The "value perspectives of nature" scale: A validated scale to measure plural value perspectives of future nature from a transformative angle.

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PRE-PRINT

MANUSCRIPT CURRENTLY UNDER REVIEW

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The “Value Perspectives of Nature” scale: A validated scale to measure plural value perspectives of future nature from a transformative angle.

Abstract

1. Just sustainability transformation is a process of change that has a dual commitment to human well-being and environmental sustainability. Inclusive transformation critically depends on recognition of the plural values of nature in society. Lack of value alignment can lead to profound disagreements with those in society not sharing the same views on nature.
2. To explore plural value perspectives, we introduce the Value Perspectives of Nature (VPN) scale. This scale builds on existing value literature and measurement scales as well as on transformative approaches, most notable the Nature Futures Framework.
3. Using a seven-step process that includes qualitative expert evaluations, cognitive interviews, and three rounds of quantitative pre-testing and validation, the scale is developed, refined, and validated across five European countries (representative sample; N=1000).
4. The final VPN scale consists of 11 items, measuring instrumental value perspectives (material and nonmaterial contributions to people), relational value perspectives (place attachment and identity; Fulfilment and well-being; Spirituality; and Kinship) and intrinsic value perspectives (nature as an end in itself and acknowledgement of the rights of nature). The final validation study shows moderate to high internal consistency, reliability, and predictive validity of the scale across all countries.
5. While existing scales often focus on single values, the VPN is the first cross-culturally validated scale that integrates intrinsic, instrumental, and relational value perspectives into one composite scale with a focus on changes for the future. Based on the development and analysis of the VPN, we discuss several theoretical and conceptual issues in relation to relational values.

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6. Policy implications: The VPN scale can be used in survey research to understand attitudes towards nature restoration measures. This may facilitate dialogue on effective and just transformative change in nature, through sensitising to the plural values of diverse communities. It may also be used to monitor the diversity of value perspectives over time and between communities and stakeholders. Understanding such changes in mind-sets and taking into account concerns from critical groups in society will help navigate towards positive nature futures supported by the general public.

Keywords:

Attitudes; Biodiversity; Conservation; Nature Futures Framework; Relational values.

Introduction

The world is facing unprecedented environmental challenges, especially related to climate and biodiversity. The Kunming-Montréal Global Biodiversity Framework (GBF) in 2022 has established biodiversity safeguarding targets to be reached in 2030 as well as targets to ensure sustainable use of nature (Hughes & Grumbine, 2023). In doing so, the GBF recognizes that human societies and nature are intertwined, an acknowledgement that is also made in the scientific literature concerning social-ecological systems (Partelow, 2018). This perspective is often regarded as essential for the large-scale societal changes (transformations) and related shifts in complex, adaptive systems (transitions) that are needed to tackle the world's environmental polycrises.

A societal transformation can, in a reasonably well-functioning democracy, only take place if it has public support. This support, in part, depends on people's perceptions, values and cognitions (Patterson et al., 2017). However, views of nature vary within and between sociodemographic groups, cultures, countries and regions (Buijs et al., 2009; Kloek et al., 2017). This has led to researchers

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advocating for recognition of diverse nature value positions and for incorporating a plurality of values in conservation (Chan et al., 2016; Diaz et al., 2018; Pascual et al., 2023; Pereira et al., 2020). Nature conservationists are often guided by one set of values, often with a narrow view on the so-called intrinsic value of nature, which then risks failing to address the plurality of values and ethical worldviews in society (Andersen et al., 2022). In turn, this lack of value alignment can lead to profound disagreements with those in society not sharing the same views on nature as (Chan et al., 2016) and challenges the widely acknowledged need for a just and inclusive transformation (Bennett et al., 2019). A just transformation can be seen as a process of change that has a dual commitment to human well-being and environmental sustainability, sensitive to the plural values present in society (Perino et al., 2022).

Values of Nature

The plural values of nature are often conceptualised into instrumental, intrinsic and relational values (Chan et al., 2016; Pascual et al., 2023). However, decades of philosophical, sociological and psychological explorations (e.g. Buijs, 2009; Chan et al., 2018; Kempton et al., 1995; Lockwood, 1999) have shown that this categorisation is not without issues (Kenter et al., 2019).

Values can be seen as standards or criteria for the selection or evaluation of policies and actions (Schwartz, 1994). They are generally stable and apply across different situations and objects. Since the 1970s, research has focused on cultural and personal differences in intrinsic and instrumental values, also to understand conflicts over natural resources and individual behaviour towards nature and the environment (e.g. Stern et al., 1998). Instrumental values are based on the value that an individual and/or society may derive *from* nature, that is, from animals, plants, ecosystems and natural processes. They are *means* to some end (Himes & Muraca, 2018); as the value of living entities as means to achieve human-defined ends, or *satisfy human preferences* (Pascual et al., 2017), or the basis of *services* and *benefits* that nature can provide for human beings (See, 2020). Especially

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the latter is often associated with the concept of ecosystem services, providing, regulating, cultural, and supporting services, as well as with the related concept of nature's contribution to people (Feucht et al., 2023). One important characteristic of instrumental values is that they are, in principle, substitutable.

The concept of *intrinsic* value in relation to nature can be defined as: 'values inherent to nature, independent of human judgment, have been intensely debated. (Pascual et al., 2017). This definition conflates three different elements (Cf. O'Neill, 1992), i) the *Inherent*, non-relational properties of nature/natural objects; ii) the value of nature *independent* of human valuation and judgment, and iii) nature as bearer of inherent moral value as *ends in itself*, and subjects/objects with their own good (In line with Palmer, 2013). Even this narrower focus raises the question of what intrinsic value is, e.g. the. attributes of individual organisms, such as ability to flourish or rather more abstract notions such as diversity, richness, naturalness, or balance (Buijs, 2009; Palmer, 2013). Unlike instrumental values, intrinsic values cannot be substituted.

Finally, relational values are concerned with the value of nature stemming from relationships (interactions, responsibilities) between people and nature or between people with regard to nature. Relational values have been suggested as a way to break up the dichotomy of instrumental and intrinsic values, first articulated in land use literature by Brown (Brown, 1984), coined in the philosophical literature by Muraca (Muraca, 2011) and in sustainability science by Chan et al. (Chan et al., 2016). The advent of this suggested type of value can be seen as a response to a growing critique of (economic) environmental valuation (e.g. Spash, 2020) and as an effort to move beyond the heavily debated human-nature dichotomy (Himes et al., 2024). It also responds to critiques that with instrumental and intrinsic values, only a narrow spectrum of values is captured (Gould et al., 2024; Himes et al., 2024). The concept of relational values is still under debate. While some authors argue that all environmental values are ultimately relational (Norton & Sanbeg, 2021), others question the conceptual and pragmatic worth, arguing that relationality is inherent to both instrumental and

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intrinsic values (Luque-Lora, 2023). When the term relational values is used, it captures a more diverse and equitable array of nature's values than intrinsic and instrumental values - meanings and uses, including kinship, stewardship, indigenous, spiritual, and place-based values, as well as eudemonic values; i.e. living a fulfilling life of care, well-being and reciprocity (Anderson, 2022; Chan et al., 2018; Feucht et al., 2023; Himes et al., 2024; Pratson et al., 2023). Relational values are distinct from instrumental and intrinsic values in three ways: relationships have inherent interconnected qualities; they are nonsubstitutable (although there are instrumental threads to relational values); and relationships are reciprocal (instrumental values of nature are transactional).

Value perspectives and transformative change

Keeping the distinction between relational, intrinsic, and instrumental value, the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) has developed the Nature Futures Framework (NFF) as a tool designed to explore different paths for bringing about transformative change, focusing on positive and diverse relationships between people and nature, often typified as 'nature positive futures' (Pereira et al., 2020). The term 'nature positive' refers to stopping biodiversity loss and restoring nature to get full ecosystem recovery by 2050 according to policy aims including the Kunming-Montreal Global Biodiversity Framework. The paths towards nature-positive futures are explicitly inspired by the plurality of values. Because the NFF is future-oriented, it conceptualises the values as value *perspectives*. These value perspectives can encompass a wide variety of dimensions that assess the degree of interdependence between nature and societies from a plural value lens (value-pluralism). Value perspectives are conceptualised as (1) nature for nature, prioritizing the intrinsic value perspectives of nature, (2) nature for society, prioritizing the instrumental values perspectives; and (3) nature as culture, prioritizing relational value perspectives (Pereira et al., 2020). These perspectives allow for exploring multiple pathways towards more sustainable futures (Kim et al., 2023). The NFF framework is increasingly being applied in practical

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case studies across the globe including: urban development (Mansur et al., 2022), policy design and guidance (Palacios-Abrantes et al., 2022), and biodiversity conservation and ecological restoration (Quintero-Uribe et al., 2022). Meanwhile, quantitative adaptations to measure NFF value perspectives or people's perspectives on halting biodiversity loss to be incorporated in, for example, surveys or participatory planning exercises are still lacking. Combining insights from environmental psychology and other disciplines about understanding and measuring values and value perspectives with the NFF literature, we aim to take the NFF a step further by quantifying the value perspectives of nature-positive futures as developed and used in the NFF. In the following we build on the NFF value perspectives, but to capture all the aspects of nature valuation described in the previous section, we prefer to use the categories of instrumental, intrinsic, and relational value perspectives.

Aim

The aim of this paper is to develop a psychometrically validated scale to measure value perspectives of nature. Prime examples of existing scales of human-nature views and relations, as reviewed by Cruz and Manata (Cruz & Manata, 2020), are the revised New Ecological Paradigm scale (NEP)(Dunlap et al., 2000); the Environmental Attitude Scale (Kuhn & Jackson, 1989); and the Environmental Concerns scale (Schultz, 2001). More specifically in relation to the *value* of nature, there are many scales to capture the value of nature to humans (intrinsic, instrumental, and relational), or human value orientations (egoistic, altruistic, biospheric) (Arias-Arévalo et al., 2017; Klain et al., 2017; Winter & Lockwood, 2004). However, many of these scales focus on a single-value dimension. Further, none of the existing scales addresses the values, connections or worldviews from a *transformative* perspective, and particularly the transformation towards nature-positive futures. There are some exemptions, but the focus has been on very specific settings, such as a specific national park, see e.g. (Kuiper et al., 2022) or an urban setting, see e.g. (Mansur et al., 2022).

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To address these gaps, our aim is to develop a scale to measure the value perspectives of people regarding *futures* for nature, integrating all three perspectives described above into one psychometric scale. To maximise usability and the ability to include the scale in larger questionnaires, we aim for a condensed scale (Stern et al., 1998). This scale, the Value Perspective of Nature (VPN) scale, is validated across five European countries.

Materials and Methods

We developed the Value Perspectives of Nature (VPN) scale, following recommended development and validation practices as outlined in Hair et al. (Hair et al., 2019) and Boateng at al. (Boateng et al., 2018), via seven steps (Fig 1). The Table S1 in the supplementary material provides the formulation of all items at each step and the changes made between them. A notable difference from other attempts to develop a psychometric measurement scale is that we developed VPN simultaneously within multiple (European) cultural settings, which required additional considerations regarding the scale validation and specifically statistical analysis. Thus, during the development and validation steps, special attention was given to existing guidelines for cross-cultural scale adaptations.

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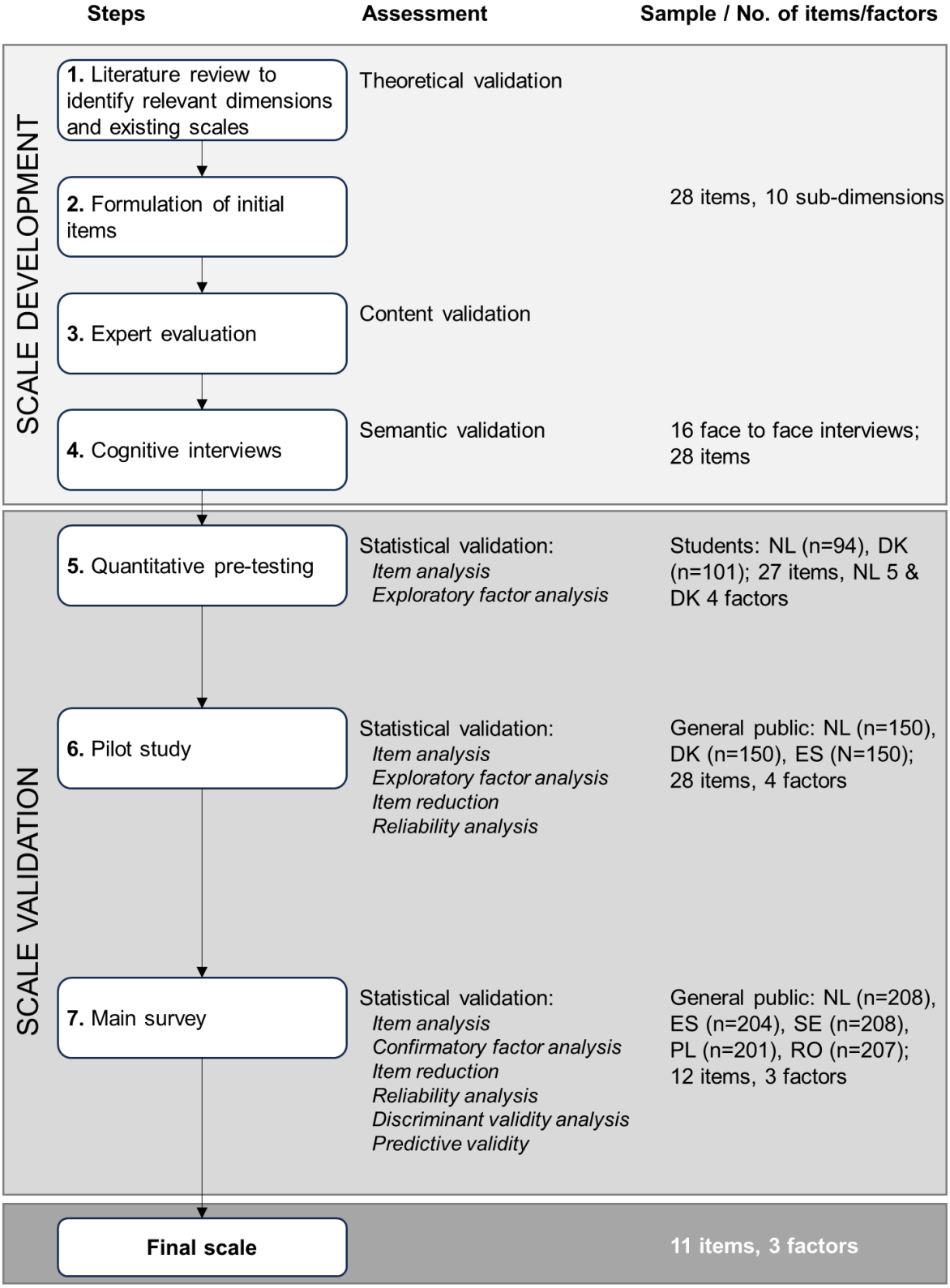
183 **Fig. 1. Methodological overview of VPN scale development and validation process**



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Instrument Development

An initial narrative literature review was carried out to identify existing related scales and explore relevant subdimensions that should be considered within each value perspective. For the instrumental value perspective, we build on previous conceptualisations of ecosystem services (ESS) and Nature's Contribution to People (NCP), differentiating between *material, non-material, and regulating contributions* to people (Fig 2)(Diaz et al., 2018). For the intrinsic value perspective, we build on existing conceptualisations seeing *nature as an end in itself* and acknowledging *rights of nature* (Hourdequin, 2024). The conceptualisation of relational value perspective proved to be the most difficult, as this relatively new concept is still in development, quite complex and broad, and has noticeable overlaps with indirect, non-material aspects of instrumental values. Although items and scales have recently been suggested to measure relational values, they have either focused on relational values as metaphors, without a clear conceptual distinction with other values (Klain et al., 2017), or were very limited in their application (Feucht et al., 2023). In addition, conceptualisations of relational values often overlap explicitly (Andersen et al., 2022) or implicitly (Klain et al., 2017) with instrumental or intrinsic values. Next to these existing scales, we found inspiration to distinguish subdimensions for the relational perspective from the IPBES Value Assessment, which differentiates between *Place attachment and identity*; *Fulfilment and well-being* (Eudemonia); *Spirituality*; and *Care* (as stewardship responsibility)(Anderson, 2022). Based on other reviews of relational values (Feucht et al., 2023; Pratson et al., 2023), we added the notion of *Kinship* with nonhuman entities as a fifth subdimension. With the three subdimensions for instrumental value perspective and two subdimensions for intrinsic value perspective, this resulted in a structure to develop items consisting of in total ten subdimensions (Fig. 2).

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209 **Fig. 2. Overview of the value perspectives and their subdimensions, including references and**

210 **examples from previous studies used as inspiration for the VPN.**

	Subdimensions	References	Example formulations used for inspiration
INSTRUMENTAL	**1.** Material contributions	Diaz et al., 2018; Feucht et al., 2023; Himes et al., 2024	Nature has a benefit in that it provides food, water, raw materials, etc. for humans (Feucht et al., 2023)
	2. Immaterial contributions	Diaz et al., 2018; Feucht et al., 2023; Himes et al., 2024	This green space is a good venue for recreational activity (See et al., 2020)
	3. Regulating contributions	Diaz et al., 2018; Feucht et al., 2023; Himes et al., 2024	This green space can mitigate climate change (See et al., 2020).
RELATIONAL	**4.** Place attachment and identity	Chan et al., 2016; Klain et al., 2017; Andersen et al., 2022; Lan et al., 2022; Saito et al., 2022; Pratson et al., 2023; Feucht et al., 2023; Himes et al., 2024	There are landscapes that say something about who we are as a community, a people (Klain et al., 2017)
	5. Fulfilment and well-being	See et al., 2020; Andersen et al., 2022; Saito et al., 2022; Himes et al., 2024	My care for this land fulfils me, helps me lead a good life (Saito et al., 2022)
	6. Spirituality	Lliso et al., 2021; Andersen et al., 2022; Pratson et al., 2022; Lan et al., 2022	Nature has a religious, sacred or spiritual value to me (Lliso et al., 2021)
	7. Care	Chan et al., 2016; Andersen et al., 2022; Saito et al., 2022; Pratson et al., 2023; Himes et al., 2024	Caring for all lifeforms and physical forms is a moral necessity (Saito et al., 2022)
	8. Kinship	Klain et al., 2017; Pratson et al., 2023; Feucht et al., 2023	Humans are a part of nature and nature is a part of us (Lliso et al., 2021)
INTRINSIC	**9.** Nature as an end in itself	Feucht et al., 2023; Himes et al., 2024	Nature has value regardless of whether man can derive any benefit from it (Feucht et al., 2023)
	10. Rights of nature	Himes et al., 2024	Inherent moral value of natural beings (right to exist) (Himes et al., 2024)

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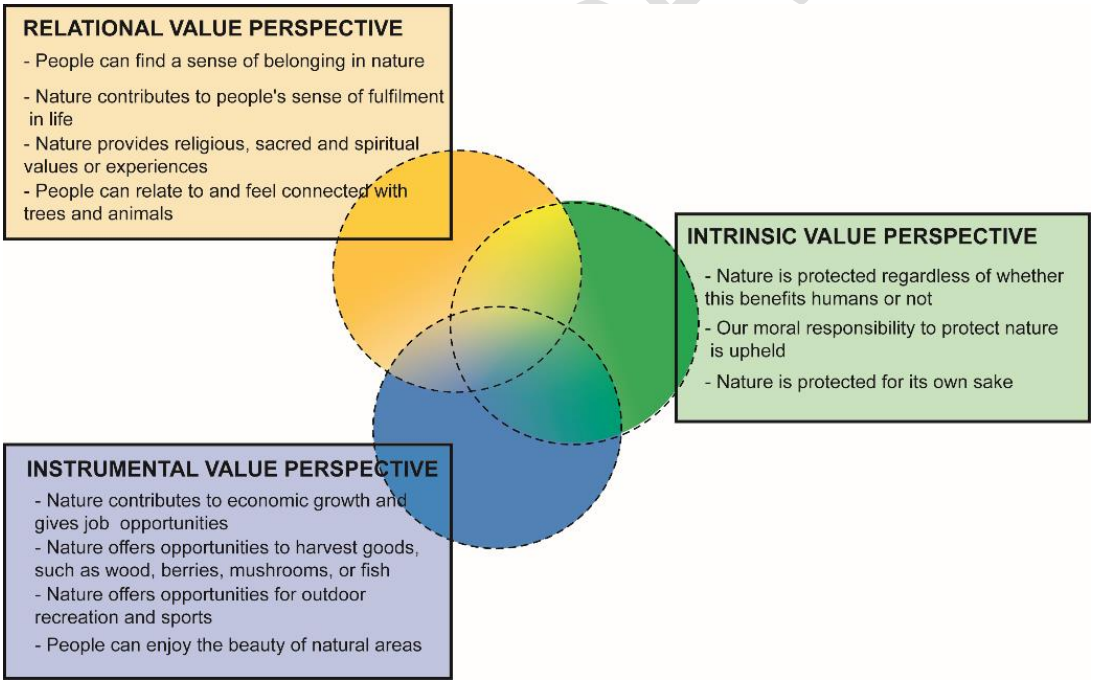
The formulations of items were validated in an online workshop with all coauthors as well as in 16 cognitive interviews with people not professionally engaged in conservation or research in the Netherlands and Denmark. We then pilot tested the 28-items for further refinement and shortening of the scale in representative international samples, resulting in 12 items in the main study and eventually 11 items in the final scale (Fig. 3). Based on the pilot study, the question stem for the final scale was adapted to '*Listed below are statements on different aspects that could be important when thinking of nature in the future. Please indicate how much of a priority you feel each aspect should have in [your country] in the future.'* and responses to each item had to be given on a 7-point scale from 'not important at all' to 'very important'. Supplementary material S1 text and S1 table give a full description of all steps and changes in formulations between each step.

Fig. 3: Final items of the Value Perspectives of Nature (VPN) scale.



Data Collection

Scale validation was carried out with three independent data collections, each containing samples from multiple countries (Fig. 1). First, an online questionnaire was administered with a convenience

sample of university students, some of these were international students, adding quality to the development of the cross-cultural scale (n=94 & n=101). After further revisions of the scale (see the results section, Table S1, S2, S3), a pilot study was conducted as an online questionnaire administered by a professional polling agency with a sample of the general public in the Netherlands, Spain and Denmark (n= 3 x 150) (Table S4). After final iterations of the scale (see results section, Table S1, S5-S8), including a back-translation of the survey to check for translation inconsistencies, it was administered in October 2024 by a professional international polling agency as part of a larger online questionnaire on restoration and rewilding. The sample consisted of people from the general public in the Netherlands, Spain, Sweden, Poland, and Romania (n=5 x 200) (S9 table). The studies were conducted according to ethical guidelines, including informed consent. The ethics approval for the study was given by the Wageningen Research Ethics Committee for nonmedical studies involving human subjects (WUR-REC-2024-112).

Data Analysis

For the statistical validation of the scale, a range of common scale reliability and validity analysis (Hair et al., 2019) were performed for each of the steps and samples (Fig. 1). Country samples were treated separately in the pretesting and pilot study to support the cross-cultural adaptation and development of the scale. All data analysis was performed in *R* and statistical significance was set at p=0.05.

Across all data collections, we evaluated the performance of individual items using basic descriptive statistics, including mean values, standard deviations (SD), skewness, kurtosis, and response range to assess the clarity of the items and response options and to check for potential ceiling or floor effects (mean values >6.5 or <1.5). To assess the appropriateness of our assumed value perspective dimensions, we performed several exploratory and confirmatory factor analysis on our different samples (Fig. 1). The reliability of the factors obtained was assessed using Cronbach's alpha. A detailed descriptions of the statistical data analysis in each validation step and for each country,

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including used configurations, tests for appropriateness, and analysis steps can be found in the Supplementary material S2 Text.

Linear regression models were used to assess the predictive validity of the final scale. The final study contained besides the value perspectives scale also several items measuring attitudes towards different restoration actions, asking how respondent would feel about these changes in their country and in an area close to them. We chose four attitude items ("Reducing the influence that humans have on nature in the country/area" and "Restoring natural processes and dynamics in the country/area"). The attitude items were then each used as a dependent variable in a linear regression model, including the three composite scales (i.e. value perspectives) as predictor variables and assessed on explained variance.

To illustrate and better understand the plurality of value perspectives, we classified respondents according to a typology of the Nature-Futures Framework, consisting of all possible combinations of value perspectives (Kim et al., 2023). The classification was based on the scores of the respondents on the composite scales, as these represent the priority given to the different value perspectives. Assuming that values above 4.5 express a high priority, we classified respondents into the eight combinatory typologies (Intrinsic; Instrumental; Relational; Intrinsic & Instrumental; Intrinsic & Relational; Instrumental & Relational; Intrinsic & Relational & Instrument; None).

Results

After the qualitative pretesting as described in the methods section, we refined and validated the scale in three subsequent quantitative steps in a pre-testing with university students, a pilot survey in three European countries, and a final survey send to the general public in five European countries. The aim of these steps was to reduce the number of items by focusing the scale on the best performing items and to validate the final scale for its adequacy to measure the three value

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perspectives. Here, we report on the results of the final validation test. We will only briefly summarize the results from the pretesting and pilot studies (see S3 Text for extensive description of results) before reporting in-depth about the final validation study.

Quantitative Pre-Testing and Pilot Study

Data analysis of the quantitative pretest (n = 94 & n=101; see Table S2) revealed a strong ceiling effect (mean scores above 6.5 on a 7-point scale) for some of the items (Table S2). Given that most of the students were enrolled in nature conservation-related programs, we decided not to adjust the items as mean values might be more moderate within more diverse samples. Both samples performed well within the exploratory factor analysis and the identified factor structures mostly support the theoretically expected three-dimensional structure of the scale. However, in the Danish sample *the instrumental value perspective* is split into two factors. Based on the findings of pretesting and additional theoretical reasoning within the research team, a total of eight items were edited in order to improve their clarity and understandability for respondents (S1 Table).

The pilot study (n= 3 x 150; see Table S4) did not show a strong ceiling effect for any of the items in either sample. Overall, the sample showed statistical adequacy in performing an exploratory factor analysis and the initially retained solution for the complete data set explained 62% of the variation (see Table S6). However, some items, most notably items from the Regulating Benefits subdimension within the instrumental value perspective and the Care subdimension within the relational perspective caused issues with low variability (e.g. 80% of respondents choosing the two highest response options and/or loaded on a factor associated to one of the other value perspectives (S5 Table and S6 Table). The reduction in items resulted in the Regulating Benefits and the Care subdimension no longer had any related items in the scale, and were therefore removed. We then performed an additional exploratory factor analysis for each country separately (S7 Table), which retained 4 factor solutions explaining 64%-69% of the variation (S7 table). Some of the proposed

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factors also indicated an overlap between the instrumental and relational value perspectives. Based on the collective findings and analysis of the quantitative pre-testing and pilot study, we selected 12 of the pilot study items (see items in bold in the Table S7). The grouping of them according to our theoretical model into instrumental, relational, and intrinsic value perspective dimensions indicated good scale reliability (Cronbach alpha>0.70) across all countries (S8 table). See S3 text in the supplementary material for an extensive description of the results. In the hope of increasing the variability in answers, we decided to slightly change the question stem and focus on the priority of value perspectives: "*Listed below are statements on different aspects that could be important when thinking of nature in the future. Please indicate how much of a priority you feel each aspect should have in [your country] in the future*" (S1 Table).

Main Survey

The main survey no longer showed strong ceiling effects (S10 Table). However, multivariate normality was not achieved, therefore a robust estimator was used within the confirmatory factor analysis (CFA). Assessment of measurement invariance across countries showed that while configural and metric invariance was established, the scalar invariance was not. This indicates that the factor structure and factor loadings are similar across countries, while there are differences in item intercepts between countries. This might be caused by the cultural differences in response (e.g., practices).

To make the scale more concise and the number of items balanced across its subdimensions, we decided to reduce the number of items representing immaterial contributions. On the basis of content and theoretical considerations, we decided to remove the item on mental well-being. Doing so results in a similarly good fit of the confirmatory factor analysis (Robust CFI=0.957, Robust TLI=0.942, Robust RMSEA=0.070, SRMR=0.050) and acceptable factor loadings across all countries (Table 1).

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Table 1. Final Value Perspectives of Nature scale. Overview of the final items included in the scale, standardized factor loadings for the hypothesized factor structure in all five samples, including the Cronbach alpha (α) and Average Variance Extracted (AVE) as measures of scale reliability and validity.

Value perspective	**Sweden (n=208)**	**Spain (n=204)**	**Romania (n=207)**	**Poland (n=201)**	**Netherlands (n=208)**
Instrumental	**α = .830 AVE=.543**	**α = .756 AVE=.424**	**α = .644 AVE=.342**	**α = .764 AVE=.412**	**α = .713 AVE=.334**
Nature contributes to economic growth and gives job opportunities	0.64	0.599	0.568	0.517	0.517
Nature offers opportunities to harvest goods, such as wood, berries, mushrooms, or fish	0.713	0.508	0.459	0.474	0.535
Nature offers opportunities for outdoor recreation and sports	0.787	0.709	0.656	0.775	0.544
People can enjoy the beauty of natural areas	0.838	0.816	0.72	0.837	0.781
Relational	**α = .819 AVE=.511**	**α = .770 AVE=.449**	**α = .822 AVE=.544**	**α = .769 AVE=.453**	**α = .797 AVE=.478**
People can find a sense of belonging in nature	0.835	0.71	0.813	0.853	0.815
Nature contributes to people's sense of fulfilment in life	0.848	0.829	0.815	0.829	0.808
Nature provides religious, sacred and spiritual values or experiences	0.559	0.528	0.656	0.42	0.52
People can relate to and feel connected with trees and animals	0.734	0.687	0.755	0.727	0.703
Intrinsic	**α = .841 AVE=.642**	**α = .859 AVE=.668**	**α = .750 AVE=.526**	**α = .774 AVE=.536**	**α = .820 AVE=.602**
Nature is protected regardless of whether this benefits humans or not	0.827	0.78	0.786	0.699	0.781
Our moral responsibility to protect nature is upheld	0.805	0.816	0.75	0.739	0.784
Nature is protected for its own sake	0.765	0.864	0.622	0.759	0.764

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Correlation Instrumental x Relational	0.891	0.773	0.842	0.869	0.85
Correlation Instrumental x Intrinsic	0.626	0.834	0.769	0.885	0.614
Correlation Relational x Intrinsic	0.682	0.639	0.754	0.789	0.716

Concerning scale reliability, the results show acceptable to good internal consistency (Cronbach's alpha > 0.7) for the three value perspectives in all countries, with the exception of *the instrumental value perspective* in Romania (Table 1). In most samples the AVE for *the instrumental and relational value perspectives* lies slightly below the recommended threshold of 0.5 indicating weak convergent validity. We assume this is partly due the fact that the items aim to capture different sub-dimensions within the value perspectives and thus represent related but distinct facets. The confirmatory factor analysis revealed high correlations (r > 0.85) between the factors. Based on follow-up assessment of the Fornell-Larcker criterion, it was confirmed that there seems to be especially a lack of discriminant validity between *instrumental and relational value perspectives.* This led to the decision to create composite scales before assessing the predictive validity of the different value perspectives.

To assess the predictive validity of our scale and of the three underlying value perspectives, we did a linear regression linking the composite scales for each value perspective to four attitudes about nature restoration on the local and national scales that were part of the larger survey. The composite scales showed lower correlations between the three value perspectives (r<0.75), allowing us to include them in the same linear regression models while avoiding issues of multicollinearity (VIF<5 for all models). The linear regression models showed a considerable to high predictive validity of the VPN scale (Table 2) with a higher predictive validity toward attitudes at the country level compared to a more local acceptance of restoration actions.

Table 2. Predictive validity of the final value perspectives scale. Summary of the linear regression models that were analysed for each country using attitude items as dependent variables and the three value perspectives as independent variables.

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	Sweden	Spain	Romania	Poland	Netherlands
Reducing the influence that humans have on nature in the country	F(3,201)=40.23, p<0.001	F(3,199)=17.12, p<0.001	F(3,195)=3.38, p<0.05	F(3,194)=15.33, p<0.001	F(3,198)=19.18, p<0.001
Intrinsic	**0.582*** **	**0.439*** **	0.156	**0.392*** **	**0.348*** **
Relational	-0.051	**0.209** **	0.044	0.064	**0.229** **
Instrumental	0.107	**-0.214* **	0.050	0.007	-0.079
R2	**0.366**	**0.193**	**0.035**	**0.179**	**0.213**
Reducing the influence that humans have on nature in the area	F(3,201)=7.69, p<0.001	F(3,199)=5.85, p<0.001	F(3,195)=2.63, p=0.05	F(3,194)=11.47, p<0.001	F(3,198)=11.40, p<0.001
Intrinsic	**0.284*** **	**0.261** **	0.062	**0.243** **	**0.235** **
Relational	0.136	**0.190* **	0.108	**0.283** **	**0.263** **
Instrumental	-0.105	**-0.236* **	0.055	-0.142	-0.211**
R2	**0.090**	**0.067**	**0.024**	**0.138**	**0.134**
Restoring natural processes and dynamics in the country	F(3,201)=33.12, p<0.001	F(3,199)=20.42, p<0.001	F(3,195)=3.35, p<0.05	F(3,194)=27.67, p<0.001	F(3,198)=22.79, p<0.001
Intrinsic	**0.557*** **	**0.414*** **	0.076	**0.429*** **	**0.383*** **
Relational	-0.024	0.071	0.045	0.143	**0.173* **
Instrumental	0.059	0.045	0.132	0.029	0.013
R2	**0.321**	**0.224**	**0.034**	**0.289**	**0.245**
Restoring natural processes and dynamics in the area	F(3,201)=16.75, p<0.001	F(3,199)=13.10, p<0.001	F(3,195)=6.17, p<0.001	F(3,194)=15.33, p<0.001	F(3,198)=14.58, p<0.001
Intrinsic	**0.434*** **	**0.237** **	0.076	**0.372*** **	**0.446*** **
Relational	-0.077	**0.234** **	0.102	0.074	0.015
Instrumental	0.100	-0.005	0.186	0.025	-0.094
R2	**0.188**	**0.152**	**0.073**	**0.179**	**0.168**

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The values shown are the standardized regression coefficients (β) and model fit statistics (F statistics with degrees of freedom, adjusted R^2. Significance Levels: *p < 0.05, **p < 0.01, ***p < 0.001).

Final scale and value perspective typology

The final scale and the weighted data set indicate in general a high importance (mean values > 4.5) of the three value perspectives in all included countries (Table 3). In Spain and the Netherlands, the intrinsic value perspective has the highest mean value, while in Sweden and Romania the instrumental value perspective is prioritized the most. Across all countries, the lowest mean value is given to the relational value perspective.

Table 3. Mean values on each of the value perspectives in all countries.

	Sweden	Spain	Romania	Poland	Netherlands	TOTAL
Mean values						
Intrinsic	5.72	**6.25**	6.06	**5.96**	**5.70**	**5.93**
Instrumental	**5.77**	5.81	**6.27**	**5.96**	5.18	5.80
Relational	5.07	4.86	5.86	5.32	4.77	5.17

Figure 4 illustrates the large overlap of the different value perspectives, showing that the majority of residents in all countries prioritize more than one value perspective. There are considerable differences in the prominence of the different types across the included countries (Fig. 4, S12 Table). For example, while 8% of the public in Sweden prioritizes solely instrumental value perspectives, this type is completely missing in Spain. Plotting the value perspectives typology (collectively for all samples) against the four attitude items reaffirms the predictive validity of the scale, showing considerable differences among the typologies (Fig. 4). Those expressing *neither* of the value perspectives consistently show the lowest support for restoration actions, followed by those

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prioritizing instrumental value perspectives. People prioritising intrinsic or all value perspectives show the highest support (Fig. 4).

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Fig. 4. Value perspective typology, the subdimensions of the value perspectives, and its relevance to restoration attitudes. *Persons indicate the prominence of the different value perspective types across the five countries, whereby one person represents 2% of the total population. The red persons outside the circles are those that were classified as 'no', meaning that they do not express high priority for any of the three value perspectives. (Note that due to the small number of participants falling purely within the relational value perspective, this type was not plotted for the attitude scales)*

Discussion

Scale Validity

The presented scale, the Value Preference for Nature (VPN) scale, is a new psychometric scale to measure people's value perspectives of nature in the future, differentiating between relational, intrinsic, and instrumental value perspectives. VPN is inspired by and related to the IPBES Nature-Futures Framework scenarios for "nature-positive futures" (Pereira et al., 2020), but also by the broader human-nature relation literature. Cross-national validation studies in five countries (N=1000) show that the internal consistency and reliability of the scale are moderate to high. The predictive validity of VPN is considerable to high when tested in a restoration setting, ranging up to 37% explained variance for the Swedish subsample. Especially the intrinsic value perspective has strong predictive value vis-à-vis attitudes towards ecological restoration. These results confirm the validity and practical value of the scale to be used in different national and cultural contexts in Europe.

The VPN is the first cross-nationally validated scale that captures relational, intrinsic, and instrumental value perspective simultaneously. The scale recognises several things: the plurality of values in society; that individuals can hold several values at the same time; and that values may be prioritized differently between people within and between cultures, leading to potential differences in nature-related preferences, attitudes, and behaviours as reflected in decision-making. Our results show that the majority of people in all countries assign a moderate to high priority (values above 4.5 on a 7-point scale) to all three value perspectives (Table 3), confirming recent calls to recognise not only instrumental and intrinsic values but also relational nature values (Andersen et al., 2022; Chan et al., 2016). Meanwhile, compared to the instrumental and intrinsic value perspective, support for the relational value perspective was on average lower in all countries, most notably for the item on the religious, sacred, and spiritual values of nature. The mean priorities for the value perspectives differ

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between countries. In Sweden and Romania, the instrumental value perspective receives the highest societal support, in Spain and the Netherlands, the intrinsic value perspective is given a higher priority (Table 3).

Scale development challenges

Instrumental and intrinsic values are well delineated in literature, whereas the conceptual debate on relational values, and its relationship to the two other values, is ongoing. This conceptual unclarity was reflected in the process of conceptualising and operationalising relational values for our scale. For example, only after a thorough review of the literature and internal discussions, we conceptualized the spiritual component of nature as a relational value and the beauty of nature as an instrumental value. Confirmatory factor analysis confirmed these decisions, although at the national level, the items sometimes also scored from other value perspectives. Furthermore, the care dimension consistently loaded on the intrinsic value perspective, leading to the decision not to include this subdimension in the VPN.

Difficulties to delineate the relational value perspective with the instrumental value perspective was a persisting issue from the initial pre-testing to the final scale. Meanwhile, the weak discriminant validity across all countries confirmed the existence of fuzzy boundaries between, especially, the relational and instrumental value perspectives. For example, in several countries, the item on berry picking as instrumental value perspective also scored high on the relational value perspective. Also items reflecting nonmaterial Contributions to People -or cultural ecosystems in ESS terminology - showed combined loadings on the relational and instrumental value perspective factor. Consequently, approaches to operationalise instrumental values through the concept of ecosystem services might need to be reconsidered in light of the more recent debate on relational values (e.g. Plieninger et al., 2013). In general, as highlighted by relational value literature, Natures Contributions to People, or ecosystem services should not be considered one-directional contributions, but multi-directional and

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emerging relationships between humans and nonhuman nature, where the relationship itself holds value and contributes to nature and people alike (Himes et al., 2024; West et al., 2018).

More generally, overlap and fuzzy boundaries raise the question of whether it would be better to use three independent scales for capturing intrinsic, instrumental, and relational value perspectives, reflecting perennial discussions within scale development (Gardner et al., 1998), including the predictive validity (Diamantopoulos et al., 2012). Obviously, developing our scale consisting of three subdimensions to capture the three value perspectives means compressing meaning, reducing complexity, and risking validity. Although the reduction of complexity in this scale may not fit the potential use for in-depth analysis of individual value perspectives, its feasibility should be seen in relation to practical use. In relation to Schwartz's 56-item measure of the structure and content of human values, Stern et al. (1998) argue in their seminal paper that a brief 'inventory' of values is more suitable for use in survey research, as the longer instrument could simply be impractical (not least in relation to challenges of survey fatigue (Jeong et al., 2023).

Two potential limitations of VPN should be discussed. First, one could ask whether it is possible to measure value perspectives without explicit reference to specific places. However, we believe that with the formulation set out in the questionnaire ("…considering nature *in your country*…"), does stimulate respondents to link the value perspectives to a spatial context – the national. That people care about nature at a national level is shown in multiple contexts (Bakhtiari et al., 2018), and hence we would also expect value perspectives to be relevant here. Further, values are generally considered to be consistent over time and conditions (cf. the introduction), and we would expect the same with value perspectives. Finally, the cognitive interviews during semantic validation suggested people were quite able and willing to reflect on items related to, e.g. recreation, spirituality and kinship without reference to specific, well-defined *places*. Here, our proposed scale may be situated in-between existing traditions, ranging from the usually highly contextualized sense-of-place literature (but see

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Raymond et al., 2023 for more fluid approaches to senses of place; Williams & Vaske, 2003), to generic approaches trying to gauge overall connection to, concern for or affinity to nature (e.g. Dunlap et al., 2000; Mayer & Frantz, 2004). Meanwhile, scholars who want to focus on perspectives of local or regional nature projects can do so by slightly adapting the stem of the scale (e.g. '...considering nature in your region').

Second, one can ask what the respondents will perceive in terms of 'future nature' - how far into the future will that be? This did not arise as a matter of ambiguity or concern during the scale validation process. Again, as time spans differ in terms of changes in nature (e.g., a forest can take more than 100 years to fully grow up, whilst changes in meadows or moors can be considerable after maybe ten or twenty years), putting on a certain time length could again act as too much of a restriction. Obviously, it will still open the question of what period respondents had in mind when answering the survey, and if a specific time length is in question, it may be useful to specify it and use the scale in such a context.

Scale Implications and Usage

The focus of our study was on validating the VPN, not on measuring the relative support for each of the value perspectives in the five countries. However, results do suggest that not only instrumental and intrinsic but also relational value perspectives are recognized by the general public. Recognising multiple value perspectives is argued in the literature to offer powerful pathways to reconnect people to their natural environment (Beery et al., 2023; Richardson et al., 2020). One particular aspect of VPN is the focus on change – leading to distinct futures. This characteristic is embedded in other fields, such as environmental valuation, where respondents are asked to value a change in a policy leading to a new environmental outcome (Johnston et al., 2017). We see VPN as a tool that can help to take stock of the current value perspectives that societies have regarding the future development

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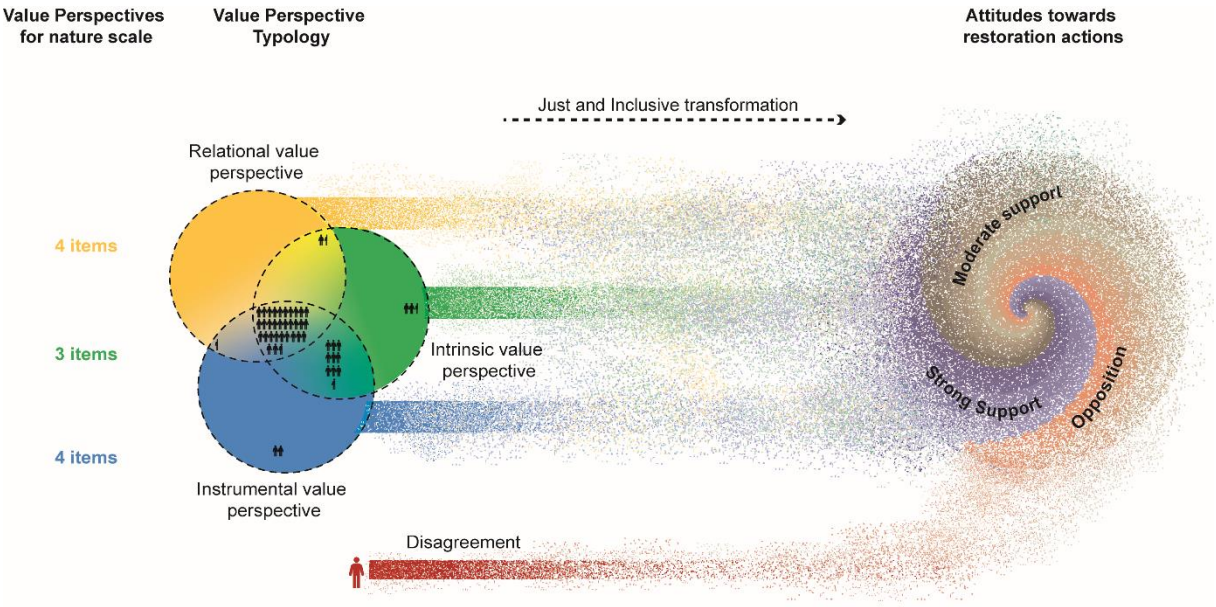
of nature, and as a monitoring tool to observe potential shift in societal value perspectives over time (Fig. 5).

Fig. 5: The Value Perspectives of Nature scale and relationships to attitudes toward restoration actions



Studies and scenario-building efforts, for example, using the Nature-Future Framework, may benefit from the scale suggested here. The significant predictive validity of our scale on nature restoration attitudes suggests its usefulness to understand people's attitudes on specific conservation or restoration issues. Using the VPN in surveys when the numbers of stakeholders may be too high or trust may be low -e.g., from marginalized groups- may add an additional layer in participatory processes and contribute to more inclusive and just transformation process.

We have shown that VPN works in different cultural settings, all within Europe. Testing the usefulness of the scale in different cultures and beyond Europe will be interesting. As the scale is heavily inspired by the NFF, which is cross-continental in its development, we expect that it may prove useful, but likely with different weights on the perspectives. Likewise, as VPN is just developed, it remains to be seen whether value perspectives remain stable over time (as values are in general perceived to do) or

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change as both society and the state of natural environment changes. These usages should be examined in future research.

Conclusions

Our aspiration for this research was to develop a tool to quantify plural value perspectives of future nature from a transformative angle. Engaging with this diversity of perspectives in an integrated manner allows for better understanding of the relative dominance of value perspectives across regions, cultures, countries, or stakeholder groups. We hope the Value Perspectives of Nature (VPN) scale can facilitate dialogue on effective and just transformative change in nature, through sensitising change efforts to the plural values of diverse communities, and to monitor the diversity of visions for natures over time. This may inform policies on smaller or larger geographical scales, ranging from regional ecological restoration projects to European or UN policies.

Furthermore, a society in transformation signals (and may require) changes in how people and societies relate to non-human nature. Understanding such changes in mind-sets, considering concerns from critical groups in society, and including a wide variety of visions will help navigating towards positive nature futures. Efforts for just and inclusive transformation require alignment of restoration measures and policies to the demands and preferences in society and among policy makers, planners, and managers to sustain momentum and support for implementation.

Authors' contributions

Arjen Buijs and Christian Gamborg conceived the ideas and designed methodology; Arjen Buijs, Angus Smits, Christian Gamborg, and Tim de Kruiff collected the data; Sabrina Dressel analysed the data; Arjen Buijs, Sabrina Dressel, Christian Gamborg, and Jette Jacobsen led the writing of the manuscript; All authors critically contributed to the drafts and gave final approval for publication.

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Ethical approval

Research has been done according to ethical standards for human subject research, including formal approval of the study by the appropriate institutional ethics commission. Ethics committee: WUR Research Ethics Commission for review of nonmedical studies with human subjects (WUR-REC) APPROVAL NUMBER: 2024-112 FORM OF CONSENT: written consent.

Conflict of Interest

The authors have no conflict of interest to declare.

Data availability statement

We intend to archive our data in the Data Station for Social Sciences and Humanities (DANS) upon acceptance.

References

Andersen, G., Fløttum, K., Carbou, G., & Gjesdal, A. M. (2022). People's Conceptions and Valuations of Nature in the Context of Climate Change [Article]. *Environmental Values*, *31*(4), 397-420. https://doi.org/10.3197/096327121X16328186623850

Anderson, C. B., Athayde, S., Raymond, C.M., . . . and González-Jiménez, D. . (2022). Chapter 2: Conceptualizing the diverse values of nature and their contributions to people. In P. Balvanera, Pascual, U., Christie, M., Baptiste, B., and González-Jiménez, D. (Ed.), *Methodological Assessment Report on the Diverse Values and Valuation of Nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.* . IPBES secretariat. https://doi.org/10.5281/zenodo.6493134

Arias-Arévalo, P., Martín-López, B., & Gómez-Baggethun, E. (2017). Exploring intrinsic, instrumental, and relational values for sustainable management of social-ecological systems [Article]. *Ecology and Society*, *22*(4), Article 43. https://doi.org/10.5751/ES-09812-220443

Bakhtiari, F., Jacobsen, J. B., Thorsen, B. J., Lundhede, T. H., Strange, N., & Boman, M. (2018). Disentangling Distance and Country Effects on the Value of Conservation across National Borders. *Ecological Economics*, *147*, 11-20. https://doi.org/https://doi.org/10.1016/j.ecolecon.2017.12.019

NOT PEER-REVIEWED

Beery, T., Stahl Olafsson, A., Gentin, S., . . . & M. Raymond, C. (2023). Disconnection from nature: Expanding our understanding of human–nature relations. *People and Nature*, *5*(2), 470-488. https://doi.org/10.1002/pan3.10451

Bennett, N. J., Blythe, J., Cisneros-Montemayor, A. M., Singh, G. G., & Sumaila, U. R. (2019). Just transformations to sustainability [Review]. *Sustainability (Switzerland)*, *11*(14), Article 3881. https://doi.org/10.3390/su11143881

Boateng, G. O., Neilands, T. B., Frongillo, E. A., Melgar-Quiñonez, H. R., & Young, S. L. (2018). Best Practices for Developing and Validating Scales for Health, Social, and Behavioral Research: A Primer [Review]. *Frontiers in Public Health*, *6*. https://doi.org/10.3389/fpubh.2018.00149

Brown, T. C. (1984). The concept of value in resource allocation. *Land Economics*, *60*(3), 231-246. https://doi.org/10.2307/3146184

Buijs, A. E. (2009). Lay people's images of nature: frameworks of values, beliefs and value orientations. *Society and Natural Resources*, *22*(5), 417-432.

Buijs, A. E., Elands, B. H. M., & Langers, F. (2009). No wilderness for immigrants: Cultural differences in images of nature and landscape preferences. *Landscape and Urban Planning*, *91*(3), 113-123. https://doi.org/10.1016/j.landurbplan.2008.12.003

Chan, K. M. A., Balvanera, P., Benessaiah, K., . . . & Turner, N. (2016). Why protect nature? Rethinking values and the environment. *Proceedings of the National Academy of Sciences of the United States of America*, *113*(6), 1462-1465. https://doi.org/10.1073/pnas.1525002113

Chan, K. M. A., Gould, R. K., & Pascual, U. (2018). Editorial overview: Relational values: what are they, and what's the fuss about? *Current Opinion in Environmental Sustainability*, *35*, A1-A7. https://doi.org/10.1016/j.cosust.2018.11.003

Cruz, S. M., & Manata, B. (2020). Measurement of Environmental Concern: A Review and Analysis. *Frontiers in Psychology*, *11*, 363 , pmid = 32210883. https://doi.org/10.3389/fpsyg.2020.00363

Diamantopoulos, A., Sarstedt, M., Fuchs, C., Wilczynski, P., & Kaiser, S. (2012). Guidelines for choosing between multi-item and single-item scales for construct measurement: a predictive validity perspective. *Journal of the Academy of Marketing Science*, *40*, 434-449.

Diaz, S., Pascual, U., Stenseke, M., Martin-Lopez, B., . . . Shirayama, Y. (2018). Assessing nature's contributions to people. *Science*, *359*(6373), 270-272. https://doi.org/10.1126/science.aap8826

Dunlap, R. E., Van Liere, K. D., Mertig, A. G., & Jones, R. E. (2000). Measuring endorsement of the new ecological paradigm: A revised NEP scale. *The Journal of social issues*, *56*(3), 425-442. http://sfx.library.wur.nl:9003/sfx_local?sid=SP%3APSYI;id=pmid%3A;id=doi%3A10.1111%2F0022-4537.00176;issn=0022-4537;isbn=;volume=56;issue=3;spage=425;pages=425-442;date=2000;title=Journal%20of%20Social%20Issues;atitle=Measuring%20endorsement%20of%20the%20new%20ecological%20paradigm%3A%20A%20revised%20NEP%20scale.;aulast=Dunlap;pid=%3CAN%3E2001-14019-004%3C%2FAN%3E%3CAU%3EDunlap%2C%20Riley%20E%3BVan%20Liere%2C%20Kent%20D%3BMertig%2C%20Angela%20G%3BEmmet%20Jones%2C%20Robert%3C%2FAU%3E%3CDT%3EJournal%3BPeer%20Reviewed%20Journal%3BEmpirical%20Study%3C%2FDT%3E

Feucht, V., Dierkes, P. W., & Kleespies, M. W. (2023). The different values of nature: a comparison between university students' perceptions of nature's instrumental, intrinsic and relational values. *Sustainability Science*, *18*(5), 2391-2403. https://doi.org/10.1007/s11625-023-01371-8

Gardner, D. G., Cummings, L. L., Dunham, R. B., & Pierce, J. L. (1998). Single-item versus multiple-item measurement scales: An empirical comparison. *Educational and psychological measurement*, *58*(6), 898-915.

Gould, R. K., Himes, A., Anderson, L. M., Arias Arévalo, P., Chapman, M., Lenzi, D., Muraca, B., & Tadaki, M. (2024). Building on Spash's critiques of monetary valuation to suggest ways forward for relational values research. *Environmental Values*, *33*(2), 139-162.

NOT PEER-REVIEWED

Hair, J. F., Gabriel, M. L. D. S., da Silva, D., & Braga Junior, S. (2019). Development and validation of attitudes measurement scales: fundamental and practical aspects. *RAUSP Management Journal*, *54*(4), 490-507. https://doi.org/10.1108/RAUSP-05-2019-0098

Himes, A., & Muraca, B. (2018). Relational values: the key to pluralistic valuation of ecosystem services. *Current Opinion in Environmental Sustainability*, *35*, 1-7. https://doi.org/10.1016/j.cosust.2018.09.005

Himes, A., Muraca, B., Anderson, C. B., Athayde, S., . . . & Zent, E. (2024). Why nature matters: A systematic review of intrinsic, instrumental, and relational values. *BioScience*, *74*(1), 25-43. https://doi.org/10.1093/biosci/biad109

Hourdequin, M. (2024). *Environmental ethics: From theory to practice*. Bloomsbury Publishing.

Hughes, A. C., & Grumbine, R. E. (2023). The Kunming-Montreal Global Biodiversity Framework: what it does and does not do, and how to improve it. *Frontiers in Environmental Science*, *11*. https://doi.org/10.3389/fenvs.2023.1281536

Jeong, D., Aggarwal, S., Robinson, J., Kumar, N., Spearot, A., & Park, D. S. (2023). Exhaustive or exhausting? Evidence on respondent fatigue in long surveys [Article]. *Journal of Development Economics*, *161*, Article 102992. https://doi.org/10.1016/j.jdeveco.2022.102992

Johnston, R. J., Boyle, K. J., Vic Adamowicz, W., . . . & Vossler, C. A. (2017). Contemporary guidance for stated preference studies [Article]. *Journal of the Association of Environmental and Resource Economists*, *4*(2), 319-405. https://doi.org/10.1086/691697

Kempton, W., Boster, J. S., & Hartley, J. A. (1995). *Environmental Values in American Culture*. MIT Press.

Kenter, J. O., Raymond, C. M., van Riper, C. J., . . . Thankappan, S. (2019). Loving the mess: navigating diversity and conflict in social values for sustainability. *Sustainability Science*, *14*(5), 1439-1461. https://doi.org/http://dx.doi.org/10.1007/s11625-019-00726-4

Kim, H., Peterson, G. D., Cheung, W. W. L., . . . Pereira, H. M. (2023). Towards a better future for biodiversity and people: Modelling Nature Futures. *Global Environmental Change*, *82*. https://doi.org/10.1016/j.gloenvcha.2023.102681

Klain, S. C., Olmsted, P., Chan, K. M. A., & Satterfield, T. (2017). Relational values resonate broadly and differently than intrinsic or instrumental values, or the New Ecological Paradigm. *PLoS ONE*, *12*(8), e0183962. https://doi.org/10.1371/journal.pone.0183962

Kloek, M. E., Buijs, A. E., Boersema, J. J., & Schouten, M. G. C. (2017). Beyond Ethnic Stereotypes – Identities and Outdoor Recreation Among Immigrants and Nonimmigrants in the Netherlands. *Leisure Sciences*, *39*(1), 59-78. https://doi.org/10.1080/01490400.2016.1151843

Kuhn, R. G., & Jackson, E. L. (1989). Stability of factor structures in the measurement of public environmental attitudes. *The Journal of Environmental Education*, *20*(3), 27-32.

Kuiper, J. J., van Wijk, D., Mooij, W. M., Remme, R. P., Peterson, G. D., Karlsson-Vinkhuyzen, S., Mooij, C. J., Leltz, G. M., & Pereira, L. M. (2022). Exploring desirable nature futures for Nationaal Park Hollandse Duinen. *Ecosystems and People*, *18*(1), 329-347. https://doi.org/10.1080/26395916.2022.2065360

Lockwood, M. (1999). Humans Valuing Nature: Synthesising Insights from Philosophy, Psychology and Economics. *Environmental Values*, *8*(3), 381. http://www.swetswise.com/link/access?db?issn=0963-2719&vol=00008&iss=00003&year=1999&page=381&ft=1

Luque-Lora, R. (2023). The Trouble with Relational Values. *Environmental Values*, *32*(4), 411-431. https://doi.org/10.3197/096327122x16611552268681

Mansur, A. V., McDonald, R. I., Güneralp, B., . . . & Pereira, H. M. (2022). Nature futures for the urban century: Integrating multiple values into urban management [Article]. *Environmental Science and Policy*, *131*, 46-56. https://doi.org/10.1016/j.envsci.2022.01.013

Mayer, F. S., & Frantz, C. M. (2004). The connectedness to nature scale: A measure of individuals' feeling in community with nature. *Journal of Environmental Psychology*, *24*(4), 503-515. https://doi.org/10.1016/j.jenvp.2004.10.001

NOT PEER-REVIEWED

Muraca, B. (2011). The map of moral significance: A new axiological matrix for environmental ethics. *Environmental Values*, *20*(3), 375-396.

Norton, B., & Sanbeg, D. (2021). Relational values: a unifying idea in environmental ethics and evaluation? *Environmental Values*, *30*(6), 695-714.

O'Neill, J. (1992). The varieties of intrinsic value. *The Monist*, *75*(2), 119-137.

Palacios-Abrantes, J., Badhe, R., Bamford, A., . . . & Pereira, L. M. (2022). Managing biodiversity in the Anthropocene: discussing the Nature Futures Framework as a tool for adaptive decision-making for nature under climate change [Article]. *Sustainability Science*. https://doi.org/10.1007/s11625-022-01200-4

Palmer, C. (2013). Contested frameworks in environmental ethics. *Linking Ecology and Ethics for a Changing World: Values, Philosophy, and Action*, 191-206.

Partelow, S. (2018). A review of the social-ecological systems framework. *Ecology and Society*, *23*(4). https://www.jstor.org/stable/26796887

Pascual, U., Balvanera, P., Anderson, C. B., . . . Zent, E. (2023). Diverse values of nature for sustainability. *Nature*. https://doi.org/10.1038/s41586-023-06406-9

Pascual, U., Balvanera, P., Díaz, S., . . . Yagi, N. (2017). Valuing nature's contributions to people: the IPBES approach. *Current Opinion in Environmental Sustainability*, *26-27*, 7-16. https://doi.org/10.1016/j.cosust.2016.12.006

Patterson, J., Schulz, K., Vervoort, J., van der Hel, S., Widerberg, O., Adler, C., Hurlbert, M., Anderton, K., Sethi, M., & Barau, A. (2017). Exploring the governance and politics of transformations towards sustainability. *Environmental Innovation and Societal Transitions*, *24*, 1-16. https://doi.org/10.1016/J.EIST.2016.09.001

Pereira, L. M., Davies, K. K., den Belder, E., . . . Lundquist, C. J. (2020). Developing multiscale and integrative nature–people scenarios using the Nature Futures Framework. *People and Nature*, *2*(4), 1172-1195. https://doi.org/https://doi.org/10.1002/pan3.10146

Perino, A., Pereira, H. M., Felipe-Lucia, M., . . . Bonn, A. (2022). Biodiversity post-2020: Closing the gap between global targets and national-level implementation [Article]. *Conservation Letters*, *15*(2), Article e12848. https://doi.org/10.1111/conl.12848

Plieninger, T., Dijks, S., Oteros-Rozas, E., & Bieling, C. (2013). Assessing, mapping, and quantifying cultural ecosystem services at community level. *Land Use Policy*, *33*, 118-129. https://doi.org/10.1016/j.landusepol.2012.12.013

Pratson, D. F., Adams, N., & Gould, R. K. (2023). Relational values of nature in empirical research: A systematic review. *People and Nature*, *5*(5), 1464-1479. https://doi.org/10.1002/pan3.10512

Quintero-Uribe, L. C., Navarro, L. M., Pereira, H. M., & Fernández, N. (2022). Participatory scenarios for restoring European landscapes show a plurality of nature values [Review]. *Ecography*, *2022*(4), Article e06292. https://doi.org/10.1111/ecog.06292

Raymond, C. M., Stedman, R., & Frantzeskaki, N. (2023). The role of nature-based solutions and senses of place in enabling just city transitions. *Environmental Science & Policy*, *144*, 10-19. https://doi.org/https://doi.org/10.1016/j.envsci.2023.02.021

Richardson, M., Dobson, J., Abson, D. J., Lumber, R., Hunt, A., Young, R., & Moorhouse, B. (2020). Applying the pathways to nature connectedness at a societal scale: a leverage points perspective. *Ecosystems and People*, *16*(1), 387-401. https://doi.org/10.1080/26395916.2020.1844296

Schultz, P. W. (2001). The structure of environmental concern: Concern for self, other people, and the biosphere. *Journal of Environmental Psychology*, *21*(4), 327-339. http://sfx.library.wur.nl:9003/sfx_local?sid=SP%3APSYI;id=pmid%3A;id=doi%3A10.1006%2Fjevp.2001.0227;issn=0272-4944;isbn=;volume=21;issue=4;spage=327;pages=327-339;date=2001;title=Journal%20of%20Environmental%20Psychology;atitle=The%20structure%20of%20environmental%20concern%3A%20Concern%20for%20self%2C%20other%20people%2C%20and%20the%20biosphere.;aulast=Schultz;pid=%3CAN%3E2002-10149-001%3C%2FAN%3E%3CAU%3ESchultz%2C%20P.%20Wesley%3C%2FAU%3E%3CDT%3EJournal%3BPeer%20Reviewed%20Journal%3BEmpirical%20Study%3C%2FDT%3E

NOT PEER-REVIEWED

Schwartz, S. H. (1994). Are There Universal Aspects in the Structure and Contents of Human Values? [Article]. *Journal of Social Issues*, *50*(4), 19-45. https://doi.org/10.1111/j.1540-4560.1994.tb01196.x

Spash, C. L. (2020). A tale of three paradigms: Realising the revolutionary potential of ecological economics. *Ecological Economics*, *169*, 106518.

Stern, P. C., Dietz, T., & Guagnano, G. Y. (1998). A brief inventory of values. *Educational and psychological measurement*, *58*(6), 984-1001. http://sfx.library.wur.nl:9003/sfx_local?sid=Elsevier%3AScopus;genre=article;issn=00131644;volume=58;issue=6;spage=984;epage=1001;pages=984-1001;date=1998;title=Educational%20and%20Psychological%20Measurement;atitle=A%20brief%20inventory%20of%20values;aufirst=P.C.;auinit=P.C.;auinit1=P;aulast=Stern;artnum=;_service_type=getFullTxt

West, S., Haider, L. J., Masterson, V., Enqvist, J. P., Svedin, U., & Tengö, M. (2018). Stewardship, care and relational values [Review]. *Current Opinion in Environmental Sustainability*, *35*, 30-38. https://doi.org/10.1016/j.cosust.2018.10.008

Williams, D. R., & Vaske, J. J. (2003). The Measurement of Place Attachment: Validity and Generalizability of a Psychometric Approach. *Forest Science*, *49*(6), 830-840. http://www.scopus.com/scopus/inward/record.url?eid=2-s2.0-0347380937&partnerID=40&rel=R7.0.0

Winter, C., & Lockwood, M. (2004). The natural area value scale: A new instrument for measuring natural area values. *Australasian Journal of Environmental Management*, *11*(1), 11-20.

NOT PEER-REVIEWED