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Cross-cultural applications of the New Ecological Paradigm in protected area contexts

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Abstract

Working mostly in Western, Educated, Industrialised, Rich, and Democratic countries, environmental psychologists have developed scales assessing relationships between pro-environmental beliefs and behaviours. Working in Tanzanian and Indonesian protected area landscapes, containing important biodiversity and conflict over human-nature interactions, we investigate the utility of the New Ecological Paradigm for measuring pro-environmental beliefs and understanding support for protected area regulations. We found the New Ecological Paradigm ineffective at measuring pro-environmental beliefs in both countries; in Tanzania due to acquiescence bias, and in Indonesia exploratory factor analysis supported none of the original factors, with four of 15 statements loading onto a novel "eco-fragility" factor. Individual statements in both countries and the eco-fragility factor in Indonesia were weakly correlated with support for protected area regulations, highlighting while elements of the New Ecological Paradigm can improve understanding of support for protected area regulations, care must be taken when applying psychometric tools in novel cultural contexts.

Keywords: new ecological paradigm; psychometric scales; pro-environmental beliefs; protected areas**;** WEIRD contexts**;** conservation; Tanzania; Indonesia

Introduction

Psychological theory and methods are increasingly used to understand drivers of pro-environmental and pro-conservation behaviours (St. John et al., 2010; Steg & Vlek, 2009). Such research often employs behavioural models based on the cognitive hierarchy, where values and beliefs influence higher order constructs including attitudes and norms, and ultimately behaviour (Fulton et al., 1996). However, the relative roles and interactions of these different psychological constructs in influencing behaviour is complicated and poorly understood (Steg & Vlek, 2009). Many psychometric scales have been developed to measure the influence of these constructs on behaviours relating to environmental or conservation issues (Klöckner, 2013). For example, the Wildlife Value Orientations scale measures human values towards wildlife (Fulton et al., 1996) which have been found to influence support for wildlife management interventions including habitat restoration and large predator recovery in the USA (Dietsch et al., 2016), as well as management of problem wildlife in the Netherlands (Jacobs et al., 2014). Additionally, the Portrait Values Questionnaire measures fundamental human values (Schwartz et al., 2012), and has been shown to predict a suite of pro-environmental behaviours including water and power conservation and environmental volunteering in Sweden (Engqvist Jonsson & Nilsson, 2014), alongside support for energy saving policies and intention to save energy in the Netherlands (Sharpe et al., 2021).

Initial steps in psychometric scale development include articulating the psychological construct to be measured (e.g., environmental attitudes, wildlife value orientations), and identifying the context where the scale will be used (Clark & Watson, 2016; Furr, 2011). These decisions influence subsequent steps in scale development, including the writing of statements and psychometric analysis (Clark & Watson, 2016; Furr, 2011). Consequently, scales designed in one context may be inappropriate or invalid if applied elsewhere (Aoyagi-Usui et al., 2003; Furr, 2011; Henrich et al., 2010; Rosa et al., 2023; Whitehouse-Tedd et al., 2021). Many psychometric scales, such as the Wildlife Value Orientations (Fulton et al., 1996), Environmental Motives Scale (Schultz, 2001), and New Ecological Paradigm (Dunlap et al., 2000) were initially developed and validated in what Henrich

et al. (2010) describe as Western, Educated, Industrialised, Rich, and Democratic (WEIRD) societies. Whilst these scales have been applied in some other cultural settings (e.g., studying student's Wildlife Value Orientations in Malaysia (Zainal Abidin & Jacobs, 2016); investigating differences in the Environmental Motives Scale between European and Asian New Zealanders (Milfont et al., 2006); and investigating perceptions of climate change risk in China (Xue et al., 2018)), questions remain regarding both their applicability in non-WEIRD contexts where much conservation occurs. Given the global nature of the conservation sector, and the increasing reliance on psychological theory and methods for improving understanding of human behaviour (Bennett et al., 2017; Selinske et al., 2018; St. John et al., 2010), addressing concerns regarding the universality and validity of psychometric scales in cultural contexts beyond those in which they were developed is critical.

The New Ecological Paradigm

One of the most widely used scales for measuring pro-environmental orientations is the New Ecological Paradigm, which has been applied in disciplines including environmental psychology, sustainability studies, environmental education, and conservation science (Bernstein & Szuster, 2019; Hawcroft & Milfont, 2010). The scale's first iteration, called the New *Environmental* Paradigm (NEP1), was developed in the 1970's by Dunlap and Van Liere (1978) to measure support for an emerging pro-environmental worldview. The authors saw this pro-environmental worldview developing in contrast to north America's dominant social paradigm; which was devoted to economic growth, prosperity, science and technology, and laissez-faire economic policy (Dunlap & Van Liere, 1978). The original scale contained 12 statements representing three facets of a pro-environmental worldview: the ability of humans to upset the balance of nature (balance of nature); the existence of limits to growth for human societies (limits to growth); and humanity's right to rule over nature (anti-anthropocentrism) (Dunlap & Van Liere, 1978). Testing the scale on a representative sample of Washington state households and a separate sample of members from a state-wide environmental organisation, Dunlap & Van Liere (1978) reported strong internal

consistency across the 12 statements in both samples, suggesting the scale measured one underlying construct. Further, higher NEP1 scores, indicative of a stronger pro-environmental worldview, were associated with membership of environmental organisations, support for pro-environmental policy, and engagement in pro-environmental behaviour.

Recognising flaws in the original scale's design, and a need to update and broaden its content, Dunlap et al., (2000) revised NEP1 and, observing the increasingly ecological nature of pro-environmental worldviews, rebranded it the New *Ecological* Paradigm (NEP2). The new 15-statement scale made technical improvements to scale structure, removed outdated and sexist language, and added two new facets: anti-exemptionalism and eco-crisis (Table 1). The anti-exemptionalism facet was designed to measure the degree to which individuals viewed humanity as exempt from the laws of nature, whilst the eco-crisis facet aimed to capture views on the potentially catastrophic environmental changes facing humanity (Dunlap et al., 2000). Testing the revised scale on a representative sample of Washington state residents, Dunlap et al., (2000) found strong internal consistency across the scale's 15 statements. Again, high NEP2 scores, representative of a pro-environmental worldview, correlated with support for pro-environmental policy and personal pro-environmental behaviours. These initial findings have been echoed by others, for example, NEP2 has demonstrated robust internal consistency in samples of British students (Pahl et al., 2005) and the Norwegian public (Olli et al., 2001) (Cronbach's alpha = 0.86 and 0.71 respectively), higher NEP2 scores were associated with membership of environmental organisations in both samples and with engaging in a suite of pro-environmental behaviours in the Norwegian sample. Whilst these initial studies testing and validating both NEP scales reported data were unidimensional (i.e., all statements combined to measure a single factor, [Figure 1a]), there is evidence that more complex multidimensional structures exist (Figure 1b) (Amburgey & Thoman, 2012), and that dimensionality can differ by study population (Dunlap et al., 2000; Ogunbode, 2013; Rosa et al., 2021; Xue et al., 2018). Further development of NEP2 has occurred, with a 10-item scale developed and validated for use with children (NEP-C) (Manoli et al., 2007) and many researchers forming their own scales based

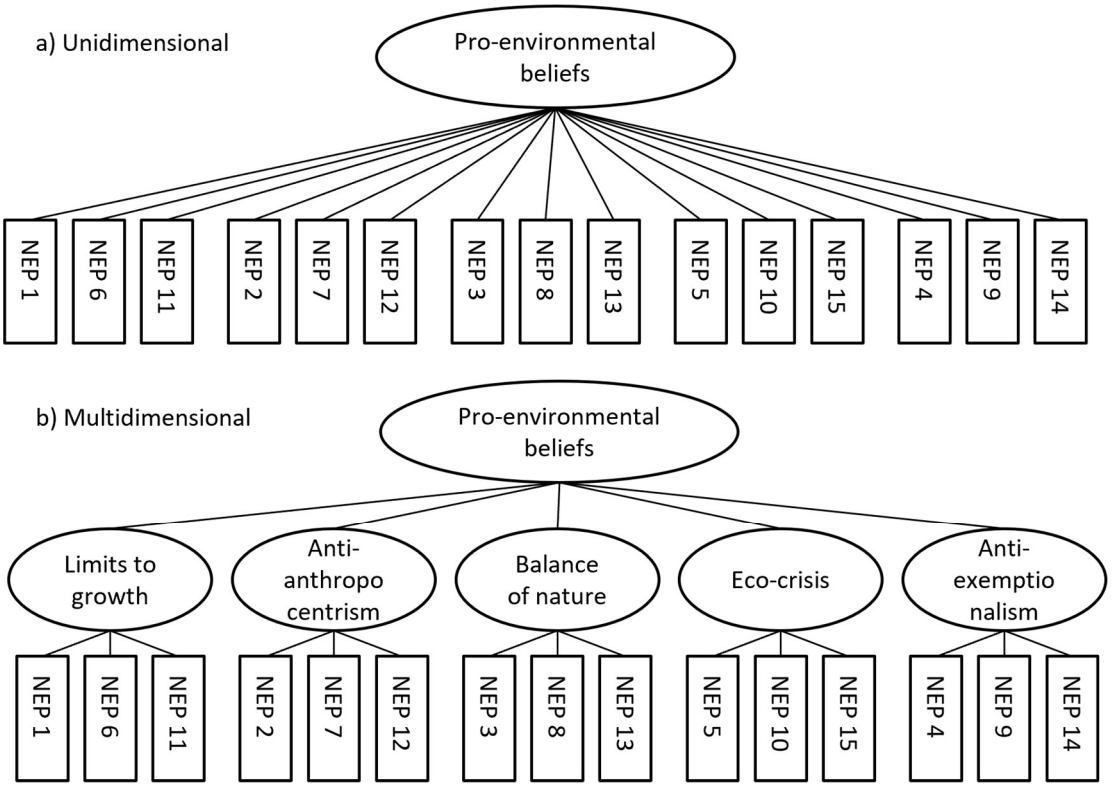
on NEP2, either by using a subset of NEP2 statements, or altering item wording to fit their own interests (Hawcroft & Milfont, 2010)

Table 1 New Ecological Paradigm statements. Agreement with odd numbered statements and disagreement with even numbered statements denotes pro-environmental beliefs[1], hence even numbered statements are reverse coded prior to analysis such that a higher NEP2 score denotes stronger pro-environmental beliefs.

NEP statement	Facet or dimension[2] of pro-environmental worldview measured by each statement
Pre-amble: I will now read out a series of statements about the relationship between humans and the environment. Please tell me how much you agree or disagree with each statement.	
1. We are approaching the limit of the number of people the earth can support.	Limits to growth
2. Humans have the right to modify the natural environment to suit their needs.	Anti-anthropocentrism
3. When humans interfere with the natural environment it often produces disastrous consequences.	Balance of nature
4. Human ingenuity will ensure that we do not make the earth unliveable.	Anti-exceptionalism
5. Humans are severely abusing the environment.	Eco-crisis
6. The earth has plenty of natural resources if we just learn how to develop them.	Limits to growth
7. Plants and animals have as much right as humans to exist.	Anti-anthropocentrism
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.	Balance of nature
9. Despite our special abilities' humans are still subject to the laws of nature.	Anti-exceptionalism
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated.	Eco-crisis
11. The earth is like a spaceship with very limited room and resources	Limits to growth
12. Humans were meant to rule over the rest of nature.	Anti-anthropocentrism
13. The balance of nature is very delicate and easily upset.	Balance of nature
14. Humans will eventually learn enough about how nature works to be able to control it.	Anti-exceptionalism
15. If things continue on their present course, we will soon experience a major ecological catastrophe.	Eco-crisis

[1]Whilst widely used, on occasion, authors have incorrectly stated that NEP scales measure pro-environmental 'attitudes' (Hawcroft & Milfont, 2010). However, both NEP scales measure primitive or general beliefs towards the environment (Dunlap et al., 2000; Stern et al., 1995).

[2] we refer to a facet is an 'element' of a unidimensional construct whilst multidimensional constructs contain 'dimensions' identified via factor analysis.



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132 Figure 1 Graphical portrayal of two potential New Ecological Paradigm (NEP2) factor structures. a)
133 Displays the scale as unidimensional, meaning all statements contribute to measuring a single
134 underlying factor representing general pro-environmental beliefs. b) Displays the scale as
135 multidimensional, with five factors each measured by three statements, and all factors contributing
136 to measuring overall pro-environmental beliefs. Adapted from Amburgey & Thoman (2012).

137

While NEP2 is one the most widely used measures of pro-environmental orientations, most studies have been conducted in North America or Europe, and often among certain groups (e.g., students or environmentalists) (Hawcroft & Milfont, 2010). With environmental values and beliefs varying across societies and cultures, there are questions over the universality of scales developed by environmental psychologists in WEIRD contexts (Rosa et al., 2023), with studies questioning the universality of NEP2 in particular (e.g. Khan et al., 2012; Ogunbode, 2013; Rosa et al., 2021, 2022; Xue et al., 2018). For example, Ogunbode (2013) used NEP2 to measure environmental attitudes of 355 Nigerian university students, and while they found evidence of acceptable internal reliability of a single unidimensional scale, principle component analysis revealed no evidence to support the original theory's theoretical structure of five separate facets with statements from multiple facets clustered on each revealed component. In a sample of 515 Mandarin-speaking residents of Beijing, a two-factor solution where two statements were allowed to cross load on both factors was found to fit the data better than both the original single factor structure (Dunlap et al., 2000) or the structures proposed by Amburgey & Thoman (2012) (Xue et al., 2018). Combining their own empirical data from 224 undergraduates with a systematic review of 13 previous studies that used either the NEP or NEP2 scales in Brazil, Rosa et al. (2021) found the scales generally presented low internal consistency and a different dimensional structure to the original theory. A subsequent systematic synthesis of studies using the NEP-C scale found weak evidence of a universal structure across 11 studies conducted in seven languages (Rosa et al., 2022).

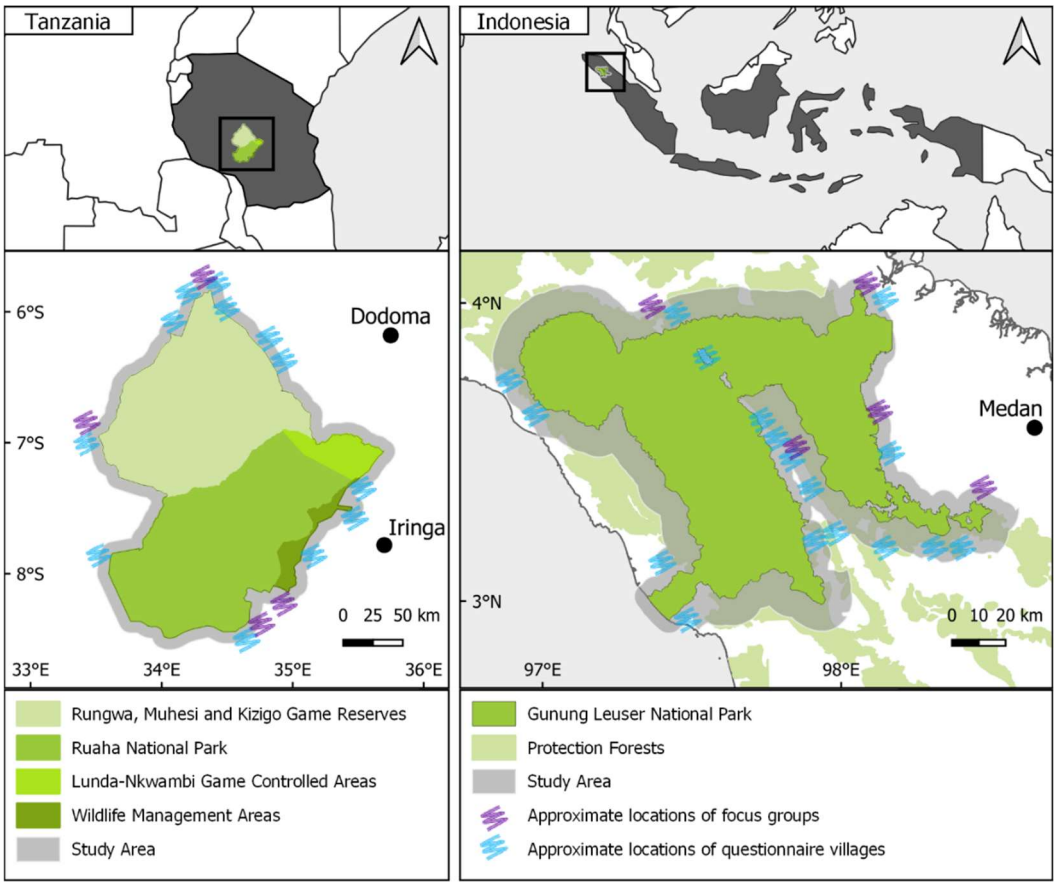
Understanding the universality of psychometric scales generally, and NEP2 in particular, is especially pertinent to conservation science given the global nature of the discipline, and the potential for these scales to help understand drivers of pro-environmental behaviour, including support for conservation interventions. Globally, protected areas - specific geographical areas where formal or informal regulations restrict human access to natural resources - are one of the most widely used conservation interventions (Dudley, 2008). However, limited support for protected areas among those whose access to natural resources is restricted, can lead to forced implementation of

protected area regulations, conflict, negative impacts on people's well-being (Soliku & Schraml, 2018), and poor conservation outcomes (Oldekop et al., 2016). Understanding human beliefs in relation to the environment, using tools such as NEP2, has the potential to improve our understanding of the drivers of support for protected area regulations and other conservation policies around the world. Here, we test the utility of NEP2 for measuring pro-environmental beliefs among people living near protected areas Tanzania and Indonesia. These landscapes are culturally and socio-economically different from each other, and from the WEIRD context NEP2 was developed in. Further, they both contain globally important biodiversity and are witness to conflict over the implementation of conservation rules. After examining the dimensional structure of the 15-statement NEP2 instrument, we explore relationships between elements of NEP2 and support for protected area regulations.

Methods

Study Landscapes

Data were collected from the Ruaha-Rungwa Ecosystem, Tanzania, and the Leuser Ecosystem in northern Sumatra, Indonesia (Figure 2). The two landscapes are centred around national parks (Ruaha and Gunung Leuser National Parks respectively) where extraction of natural resources is generally prohibited; and contain other protected area types which allow different levels of resource use. Whilst both ecosystems are of global conservation importance (Dickman et al., 2014; Myers et al., 2000), they differ culturally and socio-economically from the WEIRD context in which NEP2 was developed (Dunlap et al., 2000). Moreover, disagreements between local people and management authorities over land use, and the persistence of rule-breaking suggests limits to local support for protected area regulations in both landscapes (Knapp et al., 2017; Pusparini et al., 2018; Sloan et al., 2018; Walsh, 2012).



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190 Figure 2 Maps of the study landscapes in Tanzania and Indonesia, indicating study area, and
191 locations of villages where focus group discussions and questionnaires were conducted. In
192 accordance with ethical approval, only approximate locations of study villages are indicated. Where
193 study villages are close together, multiple villages are represented by a single marker.

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Focus group discussions

Our research was embedded within a wider study aiming to draw population-level conclusions about the prevalence and drivers of illegal behaviours in protected areas. To define our study areas, improve our understanding of people's relationships with protected areas, and understand how people interact with protected areas we conducted focus group discussions in each landscape; eight with a total of 65 participants in Tanzania, and 10 with a total of 61 participants in Indonesia (Figure 2). Discussion topics included the types of illegal behaviours, and distances travelled to commit them, inside protected areas, and the likely demographics of rule breakers. Separate groups of 6-10 people were convened for women and men, and in Tanzania, for pastoralists and agriculturalists. Sessions lasted between one and three hours depending on the level of engagement. All participants were reimbursed travel expenses, and provided refreshments.

Questionnaire sampling strategy

Due to the wider research project's aims of estimating the prevalence of rule-breaking behaviour, following the demarcation of our study areas, complex sampling strategies were used to ensure samples were representative of study populations. In Tanzania, focus group discussions reported rule breakers generally travelled between one and 120km to enter protected areas, with distances around 10km most common. Thus, our study area was defined as village land within 10km of the boundary of any protected area in the Ruaha-Rungwa ecosystem. In Indonesia, focus group discussions reported rule breakers travelled between one and 50km to enter protected areas with distances under 5km most common. Therefore, the study area was defined as village land that met the following conditions: within 5km of any protected forest contiguous with Gunung Leuser National Park; within 10km of the border of Gunung Leuser National Park and within 5km of the forest edge (calculated using data from Hansen et al. (2013) & Margono et al. (2014)). Villages were selected using a stratified, systematic, proportional to population size sampling strategy (PPS) (Cochran, 1977) with 12 villages selected in Tanzania and 18 in Indonesia.

Within selected villages, a random sample of 100 men were identified as primary study participants using village registers. A further random sample of 20 men was created as a reserve list to replace respondents who declined to participate or could not be contacted after three attempts. Guided by results from our focus group discussions, we only sampled men and targeted those aged 18-45 years in Tanzania and 18-50 years in Indonesia, as these were the demographic groups most likely to break protected area rules – the understanding of which, was the focus of the wider project. See supplementary materials for a full description of the sampling strategy.

Questionnaire

Due to the scale of the wider study our questionnaire was divided into eight question blocks (Supp Mats Table 1). Three blocks pertain to this study; the first, delivered to all respondents, gathered data on respondent and household demographics. The remaining two blocks were randomly allocated to respondents (See supplementary materials), with 30% of respondents answering the 15 NEP2 statements (Table 1), and 40% of respondents answering the five statements measuring their support for protected area regulations (Table 2). Criminal justice scholars have demonstrated that compliance behaviour is influenced by people's sense of what is morally right and wrong (Kohlberg, 1969 in Tyler & Jackson, 2014), with individuals less likely to support or obey rules they consider immoral (Trinkner et al., 2018; Tyler & Jackson, 2014). Thus, drawing on Trinkner et al., (2018), we measured support by asking respondents how morally right or wrong they considered it to conduct five illegal behaviours (identified during focus group discussions) inside their neighbouring protected area using a five-point Likert scale (1=very right to 5=very wrong) (Table 2).

We selected these illegal behaviours based on the results of our focus group discussions. For example, in Tanzania, the illegal behaviours most reported as occurring inside protected areas were hunting wildlife, grazing livestock, fishing, and collecting construction materials. We included a fifth behaviour: "entering a protected area without a permit", to capture behaviours (such as honey and firewood collecting) that were reported as occurring, albeit infrequently. In Indonesia, clearing land

for farming, collecting songbirds, collecting plants, and wildlife hunting were the illegal behaviours most frequently reported as occurring inside local protected areas. Collecting firewood was the fifth most mentioned behaviour and logging the sixth. However, we opted to include logging in our questionnaire, due to its relevance to national and international policy. In Indonesia, many focus group participants displayed poor knowledge of local protected areas with confusion over the names and rules of nearby sites, as well as the authorities responsible for their management.

256 Table 2 Statements measuring support for protected area regulations. In Tanzania [PA] was replaced

257 with the name of the protected area closest to the respondent's village.

Tanzania
Pre-amble: Please indicate how morally right or wrong you think the following behaviours are on a scale of very right to very wrong:
1. How morally right or wrong would you say it is to hunt wildlife inside [PA] for example birds francolin, guinea fowl, quail, small animals like dik dik or impala, or larger animals like buffalo, giraffe or others?
2. How morally right or wrong would you say it is to fish inside [PA]?
3. How morally right or wrong would you say it is to take livestock inside [PA] to graze or for water?
4. How morally right or wrong would you say it is collect timber or other construction materials inside [PA]?
5. How morally right or wrong would you say it is to enter [PA] without a permit?
Indonesia
Pre-amble: I will now ask your opinions on behaviours people may conduct in protected forests. When we talk about protected forests, we mean forests like Gunung Leuser National Park, Protection Forests, and other conservation forests. Please indicate how morally right or wrong you think the following behaviours are on a scale of very right to very wrong:
1. How morally right or wrong would you say it is to collect plants or plant products inside protected forests?
2. How morally right or wrong would you say it is to clear land inside protected forests?
3. How morally right or wrong would you say it is to hunt or snare wildlife inside protected forests?
4. How morally right or wrong would you say it is to collect birds inside protected forests?
5. How morally right or wrong would you say it is cut trees for timber inside protected forests?

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The questionnaire was developed in English, translated into Kiswahili and Indonesian, and then independently back-translated to ensure accuracy. Using authors' knowledge of local cultural contexts, care was taken to ensure NEP2 statements represented meaningful concepts in our study sites. Consequently, at both sites we changed statement 11 from "The earth is like a spaceship with very limited room and resources" to "The earth is like a small island with very limited room and resources". Further refinements to question wording and translation occurred during piloting which was conducted alongside interviewer training. Questionnaires were piloted and delivered face-to-face by S.S., J.M., J.F., and R.M. in Tanzania and K.P., A.W.S., H.S., T.T., and I.A. in Indonesia. Respondents were thanked for their time with small, culturally appropriate gifts (e.g., phone voucher, or reusable shopping bag). Data were collected using Open Data Kit (Hartung et al., 2010) on encrypted mobile phones.

Ethics and Research Permits

Our research was approved by the Bangor University College of Environmental Science and Engineering Ethics Committee (CoESE2019FSJ01 & CoESE2022FSJ01A). Free, prior, and informed consent was sought from all respondents. All data were confidential with respondents invited to provide their name and contact details to take part in future research. Data were encrypted at point of collection with de-encryption and pseudo-anonymisation conducted by authors outside of the country where the data originated. All personal information was stored separately from questionnaire responses. Most data collection occurred following the emergence of COVID-19, all field activities conformed to local and national government guidelines concerning COVID-19 with rigorous health and safety measures implemented to minimise risk of transmission. All research was conducted with the required research permits (see supplementary materials) and the approval of national and local authorities.

Analysis

All analyses were conducted in R 4.2.0 (R Core Team, 2022) with plotting and data preparation using tidyverse packages (Wickham et al., 2019). QGIS (QGIS Development Team, 2022) was used for mapping and spatial analysis.

Factor analysis

Data from each country were analysed separately. Prior to analysis, NEP2 statements were coded such that high scores were indicative of the strongest pro-environmental beliefs. Mean imputation replaced missing data where appropriate (Watkins, 2018). Given the uncertainty over the scale's dimensionality researchers are advised to conduct exploratory factor analysis to investigate the sample-specific dimensionality of NEP2 data (Amburgey & Thoman, 2012; Dunlap et al., 2000). Consequently, we conducted Exploratory Factor Analysis (EFA) following Watkins (2018) and using the 'pysch' package in R (Revelle, 2023). Factorability was confirmed using Bartlett's test of sphericity (Bartlett, 1951) and the Kaiser-Meyer-Olkin (KMO) test (Kaiser, 1974). The appropriate number of factors was determined with parallel analysis (Horn, 1965). Model fit was assessed using Root Mean Square Error of Approximation (RMSEA ≤ 0.08 indicating acceptable model fit) and Tucker Lewis Index (TLI ≥ 0.95 indicating acceptable model fit) (Hooper et al., 2008). Factor loadings ≥0.4 were considered as acceptable, with loadings ≥0.7 considered very strong (Furr, 2011). We used an oblimin rotation as we assumed factors would be correlated (Furr, 2011) and used MINRES estimation where our data displayed non-normality (Watkins, 2018). Internal consistency of the entire scale, and of factors revealed by the EFA, were checked with Cronbach's Alpha and McDonald's Omega, accepting scores above 0.6 (Hayes & Coutts, 2020; Ursachi et al., 2015). Following EFA, respondent-level factor scores were calculated as the mean value of the statements in each factor. Internal consistency of statements measuring support for protected area regulations were examined using Cronbach's Alpha and McDonald's Omega. Where internal consistency was adequate ($\underline{\geq}$0.6), data across the five statements were combined into a single score calculated as a respondent's mean response to the five statements, which represents their support for protected area regulations.

We used Spearman's rank correlations to investigate the strength of the relationship between pro-environmental beliefs (measured through revealed factors and individual statements of NEP2) and respondent's support for protected area regulations.

Results

Tanzania

Questionnaire Summary

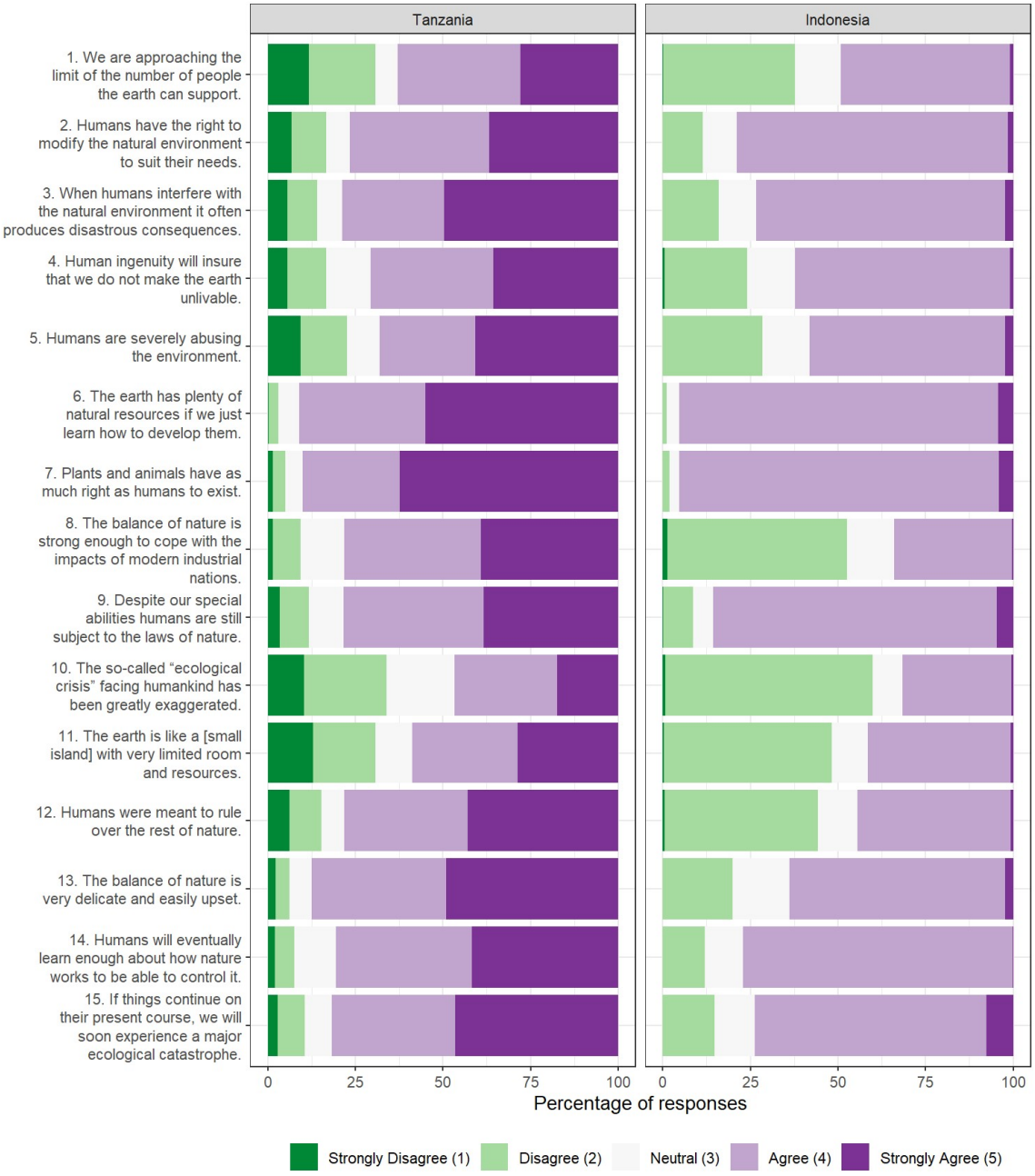
Between February 2020 and December 2021, 368 men answered demographic and NEP2 questions; of these 38% (n=142) also answered the support for protected area regulations questions. The median age of respondents was 32 (interquartile range (IQR)=26-40) and the median years of formal schooling completed was 7 (IQR=5-7); 84% of respondents had a primary education or less (7 or fewer years of school), and 2% had completed secondary education (13 years of school).

NEP2

Missing data (7.21%, 398 data points from 94 respondents) were replaced by mean imputation (Watkins, 2018). Internal consistency tests of the 15 NEP2 statements suggested the structure was not unidimensional (Cronbach's alpha = -0.31, McDonald's Omega = 0). Bartlett's test of sphericity ($\chi2=1344$, $p<0.001$) and the KMO statistic (0.86) confirmed the factorability of the data. Parallel analysis suggested five factors should be retained. However, the five-factor solution was inadequate. While the RMSEA score was acceptable (0.048, 90% CI: 0.03 - 0.065), the TLI score was below the acceptable threshold (0.928) and Chi-square statistics indicated poor model fit ($\chi2=73.8$, df=40, $p<0.001$) (Table 3). Cross-examination of the raw data prior to recoding (Figure 3) revealed strong agreement with most NEP2 statements, irrespective of the statement's directionality (hence the negative Cronbach's alpha indicative of peculiarity in the data), suggesting acquiescence bias amongst respondents.

Table 3 Results and model fit from exploratory factor analysis with five factors. Only factor loadings above the 0.4 threshold are displayed. Cronbach's alpha and Macdonald's omega scores were only calculated for factors containing multiple statements with acceptable factor loadings. A negative Cronbach's alpha value generally identifies there is something wrong with the data (e.g., neglecting to reverse score statements as required, or that the statements do not form a single scale) (Ursachi et al., 2015).

	Tanzania					Indonesia				
Confirmation of factorability										
Bartlett's test of sphericity	$\chi2$=1344, p<0.001					$\chi2$=683, p<0.001				
KMO	0.86					0.71				
Model statistics										
Sample size	368					510				
Missing data points	398 (7.2%)					99 (1.3%)				
Likelihood chi-square	73.8 (df=40, p<0.001)					49.1 (df=40, p<0.15)				
RMSR	0.03					0.02				
RMSEA	0.048 (90% CI:0.030-0.065)					0.021 (90% CI:0-0.039)				
TLI	0.93					0.96				
Factor loadings										
	Factors					Factors				
Statement	1	2	3	4	5	1	2	3	4	5
NEP 1										
NEP 2										0.47
NEP 3	0.84					0.70				
NEP 4	-0.43									
NEP 5	0.49					0.44				
NEP 6			-0.67							
NEP 7			0.74							
NEP 8							0.76			
NEP 9										
NEP 10		-0.56							0.49	
NEP 11		0.54								
NEP 12										
NEP 13						0.60				
NEP 14				0.80				0.48		
NEP 15	0.40					0.61				
Sum of squared loadings	1.38	0.97	1.41	1.05	0.42	1.60	0.72	0.58	0.45	0.52
Proportion variance	0.09	0.07	0.09	0.07	0.03	0.11	0.05	0.04	0.03	0.03
Cumulative variance	0.11	0.16	0.25	0.32	0.35	0.11	0.16	0.20	0.23	0.26
Internal consistency of factors										
Cronbach's alpha	0.067	-0.68	-2.2	-	-	0.70	-	-	-	-
Macdonald's omega	0.44	0.00	0.00	-	-	0.70	-	-	-	-



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348 Figure 3 Frequency distributions of raw responses to New Ecological Paradigm statements in

349 Tanzania (n=368) and Indonesia (n=510).

350

Support for protected area regulations in Tanzania

Engaging in any of the five illegal behaviours assessed was considered wrong or very wrong by at least 97% of respondents in Tanzania (Figure 4a). Internal consistency checks supported combining the five statements into a single score indicative of respondents' level of support for protected area regulations (Cronbach's Alpha=0.88, Omega Total=0.90). The median score (5.0, IQR=4.4-5.0) indicated that respondents generally perceived conducting any of the illegal behaviours inside their nearest protected area as morally very wrong (Figure 4b).

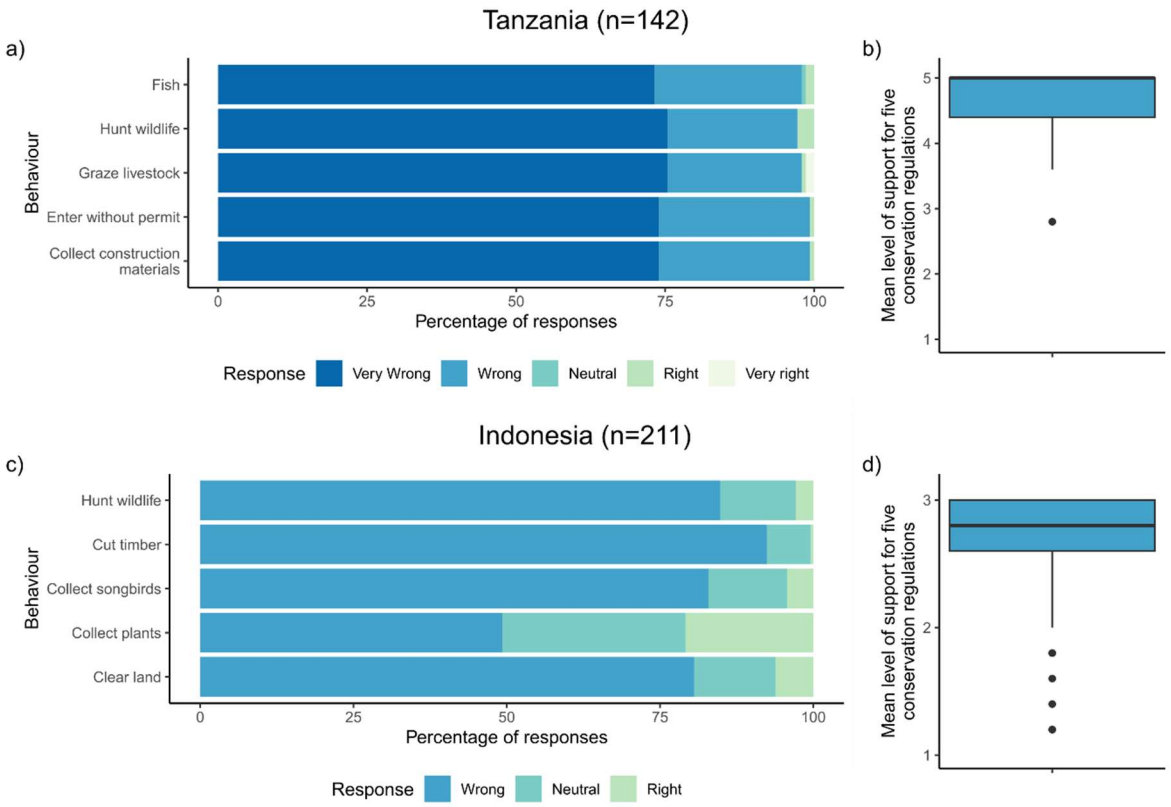

Figure 4. Frequency distribution of responses to individual statements measuring support for protected area regulations in Tanzania (a) and Indonesia (c), statements read “How morally right or wrong would you say it is to X inside Y”, with X replaced by the behaviour of interest and Y replaced by the nearest protected area in Tanzania and “protected forests” in Indonesia. Plots b and d show the distribution of mean level of support for five protected regulations in Tanzania and Indonesia respectively; higher numbers denote higher support. The bold line represents the median, the lower and upper edges of the box are the first and third quartiles and the whiskers the maximum and minimum points, with outliers displayed as dots. In figures c and d the original five-point response scale was condensed to a three-point scale.

Relationship between NEP2 statements and support for protected area regulations in Tanzania

Due to the low validity of the NEP2 scale as a whole and the lack of revealed factors from the EFA, we investigated correlations between individual NEP2 statements and respondent's support for protected area regulations. Responses to four individual NEP2 statements (6, 7, 12 and 13, Table 4) and respondent's support for protected area regulations were significantly correlated ($p<0.05$), however, all correlation coefficients were weak ($\rho \leq 0.26$).

376 Table 4 Spearman's rank correlations between each NEP2 item and respondents' support for
377 protected area regulations in Tanzania and Indonesia, and between the eco-fragility factor and
378 support for protected area regulations in Indonesia. *p<0.05, **<0.01, ***p<0.001

	Tanzania (n=142)		Indonesia (n=211)	
	Spearman's *ρ*	p	Spearman's *ρ*	p
1. We are approaching the limit of the number of people the earth can support.	-0.04	0.62	-0.01	0.87
2. Humans have the right to modify the natural environment to suit their needs.	0.12	0.18	0.00	0.97
3. When humans interfere with the natural environment it often produces disastrous consequences.	0.13	0.13	0.17	0.01*
4. Human ingenuity will ensure that we do not make the earth unliveable.	0.13	0.16	0.14	0.05*
5. Humans are severely abusing the environment.	0.01	0.90	0.03	0.70
6. The earth has plenty of natural resources if we just learn how to develop them.	0.23	0.007**	0.21	0.002**
7. Plants and animals have as much right as humans to exist.	0.19	0.03*	0.22	0.002**
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.	0.11	0.21	0.08	0.27
9. Despite our special abilities' humans are still subject to the laws of nature.	0.05	0.54	0.14	0.04*
10. The so-called "ecological crisis" facing humankind has been greatly exaggerated.	-0.05	0.60	0.03	0.66
11. The earth is like a spaceship with very limited room and resources	0.10	0.29	0.11	0.11
12. Humans were meant to rule over the rest of nature.	0.20	0.02*	-0.05	0.44
13. The balance of nature is very delicate and easily upset.	0.26	0.003**	0.16	0.02*
14. Humans will eventually learn enough about how nature works to be able to control it.	0.11	0.24	0.04	0.53
15. If things continue on their present course, we will soon experience a major ecological catastrophe.	0.15	0.09	0.26	<0.001***
Eco-fragility factor	NA	NA	0.18	0.008**

379

Indonesia

Questionnaire Summary

Between January 2021 and February 2022, 510 men completed demographic and NEP2 questions, of which 41% (n=211) also answered support for protected area regulations statements. The median age of respondents was 38 (IQR=31-46) and the median years of formal schooling completed was 12 (IQR=6-12); 25% of respondents had a primary education or less (6 or fewer years of school), 56% had completed secondary education (12 years of school).

NEP2

Due to low usage of extreme points on the Likert scale (Figure 3), responses to the NEP2 statements were condensed to a three-point scale (1=disagree, 2=neutral, 3=agree). Mean imputation replaced missing data (1.3%, 99 data points from 54 respondents). Tests for internal consistency of the 15 NEP2 statements provided no evidence for a unidimensional structure (Cronbach's alpha = 0.38, McDonald's Omega = 0.4). Bartlett's test of sphericity ($\chi 2=683$, $p<0.001$) and the KMO statistic (0.71) confirmed the factorability of the data. Parallel analysis suggested data had a five-factor structure. While the five-factor solution had an adequate model fit (RMSEA index=0.021, 90% CI: 0 – 0.039; TLI=0.96) it showed no support for any of the NEP2 theorised structures in our sample, with only one factor containing multiple statements with loadings >0.4 (Factor 1,Table 3). Containing statements from both the eco-crisis, and the fragility of the balance of nature facets, we named this the Eco-fragility factor. Measures of internal consistency for the Eco-fragility factor were adequate (Cronbach's Alpha=0.70, MacDonald's Omega=0.70), and the mean score calculated across the four statements was 2.47 (SE=0.025) indicating that on average, respondents are concerned about the negative impact humans have on a fragile environment.

Support for protected area regulations in Indonesia

405 Data from the questions measuring support for protected area regulations were also condensed to a
406 three-point scale. Mean imputation was used to replace missing data (0.57%, six data points from
407 three respondents). All behaviours were perceived as wrong by at least 80% of respondents (Figure
408 4c), except for collecting plants from protected forests, which was reported as wrong by far fewer
409 respondents (49%). Internal consistency checks (Cronbach's alpha=0.62, MacDonald's Omega=0.69)
410 supported combining the five statements into a single score indicative of respondents' support for
411 protected area regulations. The median score (2.8, IQR=2.6-3.0) indicated people generally
412 considered it wrong to conduct activities illegally inside protected areas (Figure 4d).

413

414 **Relationship between NEP2 statements and support for protected area regulations in Indonesia**

415 Again, due to the low validity of the NEP2 scale, we investigated correlations between individual
416 NEP2 statements and respondent's support for protected area regulations and correlations between
417 the eco-fragility factor and respondents support for protected area regulations. We found responses
418 to seven NEP2 statements (3, 4, 6, 7, 9, 13 and 15, Table 4) were significantly ($p<0.05$) correlated to
419 respondent's support for protected area regulations. However, all correlation coefficients were
420 weak ($\rho \leq 0.26$). Similarly, the eco-fragility factor was significantly ($p<0.001$) but weakly correlated
421 ($\rho=0.18$) to support for protected regulations.

422

423

Discussion

Conservationists are increasingly using psychological scales to understand human behaviour and support for environmental conservation in general. However, it is vital to ensure such tools are valid in the contexts in which they are applied. In this study we assessed the effectiveness of one of the most widely used measures of pro-environmental orientations, NEP2, at measuring pro-environmental beliefs held by people living around protected areas in Tanzania and Indonesia. Moreover, we examine how elements of NEP2 related to individual's support for protected area regulations. In Tanzania and Indonesia, NEP2 did not work as hypothesised in the originally theory (Dunlap et al., 2000), supporting the findings of other authors who have found the NEP2 scale to have low validity, or differing dimensionality, when applied in non-WEIRD contexts (e.g. Khan et al., 2012; Ogunbode, 2013; Rosa et al., 2021; Xue et al., 2018). In Indonesia our exploratory factor analysis identified a single latent factor comprised of four out of 15 statements, two statements from the eco-crisis facet and two from the fragility of the balance of nature facet. Combined, this "eco-fragility" factor measures concern about the negative impact humans have on a fragile environment. The high mean score across these four statements indicates our respondents are concerned about humanities' impact on a fragile environment. However, our data provided no evidence of latent factors related to the anti-anthropocentrism, anti-exemptionalism, or limits to growth facets of the NEP2, suggesting that these facets or dimensions, as measured by NEP2, did not play an important role in constructing pro-environmental beliefs among our sample.

We found no evidence of a unifying theme underpinning our data from Tanzania. Respondents here agreed with most statements, even where there were contradictions (e.g., statement 8 "The balance of nature is strong enough to cope with the impacts of modern industrial nations" and statement 13 "The balance of nature is very delicate and easily upset"), indicating acquiescence bias. To a lesser extent, similar patterns were detected in Indonesia. Both countries represent relatively collectivist cultures (Hofstede et al., 2010) and this cultural characteristic can lead to acquiescence bias, where

450 respondents provide affirmative responses rather than negative or neutral ones to maintain in-
451 group harmony (Smith, 2004; van Herk et al., 2004). Additionally, the WEIRD origins of NEP2, and the
452 comparatively low levels of formal education among our samples, particularly in Tanzania, may have
453 impacted respondents' ability to engage with and interpret NEP2 statements appropriately. Despite
454 our iterative piloting and editing of NEP2 statements, some concepts may have been outside
455 respondents' experience or knowledge, making answering statements cognitively difficult, and
456 leading to inaccurate or biased responses (MacKenzie & Podsakoff, 2012; Rammstedt & Farmer,
457 2013; Rosa et al., 2023).

458

459 Although there have been prior applications of NEP2 in Indonesia, rarely have they explored the
460 scale's structure or employed tests such as Cronbach alpha to assess internal consistency (e.g.
461 (Hidayati et al., 2020; Meilinda et al., 2017)). Studies which have conducted factor analysis, reported
462 structures of pro-environmental beliefs that differ compared to the original theory (Dunlap et al.,
463 2000) or structures found in WEIRD contexts (Amburgey & Thoman, 2012; Dunlap et al., 2000),
464 where it is expected that all revealed factors should positively correlate with each other, or load
465 positively onto a pro-environment latent factor. For example, a study of visitors to urban forests in
466 Jakarta found NEP2 had acceptable internal consistency as a unidimensional scale, while
467 confirmatory factor analysis of a five-factor solution also showed acceptable model fit (15 NEP2
468 statements loading onto five factors) (Doyeon Kim et al., 2021). However, the analysis did not test if
469 the five factors subsequently loaded positively onto a single pro-environment latent variable (Figure
470 1b). Respondents, on average, showed agreement with the balance of nature, limits to growth, and
471 eco-crisis factors, but disagreement and neutrality with the anti-anthropocentrism and anti-
472 exemptionalism factors respectively (Doyeon Kim et al., 2021), suggesting that while respondents
473 were concerned with the state of the environment and human impacts on it, they simultaneously
474 viewed the environment as existing for human benefit. Moreover, when applying NEP2 in a sample
475 of 273 trainee teachers from Java, in Indonesia, and Korea, Rachmatullah et al., (2020) identified just

three prominent factors; egoistic, altruistic and biospheric. Among the Indonesian sample they found their egoistic factor (humans should not dominate over nature) to be negatively correlated with the altruistic (balancing human and environmental needs) and biospheric factors (concern for ecological systems).

The theory underpinning NEP2, posits that holding pro-environmental beliefs means rejecting human-exemptionalism (humans are exempt from the laws of nature) and environmental exploitation for the benefit of humanity (Dunlap et al., 2000). However, our data and previous studies suggest that this is not the case in Indonesia where these latent factors either do not exist, or are not rejected by those who hold pro-environmental beliefs as measured by other NEP2 factors (Doyeon Kim et al., 2021; Rachmatullah et al., 2020). Similar dynamics have been found where NEP2 has been applied in other non-WEIRD contexts. For example, in Brazil, Mexico, China and Nigeria respondents were found to hold utilitarian views towards the environment while also being concerned about environmental damage caused by humanity (Bechtel et al., 1999; Corral-Verdugo & Armendáriz, 2000; Ogunbode, 2013; Vikan et al., 2007; Xue et al., 2018). These differences in environmental beliefs may result from fundamental differences in culture (Bechtel et al., 2006; Vikan et al., 2007), as well as countries' differing stages of economic development (Doo-Sik Kim, 1999). Agriculture, forestry, and fisheries contribute 13% of Indonesia's GDP and employ over 29% of the workforce, compared to 1.1% and 1.4% respectively for the USA (where NEP2 originated) (World Bank, 2022a, 2022b). The economic importance of the natural environment in many developing economies could explain the existence of utilitarian environmental views existing alongside concern for environmental health. Although rising awareness of environmental issues, particularly topics such as climate change and biodiversity loss, may also be a contributing factor (USAID, 2018).

Theoretical assumptions over which concurrently held views contribute to a pro-environmental worldview are another factor likely impeding NEP2 performance in non-WEIRD contexts. For example, western respondents are more likely to interpret statements about humanity and the laws of nature in the context of nature as a bio-physical system that humans are either subject to or exempt from (Ogunbode, 2013). Thus, theory underpinning NEP2 suggests agreement with the statement "9. Despite our special abilities, humans are still subject to the laws of nature" will correspond with disagreement to "14. humans will eventually learn enough about how nature works to be able to control it" and vice versa (Ogunbode, 2013). However, non-WEIRD cultures may view human-nature relations as part of a wider spiritual system, with humanities place in the "laws of nature" defined by mystical and religious ideology (Ogunbode, 2013). For example, some Christian beliefs systems posit humanity as being granted stewardship or dominion of earth by god (Harrison, 1999), in this belief system, while humanity is still subject to the (spiritual) laws of nature, as laid down by a higher power, it has also been granted control over the rest of earth, nature and the environment. Here, agreement with both statements is consistent with a view where humanity is subject to spiritual laws, but these laws also allow humanity to control other elements of nature through spiritual or religious means. Consequently, when applying psychometric scales in novel contexts, it is vital to consider the context in which tools are being used, including the theories behind their development, and how this relates to local experiences, beliefs, and cultures (Beaton et al., 2000; Furr, 2011; MacKenzie & Podsakoff, 2012).

Importantly, reported support for protected area rules was high across both study landscapes, suggesting protected area regulations aligned with people's sense of what is morally right (Trinkner et al., 2018). Most respondents in Tanzania reported that it was morally wrong to enter a protected area to hunt wildlife, fish, graze livestock, or collect construction materials. Results from Indonesia were similarly indicative of support for protected area regulations, although a greater proportion of respondents perceived illegal behaviours neutrally, compared to Tanzania. Variation in the levels of

reported support for protected area regulations across the two study landscapes may be driven by several factors. Firstly, people's willingness to talk about conservation rule-breaking has been found to be lower in Tanzania than Indonesia (Ibbett, Jones, et al., 2023), potentially resulting in social desirability biases making those in Tanzania reluctant to express disagreement with protected area regulations. Where research topics are sensitive, specialised questioning techniques, such as the randomised response technique or unmatched count technique, may reduce sensitivity biases by offering respondents a level of protection when discussing sensitive topics (Nuno & St. John, 2015). However, where topic sensitivity is very high, these methods still have limitations (Ibbett, Dorward, et al., 2023). Secondly, poor knowledge of protected area types, authorities, and rules in Indonesia may cause respondents to be unaware that certain behaviours are illegal and therefore less likely to view them as morally wrong.

Importantly, a considerable minority in Indonesia (21%) deemed it acceptable to collect plants from protected areas. Low levels of support for rules restricting plant collection inside Indonesian protected areas may be due to several factors. Firstly, anecdotal data from respondents and village officials suggested that the COVID-19 pandemic and associated lockdowns led to increased demand for houseplants across Indonesia. This resulted in the collection and sale of decorative forest plants providing vital short-term income for those, for example, in the eco-tourism industry, which was heavily impacted by pandemic-related travel restrictions. Forest plants were also associated with health needs, with the gathering of medicinal plants the most common reason given in focus groups for plant collecting. Lastly, plant awareness disparity is a widely reported phenomenon where the importance and conservation of plant species are often overlooked in favour of animals (Parsley, 2020). This can result in plants being overlooked in the design, dissemination, and enforcement of regulations (Margulies et al., 2019), potentially impacting local support for regulations that restrict collection of plants among our Indonesian sample.

In both countries we found responses to several individual NEP2 statements (and one combination of four items in Indonesia) were weakly and significantly correlated with participants support for protected area rules. These results provide limited evidence that that NEP2 can help us understand support for environmental policies and behaviours in non-WEIRD contexts. However, it is important to note that the role of general beliefs in influencing behaviour is mediated by other behavioural and context-specific higher order psychological constructs (e.g., emotions, norms, specific beliefs and attitudes) (Ajzen, 1991; Fulton et al., 1996; Steg & Vlek, 2009; Stern et al., 1995), which could explain the weakness of correlations between elements of NEP2 and support for protected area regulations in our samples.

Conclusion

Psychological research tools and methods offer great potential to conservation scientists who increasingly seek to understand drivers of conservation-relevant behaviours, including support for protected area regulations (St. John et al., 2010; Whitehouse-Tedd et al., 2021). We found the overall validity of NEP2 was low across our two study landscapes, despite iterative rounds of piloting and adjustments to account for local contexts. Whilst piloting can address issues of respondent comprehension and questionnaire structure, properties of psychological constructs can differ between contexts and culture's (Aoyagi-Usui et al., 2003; Henrich et al., 2010), meaning scales designed in one context, may lack utility elsewhere (Furr, 2011; Whitehouse-Tedd et al., 2021). This is of particular relevance to conservation given the diverse conceptualisations of the environment and human-environment relationships across cultures and societies (Rosa et al., 2023). Importantly, we highlight the challenges associated with the cross-cultural application of psychometric scales where researchers must balance maintaining construct consistency and comparability across samples (Beaton et al., 2000) whilst ensuring that concepts, framings, and phrasings within scales are easily understood and within the cognitive, lived, and cultural experiences of respondents.

Author Contributions

Research was conceived by Leejiah Dorward, Freya A. V. St John, and Harriet Ibbett. Data were collected by Stephen Sankeni, Joseph Kaduma, Jesca Mchomvu, Rose Mawenya, Karlina Prayitno, Humairah Sabiladiyni, Andie Wijaya Saputra, Ika Agustin and Tyassanti Trywidiarini; with support from Edward Kohi and Asri A. Dwiyahreni. Analyses and writing were conducted by Leejiah Dorward, with editing by Freya A. V. St John and Harriet Ibbett. All authors reviewed and commented on the manuscript.

Statement on Inclusion

Our study brings together authors from the UK, Indonesia, and Tanzania, and thus includes scientists from countries where primary data collection was carried out. While original study conceptualisation was conducted by UK based academics, authors from Tanzania and Indonesia were involved in the design and implementation of the survey tool and in interpretation of results.

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Conflict of Interests

In line with research permit conditions, prior to submission this manuscript was reviewed and approved (without changes) by Tanzania Wildlife Research Institute (TAWIRI). Authors declare no conflicts of interest.

Data availability

Data, code and survey instrument available at: 10.6084/m9.figshare.25304338

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