses were performed in R (R Core Team, 2021) using the lavaan package (Rosseel, 2012). We first fit measurement models in which BFAS items loaded on the two aspects, separately for each trait domain. We included a method factor with paths to all reverse-coded items in these models. We next included regression paths to each proenvironmental attitude variable in separate models (i.e., one model for each trait and each proenvironmental attitude, or $5 \times 8 = 40$ total models). We compared the fit of models in which these two regression paths were either freed to vary or constrained to equality, using a 1df chi-square test. We interpreted the domain-level correlation for models in which the data fit better when the paths were constrained. We interpreted the aspect-level regression paths for models in which the data fit better when the paths were freed to vary.

We fit these models separately in each sample, but for this paper, we report trait-attitude associations based on findings that replicated across all three studies. For instance, if our results suggested that the two aspects of a trait domain had different associations with a proenvironmental attitude in one sample but not the other two, we ignored aspect differences in presenting results. This is a relatively strict or conservative approach, in that some instances where aspects could arguably be distinguished may have been missed based on the overall weight of evidence. For this reason, we include sample-specific results in Supplemental Materials.

Finally, we included age, centered at the median, and political orientation, centered the absolute midpoint of the raw scale (i.e., neither conservative nor liberal), as moderators of trait-attitude associations. We used a *p*-value of .01 for all statistical tests in the first exploratory study with sample 1. For the pre-registered studies, we used a family-wise Holm's correction with a *p*-value of .01.

3 | RESULTS

Means, standard deviations, and bivariate correlations among all study variables are presented in Tables S4–S7. We first fit measurement models for each of the trait domains. In sample 1, the fits of these models were acceptable to marginally acceptable (Table 1), with RMSEA values ranging from .057 to .090 and CFI values ranging from .832 to .931. Although it may have been possible to improve these fits by further modifying the models, we were concerned that these changes would not be generalizable (Hopwood & Donnellan, 2010). Considering that our main goal was to generate aspect scales to use in regression models, we tolerated somewhat imperfect fit estimates in all three samples.

We next compared models in which the regression paths from environmental variables were constrained to be equal for both aspects of each trait to models in which these paths were freed to vary. These models tested how aspects had significantly different associations with environmental variables. Results varied by trait domain and sample (Table 1). Openness to Experience was the only domain for which models consistently suggested different patterns of association across aspects. This effect was significant in all three samples for five of eight proenvironmental variables (proenvironmental/social justice values, connectedness to nature, environmental motives for veg*n diet, intrinsic environmental motives, and biospherism). No other model comparison tests supported distinguishing between the personality aspects in all three samples. However, the freely estimated aspect model fit the data better for extrinsic environmental motives in samples 1 and 3, and it was very close ($p = .053$) in sample 2. For this reason, we distinguished the Openness to Experience aspects of Openness and Intellect for this variable. Moreover, models for the association between Agreeableness aspects and social environmental motives fit better for aspects in samples 1 and 2, and marginally better ($p = .065$) in sample 3. Thus, we distinguished the Agreeableness aspects for social environmental motives.

Overall, these findings support the conclusion that aspects can help depict proenvironmental attitudes in a finer grain than the trait domain. However, this benefit is mainly restricted to distinguishing between the Openness and Intellect aspects of Openness to Experience.

Regression coefficients revealed significant associations between personality traits and all eight proenvironmental attitudes. Seven (all but faith in growth) specific trait-attitude associations replicated across all three samples (Table 2; results based on model findings specific to each sample are in Table S1). Appreciable variation in these associations supported the underlying premise of this study that nuance is lost when environmental attitudes are aggregated into a single summary score. In what follows, we focus on effects that replicated across all three samples.

The most consistent associations with proenvironmental attitudes were observed for the Openness aspect of Openness to experience and domain-level Agreeableness. These traits were positively related to proenvironmental/social justice values, connectedness to nature, and intrinsic environmental motives, and negatively related to extrinsic environmental motives. The Openness aspect was

TABLE 1 Fit statistics for measurement and regression models.

Measurement model	**Neuroticism**		**Extraversion**		**Openness**		**Agreeableness**		**Conscientiousness**	
df	161		160		161		158		159	
Sample 1										
χ^2	1320.729		1420.497		1046.957		802.313		1661.895	
RMSEA [95% CI]	.076 [.073, .080]		.080 [.076, .084]		.067 [.063, .071]		.057 [.054, .061]		.088 [.084, .091]	
CFI	.909		.883		.871		.931		.842	
Sample 2										
χ^2	1084.267		1345.839		1074.929		757.094		1566.177	
RMSEA [95% CI]	.076 [.071, .080]		.086 [.082, .090]		.075 [.071, .080]		.062 [.057, .066]		.094 [.090, .098]	
CFI	.931		.866		.859		.909		.830	
Sample 3										
χ^2	684.772		736.838		664.424		431.938		790.462	
RMSEA [95% CI]	.074 [.068, .079]		.078 [.072, .083]		.072 [.067, .078]		.054 [.048, .060]		.081 [.076, .087]	
CFI	.909		.872		.858		.925		.846	
Regression models	**$\Delta\chi^2$**	***p***	**$\Delta\chi^2$**	***p***	**$\Delta\chi^2$**	***p***	**$\Delta\chi^2$**	***p***	**$\Delta\chi^2$**	***p***
Sample 1										
Proenvironmental/social justice values	0.012	.911	2.465	.116	**79.132**	<.001	**20.076**	<.001	3.726	.054
Connectedness to nature	1.313	.252	1.585	.208	**112.837**	<.001	**15.308**	<.001	**24.980**	<.001
Environmental motives for veg*n diet	**14.317**	<.001	0.757	.384	**65.873**	<.001	6.317	.012	0.381	.537
Extrinsic environmental motives	0.004	.949	**12.253**	<.001	**27.301**	<.001	0.612	.434	**34.597**	<.001
Intrinsic environmental motives	0.829	.363	3.976	.046	**69.983**	<.001	**11.982**	<.001	0.257	.612
Social environmental motives	0.952	.329	0.063	.802	1.848	.174	**47.366**	<.001	0.309	.578
Faith in growth	**8.092**	.004	0.055	.814	**19.374**	<.001	0.877	.349	0.125	.724
Biospherism	**14.206**	<.001	0.026	.873	**67.489**	<.001	0.930	.335	1.613	.204
Sample 2 (US American)										
Proenvironmental/social justice values	3.788	.936	5.229	.462	**54.037**	<.001	0.399	1.000	0.051	1.000
Connectedness to nature	0.075	1.000	0.527	1.000	**110.557**	<.001	5.719	.391	4.790	.551
Environmental motives for veg*n diet	**19.667**	<.001	2.773	1.000	**36.105**	<.001	0.292	1.000	5.366	.462
Extrinsic environmental motives	0.149	1.000	0.048	1.000	9.502	.053	1.905	1.000	**21.044**	<.001
Intrinsic environmental motives	**13.521**	.007	**14.869**	.003	**50.625**	<.001	5.162	.462	0.115	1.000
Social environmental motives	0.098	1.000	1.677	1.000	1.756	1.000	**27.837**	<.001	**25.428**	<.001
Faith in growth	12.383	.012	0.003	1.000	9.159	.062	0.000	1.000	7.949	.115
Biospherism	**17.732**	.001	3.177	1.000	**46.776**	<.001	1.282	1.000	10.547	.031
Sample 3 (UK)										
Proenvironmental/social justice values	3.342	1.000	**13.518**	.008	**29.098**	<.001	0.558	1.000	0.789	1.000
Connectedness to nature	0.810	1.000	0.340	1.000	**65.427**	<.001	0.003	1.000	8.817	.093
Environmental motives for veg*n diet	6.338	.360	1.978	1.000	**22.613**	<.001	0.538	1.000	0.902	1.000
Extrinsic environmental motives	6.215	.377	4.997	.600	**22.484**	<.001	0.792	1.000	0.610	1.000
Intrinsic environmental motives	6.164	.377	**18.367**	.001	**19.127**	<.001	5.265	.550	0.098	1.000

(Continues)

TABLE 1 (Continued)

Regression models	$\Delta\chi^2$	p	$\Delta\chi^2$	p	$\Delta\chi^2$	p	$\Delta\chi^2$	p	$\Delta\chi^2$	p
Social environmental motives	1.543	1.000	0.074	1.000	0.619	1.000	9.524	.065	5.998	.378
Faith in growth	0.716	1.000	0.540	1.000	6.032	.378	1.695	1.000	0.170	1.000
Biospherism	0.955	1.000	1.595	1.000	**21.915**	<.001	0.062	1.000	1.046	1.000

Note: Estimates listed under regression models indicate the results of the chi-square difference tests between free and constrained models. Bolded values indicate $p < .01$. We applied Holm's correction in samples 2 and 3.

also related to environmental motives for a veg*n diet and biospherism.

Interestingly, the Intellect aspect of Openness to Experience was not a consistent predictor of any proenvironmental attitude, reinforcing the value of distinguishing it from the Openness aspect. The specificity of Openness to environmental attitudes is displayed in Figure 1, which represents weighted average effects for Openness, Intellect, and the Openness domain for all proenvironmental attitude variables with significant associations.

Extraversion was positively associated with connectedness to nature and intrinsic environmental motives and negatively associated with extrinsic environmental motives. These results suggest that these three traits represent the most robust personality predictors of core proenvironmental attitudes. The other traits only had one consistent correlate each: Conscientiousness was positively associated with connectedness to nature and Neuroticism was positively associated with social environmental motives.

We tested whether age or political orientation moderated the associations between personality traits and environmental values. Overall, there were few significant moderation effects, and none of these replicated across all three samples (Tables S2 and S3). We concluded that the personality-proenvironmental attitude associations reported above are robust across levels of age and political orientation.

4 | DISCUSSION

People vary in their proenvironmental attitudes and engage in sustainable behaviors for different reasons (Markowitz, 2012). This study adds to existing evidence that personality differences represent a robust predictor of proenvironmental attitudes (Soutter et al., 2020). In general, more open, agreeable, and extraverted people are more likely to have stronger proenvironmental attitudes. Conscientiousness and Neuroticism also play an important role in some specific attitudes. The domain-level estimates from this study, averaged across different attitudes and samples, are similar to the meta-analytic correlations reported by Soutter et al. (2020).

The general goal of this study was to augment this literature by examining whether there are more complex relationships between narrower personality traits and specific proenvironmental attitudes. Our first aim was to test whether there was a benefit in distinguishing between different aspects of broad personality traits. These results offer a compelling demonstration of the value of considering lower-order elements of personality when trying to understand individual differences in proenvironmental attitudes, particularly concerning Openness. These findings strongly suggested that the Openness aspect of Openness to Experience is driving the domain-level associations, whereas the Intellect aspect appears to have modest and inconsistent associations with proenvironmental attitudes. This finding replicates previous work suggesting that Openness is a strong and specific personality predictor of proenvironmental attitudes (Gibbon & Douglas, 2021).

The second aim of this study was to determine whether the relevance of personality traits depends on the specific proenvironmental attitude being considered. As expected, the pattern of traits differed across proenvironmental attitudes. Connectedness to nature and intrinsic proenvironmental motives were predicted by Openness, Agreeableness, and Extraversion. General proenvironmental/social justice values were reliably associated with high levels of the Openness aspect and the Agreeableness domain. However, we note that Extraversion was a significant predictor of proenvironmental/social justice values in two of the three samples, and as a single item, scores for this variable may have been somewhat unreliable. Connectedness to nature, intrinsic proenvironmental motives, and proenvironmental/social justice values can be thought of as the most core proenvironmental attitudes because they reflect an inner desire to support and protect the natural environment. They are also probably most similar to aggregate variables used in previous research or what laypeople might think of when others are described as "proenvironmental". As such, we could generally conclude that people are more likely to hold proenvironmental attitudes to the extent that they (a) are curious about the world, value beauty, and are open to a wide range of experiences, (b) care about, empathize with, and are kind to others in a way that extends to the natural environment,

TABLE 2 Regression parameters in samples 1, 2, and 3.

			Openness		Agreeableness		
	Neuroticism	**Extraversion**	**Intellect**	**Openness**	**Compassion**	**Politeness**	**Conscientiousness**
Sample 1							
Proenvironmental/social justice values	−.026	**.222**	−.067	**.432**	**.330**		**.084**
99% CI	[−.108, .056]	[.136, .307]	[−.160, .025]	[.343, .521]	[.260, 399]		[.006, .162]
p	.416	<.001	.062	<.001	<.001		.006
Connectedness to nature	**−.170**	**.362**	.037	**.562**	**.449**		**.247**
99% CI	[−.250, −.090]	[.282, .441]	[−.049, .123]	[.483, .641]	[.350, .549]		[.172, .321]
p	<.001	<.001	.270	<.001	<.001		<.001
Environmental motives							
Environmental motives for veg*n diet	.036	**.118**	−.060	**.399**	**.259**		.033
99% CI	[−.041, .114]	[.030, .206]	[−.153, .034]	[.308, .489]	[.186, .331]		[−.047, .113]
p	.226	.008	.103	<.001	<.001		.284
Extrinsic	**.257**	**−.239**	**−.094**	**−.332**	**−.393**		**−.186**
99% CI	[.180, .334]	[−.313, −.164]	[−.186, −.001]	[−.423, −.241]	[−.489, −.297]		[−.262, −.109]
p	<.001	<.001	.009	<.001	<.001		<.001
Intrinsic	−.031	**.308**	.013	**.447**	**.418**		**.177**
99% CI	[−.108, .045]	[.225, .390]	[−.079, .104]	[.360, .534]	[.316, .519]		[.090, .263]
p	.292	<.001	.724	<.001	<.001		<.001
Social	**.095**	**.255**	−.034		**.157**	**−.286**	**.175**
99% CI	[.019, .171]	[.171, .339]	[−.116, .047]		[.066, .248]	[−.389, −.183]	[.088, .262]
p	.002	<.001	.279		<.001	<.001	<.001
Faith in growth	**−.085**	**.321**	.013		−.041		**.333**
99% CI	[−.162, −.008]	[.240, .402]	[−.067, .092]		[−.131, .048]		[.252, .413]
p	.005	<.001	.681		.234		<.001
Biospherism	**.079**	−.008	−.058	**.404**	**.264**		**−.083**
99% CI	[.002, .156]	[−.085, .069]	[−.152, .036]	[.314, .494]	[.159, .368]		[−.161, −.004]
p	.009	.794	.111	<.001	<.001		.007
Sample 2							
Proenvironmental/social justice values	.029	.085	−.071	**.335**	**.210**		−.030

(Continues)

TABLE 2 (Continued)

			Openness		Agreeableness		
	Neuroticism	**Extraversion**	**Intellect**	**Openness**	**Compassion**	**Politeness**	**Conscientiousness**
99% CI	[−.058, .116]	[−.004, .174]	[−.165, .023]	[.241, .428]	[.126, .295]		[−.138, .077]
p	1.000	.225	.689	<.001	<.001		1.000
Connectedness to nature	−.108	**.255**	.009	**.519**	**.337**		**.151**
99% CI	[−.196, −.019]	[.158, .351]	[−.079, .096]	[.438, .600]	[.258, .416]		[.063, .239]
p	.057	<.001	1.000	<.001	<.001		<.001
Environmental motives							
Environmental motives for veg*n diet	.084	.036	−.026	**.284**	**.197**		−.026
99% CI	[−.001, .169]	[−.052, .124]	[−.119, .066]	[.190, .377]	[.113, .280]		[−.114, .063]
p	.176	1.000	1.000	<.001	<.001		1.000
Extrinsic	**.229**	**−.220**	**−.200**	**−.261**	**−.412**		**−.201**
99% CI	[.145, .313]	[−.316 −.124]	[−.288, −.112]	[−.351, −.170]	[−.504, −.319]		[−.287, −.116]
p	<.001	<.001	<.001	<.001	<.001		<.001
Intrinsic	.007	**.195**	.026	**.361**	**.375**		.075
99% CI	[−.078, .092]	[.111, .280]	[−.064, .116]	[.273, .450]	[.274, .476]		[−.030, .180]
p	1.000	<.001	1.000	<.001	<.001		1.000
Social	**.303**	−.067	−.263		.076	**−.331**	**−.197**
99% CI	[.222, .383]	[−.152, .018]	[−.387, −.138]		[−.039, .192]	[−.458, −.205]	[−.283, −.111]
p	<.001	.644	.018		1.000	<.001	<.001
Faith in growth	**−.121**	.134	**−.173**		−.149		**.139**
99% CI	[−.206, −.035]	[.035, .234]	[−.309, −.037]		[−.257, −.040]		[.051, .227]
p	.007	.040	.001		.170		.002
Biospherism	**.183**	−.007	−.045	**.323**	.184		**−.130**
99% CI	[.099, .267]	[−.096, .083]	[−.139, .049]	[.229, .416]	[.072, .296]		[−.219, −.042]
p	<.001	1.000	1.000	<.001	.090		.004
Sample 3							
Proenvironmental/social justice values	−.083	**.179**	−.061	**.343**	**.294**		.095
99% CI	[−.194, .028]	[.067, .291]	[−.182, .060]	[.224, .463]	[.162, .426]		[−.050, .240]
p	.935	.003	1.000	<.001	.003		1.000

TABLE 2 (Continued)

			Openness		Agreeableness		
	Neuroticism	Extraversion	Intellect	Openness	Compassion	Politeness	Conscientiousness
Connectedness to nature	−.080	**.260**	.020	**.569**	**.393**		**.219**
99% CI	[−.190, .030]	[.132, .388]	[−.089, .130]	[.471, .668]	[.270, .516]		[.109, .328]
p	1.000	.002	1.000	<.001	<.001		<.001
Environmental motives							
Environmental motives for veg*n diet	.039	.022	−.062	**.299**	.213		.053
99% CI	[−.072, .149]	[−.093, .137]	[−.184, .060]	[.176, .422]	[.077, .350]		[−.062, .169]
p	1.000	1.000	1.000	<.001	.144		1.000
Extrinsic	.106	**−.189**	−.041	**−.368**	**−.428**		−.185
99% CI	[−.004, .215]	[−.301, −.077]	[−.160, .077]	[−.484, −.251]	[−.549, −.306]		[−.322, −.049]
p	.280	.001	1.000	<.001	<.001		.189
Intrinsic	−.096	**.298**	.082	**.367**	**.422**		**.247**
99% CI	[−.206, .014]	[.192, .404]	[−.036, .199]	[.252, .482]	[.296, .547]		[.115, .380]
p	.468	<.001	1.000	<.001	<.001		.006
Social	**.156**	−.092	−.293		.094	−.216	−.139
99% CI	[.048, .264]	[−.227, .044]	[−.443, .143]		[−.053, .241]	[−.376, −.056]	[−.251, −.026]
p	.009	1.000	.031		1.000	.054	.054
Faith in growth	−.103	.138	−.129		−.046		.120
99% CI	[−.212, .007]	[.002, .275]	[−.246, −.013]		[−.158, .066]		[−.018, .259]
p	.323	.161	.176		1.000		1.000
Biospherism	.122	.022	−.011	**.332**	.244		.194
99% CI	[.013, .231]	[−.094, .137]	[−.132, .111]	[.211, .453]	[.113, .375]		[.055, .333]
p	.125	1.000	1.000	<.001	.012		.011

Note: Instances where the constrained model did not significantly differ from the free model in at least one of the three samples are indicated by only one estimate across both aspects. Bolded values indicate $p < .01$. Estimates are standardized. Effects that replicate across all three samples are underlined.

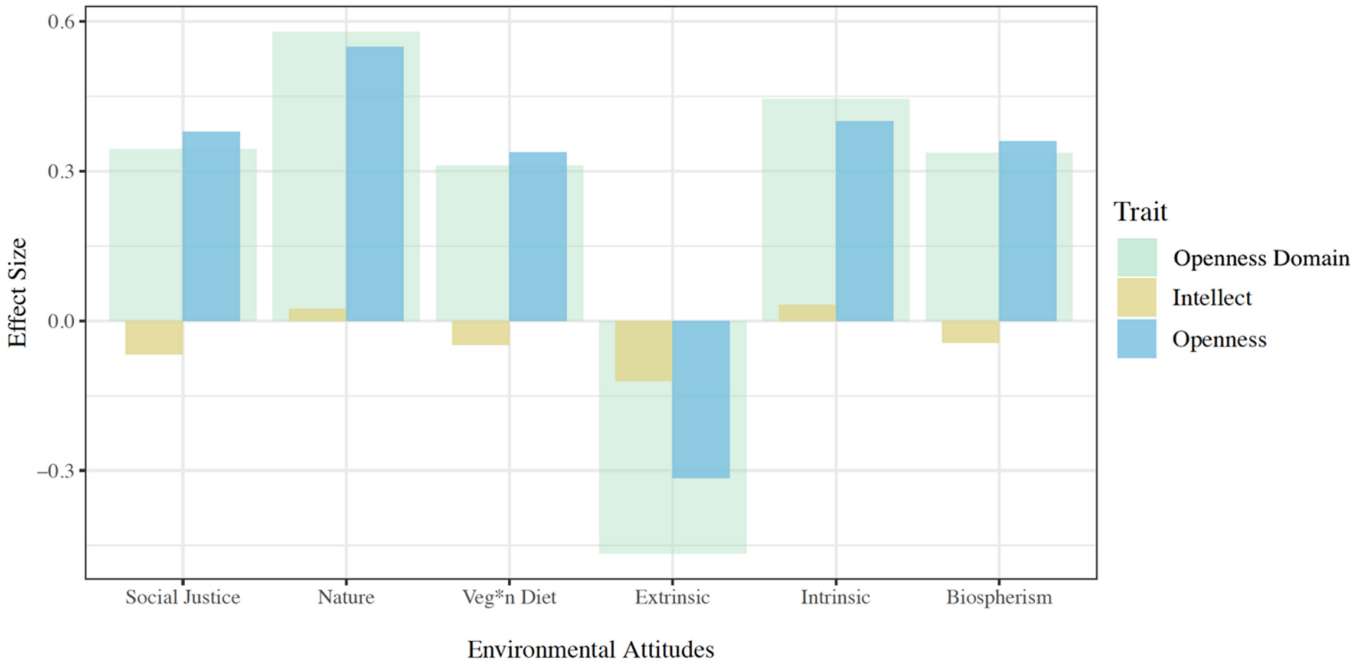

FIGURE 1 Comparison of effect sizes for openness aspects and environmental attitudes. Extrinsic, extrinsic social motives; intrinsic, intrinsic social motives; nature, connectedness to nature; social justice, environmental and social justice values; veg*n diet, environmental motives for a veg*n diet.

and (c) are optimistic, experience positive emotions, and desire engagement with people and things outside of themselves.

Other attitudes measured in this study that were perhaps more specific and less core to a general proenvironmental position had somewhat different patterns of personality correlations. The Openness aspect was the only reliable predictor of proenvironmental motives for veg*n diet, consistent with previous research connecting Openness to vegetarianism (Holler et al., 2021; Pfeiler & Egloff, 2018; Tan et al., 2021). Also consistent with previous research, Agreeableness was related to this attitude in two of the three samples.

We measured two non-intrinsic motives for proenvironmental behavior. Extrinsic motives, such as concerns about fines or other punishments, were negatively related to Extraversion, the Openness aspect, and Agreeableness. We found the opposite pattern for intrinsic motivations, which predictably suggests that people who support the environment because they think it is the right thing to do have somewhat different personalities from people who support the environment only when it is in their personal interest. Social motives, such as the desire to gain others' approval and avoid judgment, were related to Neuroticism. This finding suggests that social anxiety may be a driver of proenvironmental behavior for some people.

Finally, faith in growth and biospherism are two different worldviews about how society can best fight climate change. People who have faith in growth tend to believe that this challenge will be figured out by capitalist creativity when it is in society's interest and when the advantages of curbing climate change outweigh its costs. This was the only attitude that did not have consistent personality associations, although it was related to low Neuroticism and high Conscientiousness in two out of three samples. Biospherism is the view that society must act now to address climate change and protect the environment because the people on the earth have a responsibility to take care of it. Higher levels of the Openness aspect predicted this attitude.

The third aim of this study was to test whether age or political orientation moderate significant personality-proenvironmental attitude associations. Although some isolated effects were significant and potentially worthy of future research, particularly for political orientation, we did not find evidence for moderation when considering results across all three samples.

4.1 | Future directions

These results point toward future work designed to provide a more complete picture of how personality differences are related to moral behavior in general and proenvironmental attitudes and behaviors in particular. In addition to replicating these results, we envision five primary future directions for this area of work.

First, further nuance may be obtained by examining personality traits and environmental motives in an

even finer grain. Personality traits could be examined at the level of facets or nuances to determine, for example, which specific elements of openness matter for proenvironmental attitudes and behavior. Likewise, the pattern and magnitude of effect sizes may depend on which model or instrument is used to assess personality. For instance, Soutter et al. (2020) conducted moderation analyses indicating that Big Five and HEXACO trait analogs had different magnitudes of association to proenvironmental attitudes. For instance, Big Five Agreeableness was more strongly related than HEXACO Agreeableness to proenvironmental attitudes, perhaps implying that those elements of Big Five Agreeableness that are allocated to Honesty/Humility in the HEXACO are especially relevant for proenvironmental attitudes.

Conversely, there are a variety of attitudes about the environment that were not assessed in this study but which may have different patterns of correlation with personality traits. For instance, in a recent study, Hopwood, Schwaba, et al. (2022) found that Neuroticism was among the strongest predictors of concerns about climate change and the environment, which is an attitude that was not directly assessed here.

Second, it would be useful to understand how individual differences in proenvironmental attitudes and behaviors fits within the more general domain of moral behavior. On the one hand, how a person responds to the climate crisis is clearly a morally tinged topic. On the other, there are also apparent differences between that and other domains of moral behavior, such as honesty (Ścigała et al., 2019), social justice for human or nonhuman animals (Bastian et al., 2012; Schmitt et al., 2010), or other forms of political engagement, altruism, or volunteerism (Thielmann et al., 2020). In addition to mapping the personality correlates of individual differences within different forms of proenvironmental behavior, it will also be important to understand the relevance of personality for distinguishing different kinds of moral domains from one another.

Third, individual differences in moral behavior range from those that are broad and abstract and perhaps can even be conceptualized in terms of generalized moral dispositions (e.g., the general desire to be a good person who tries to do well by others) to those that are contextualized and specific (e.g., volunteering a certain amount of resources for a particular cause). Personality traits are very abstract within this broad spectrum, and attitudes are somewhat less abstract. However, both tend toward the general when assessed with questionnaires in cross-sectional data and detached from any specific kinds of behavior or context, as in this study. Ultimately, a complete account of how personality is associated with moral behavior will need to include general dispositions and specific, contextualized thoughts, feelings, motives, and behaviors. Future work could extend this study by measuring these patterns at different timescales and including measures of environmental features to distinguish these general traits and attitudes from more specific behaviors and adaptations that occur within particular cultural or situational contexts (Krettenauer et al., 2022).

Fourth, we used three WEIRD (predominantly white, educated, industrialized, rich, and democratic) convenience samples in this study. In one sense, the fact that the West is the biggest contributor to the climate crisis suggests that the psychology of sustainability is one of the few areas in which a case can be made for focusing on participants from WEIRD countries. However, to answer basic questions about the relevance of personality for moral behavior and proenvironmental behavior, research should be conducted so that its results can be generalized to the human population or that reliable differences between demographic groups can be understood and explained. Related to this point, our approach to interpreting significant effects is relatively conservative. For this reason, it is worth noting a handful of significant associations that replicated across two samples and are likely worthy of consideration in future research. Notably, several of these findings replicated in the two American samples but not in the UK, potentially suggesting a national moderation effect. These differences highlight that personality correlates of proenvironmental and other moral behavior might depend on national or other contextual factors.

Fifth, researchers should seek to go beyond mapping individual differences in favor of explaining the origins, causes, and implications of these individual differences. Descriptive research should set the stage for longitudinal and experimental studies that can help us understand why people are more likely to vary in their proenvironmental attitudes as a function of personality traits, among other factors. Additionally, applied studies should be conducted to test whether such personality differences could be leveraged to help combat the climate crisis via intervention, personalized messages, or other strategies. For instance, previous work showed that simple but targeted messaging can impact individuals' online behavior and purchase intentions, which, if delivered at a broad scale, may build up to meaningful effects at the population level (Matz et al., 2017). Other work shows that personality traits can be reliably inferred from passive information collected online (Kosinski et al., 2015). It follows that tailored information about the benefits of climate change could be delivered based on the personalities of individuals interacting on certain online platforms to encourage proenvironmental behaviors. For instance, the results of the current study might suggest an advantage to highlighting extrinsic as opposed to social

or intrinsic motives for proenvironmental behavior to people who tend to be more neurotic. There are naturally important ethical issues to consider with such a tailored approach, although it should also be recognized that this kind of strategy is already commonly used for less prosocial goals such as marketing or political persuasion.

5 | CONCLUSION

There is robust evidence to suggest that proenvironmental attitudes are related to broad personality traits. This study expanded this evidence by documenting specific associations among 10 personality aspects and eight proenvironmental attitudes. Overall, our results suggest that open, agreeable, and extraverted people are most likely to have proenvironmental attitudes. However, we found a network of more complex associations, suggesting that important information is missing from studies that focus only on domains and generalized attitudes. This lack was particularly apparent in the Openness to Experience domain, within which Openness was consistently a stronger correlate of proenvironmental attitudes than Intellect. This work can serve as the basis for future studies in the broader service of using personality psychology to help curb the climate crisis.

AUTHOR CONTRIBUTIONS

This study was concieved by Dr. Hopwood and Dr. Bleidorn. Data analysis was conducted primarily by Dr. Lenhausen and Dr. Stahlmann. Dr. Hopwood wrote the first draft of the article. All authors edited the manuscript.

ACKNOWLEDGEMENTS

This research was exempt from review according tothe University of Zurich College of Philosophy Ethics Commission.

CONFLICT OF INTEREST

The authors report no conflicts of interest.

ETHICS STATEMENT

All preregistrations, data, and script are available via links embedded in the paper. The studies reported in this paper were exempt from ethical review per the University of Zurich ethics guidelines.

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ENDNOTE

[1] The fourth item was not included in sample 1 because of a researcher error.

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SUPPORTING INFORMATION

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

How to cite this article: Hopwood, C. J., Lenhausen, M. R., Stahlmann, A. G., & Bleidorn, W. (2022). Personality aspects and proenvironmental attitudes. *Journal of Personality*, *00*, 1–16. https://doi.org/10.1111/jopy.12795