Evidence for increasing public support for nature conservation: A 15-year longitudinal analysis of nature conservation attitudes in the Netherlands

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ABSTRACT

Transformative change to address the root causes of biodiversity loss critically depends on public support for social, cultural, economic and political change. The general public plays a central role in this process as it influences consumer demand, voting behavior, and stewardship actions. Based on a unique time series of representative quantitative surveys conducted over 15 years (2006–2021; $N = 7037$), this paper reports on the longitudinal development of attitudes towards nature conservation of the general public in the Netherlands. Analysis shows that public support for nature conservation and for national conservation policies is generally high and rising. Meanwhile, we find an "attitude-priority gap", where pro-conservation attitudes do not result in prioritizing conservation over other policy issues, such as health care or unemployment. In addition, images of nature change, with increasing support for wilderness-oriented conservation over more managed nature. Cluster analysis identified four distinct groups in society. Groups with strong pro-conservation attitudes show significant more pro-conservation behaviors, including green consumerism, stewardship volunteering and activism. The least supportive group especially criticizes the expansion of natural areas as well as the strict protection of rare and endangered species, because they feel this may limit economic development. While critical voices in society need to be recognized, the generally high public support reported in this paper can also be of benefit to conservationists, policymakers and NGOs in the framing of their ambitions to revers biodiversity loss and taking into account attitudes and perceptions of all relevant stakeholders in society.

1. Introduction

1.1. Nature conservation and public attitudes

Transformative change – 'fundamental, system-wide reorganization across technological, economic and social factors, including paradigms, goals and values' (IPBES, 2024; p3)– is needed to bend the current global trend of biodiversity loss. In democratic societies, transformative change critically depends on public support and social acceptance of these changes. Citizens—whether as individual consumers, political voters, or active conservationists—are increasingly recognized as crucial actors in the transformative shifts needed for just and sustainable futures (IPBES, 2024). The IPBES Global Assessment Report also stresses the need to identify the unleashing of nature-positive values and attitudes as a crucial leverage point for transformations (IPBES, 2019). Furthermore, recent literature on plural values of nature argues for the need to increase our understanding of how people relate to nature and how they value nature (Pascual et al., 2023). Indeed, the European Green Deal and the EU Biodiversity Strategy for 2030 emphasize the need to understand and improve people's awareness and citizen engagement, and also

develop targeted strategies to strengthen public support for biodiversity conservation (European Commission, 2020). Consequently, NGOs and governments have developed public awareness initiatives to overcome potential disconnects to nature and understand or mitigate conservation-critical attitudes among the general public (Kidd et al., 2019; Richardson et al., 2020). These strategies are seen as foundational to developing sustainable practices and solutions for biodiversity conservation (Ives et al., 2018).

One way to explore the connection between people and nature is through the concept of attitudes. Attitudes, i.e., an individual's overall evaluation of people, objects, and things (Huajian, 2024), shape behavior. Conservation-related attitudes have been shown to influence both pro-conservation and conservation-critical behavior (Baynham-Herd et al., 2018; Ganzevoort and van den Born, 2020). Pro-conservation attitudes inspire individual pro-conservation behaviors, from unpaving the garden to buying organic products (Steg, 2016), as well as collective action, for example through place-based stewardship actions (Ganzevoort and van den Born, 2020). Furthermore, pro-conservation attitudes among the general public are potential drivers of nature conservation policies. Finally, the use of natural areas as a

resource for relaxation and health can ignite public demands for accessible natural areas or stimulate resistance against potential threats to these areas (Soga and Gaston, 2016). Meanwhile, attitudes are also socially constructed and politically framed (Buijs et al., 2014). For example, a suggested lack of public support for conservation has shaped recent European biodiversity policies, with some policymakers referring to this to oppose strict protection. Also in local and regional decision making, conservation-critical attitudes have fueled local protests against increased biodiversity or wildlife protection (Zimmermann et al., 2020).

Despite the relevance of public support for national and supranational conservation policies, many studies on people's attitudes have focused at the local and regional level. Reviews of scientific and grey literature in Europe conducted by the authors show the critical lack of longitudinal or meta-studies on public attitudes towards nature conservation. Existing studies on the national level have predominantly focused on nature connectedness and nature experiences, especially from the perspective of outdoor recreation or on longitudinal developments in policy discourses about the importance of public attitudes and engagement (Stein and Sanusi-Teichgräber, 2023; Stewart and Eccleston, 2024). Only four studies have repeated questions on one or two conservation-related attitudes. The Eurobarometer survey, administered by the European Union in 2010, 2015 and 2018, included a limited number of attitude items on biodiversity protection, showing high and stable public support over time for biodiversity protection among the European population: 96–97 % sees 'our responsibility to care for nature as a moral obligation" (Eurobarometer, 2019). Meanwhile, only a minority agrees that "economic developments in protected areas should be prohibited" (45–46 %; Ibid.). The Scottish Nature Omnibus (Granville, 2020), administered biannually between 2009 and 2019, suggests a small increase in concern for biodiversity loss among the Scottish population, based on only one single attitude question. Finally, a nature awareness study from Germany, conducted biannually from 2009 onward, also included some attitude questions (Stein and Sanusi-Teichgräber, 2023). Unfortunately, longitudinal analysis in this study is not possible due to continuous changes in indicators, except for one item on the willingness to contribute personally to biodiversity protection, which rose between 2009 and 2019 from 50 % to 63 % of the respondents, but then dropped in 2021 to 53 % (Ibid., p. 79). None of these studies included statistical analyses to investigate relationships between experiences in nature, attitudes towards conservation, or conservation behaviors.

This overview of existing studies shows that our understanding of attitudes on national levels, as well as an overview of developments over time is critically lacking. While the study focuses on the Netherlands, its results may be of relevance to the European context as well. The Netherlands used to be at the forefront of conservation policies and discourses, being one of the inspirational countries for both ecological restoration approaches as well as the ecological networks approach, culminating in the European Naturo-2000 network (Beunen and Barba Lata, 2021). More recently, the Netherlands was also one of the first countries showcasing the rise of critical discourses and protests against nature conservation policies, where interests and discourses from farmers and other interest groups were mobilised politically, halting and reversing existing conservation programs.

Based on longitudinal data from the Netherlands, collected between 2006 and 2021, this study aims to fill the empirical gap in our understanding of longitudinal developments in conservation attitudes. The following research questions have guided the research:

1. What are the attitudes towards nature conservation and nature conservation policy among the Dutch populations?
2. How have these attitudes changed over time?
3. How do these attitudes relate to the availability and use of nature areas and conservation behavior?

2. Methodology

2.1. Research approach

Data for the analyses in this study was drawn from a larger project on public support for nature and nature policy and public engagement with nature. This is a longitudinal research project that started in 1996, and that is carried out by Wageningen Environmental Research (WEnR), commissioned by the Netherlands Environmental Assessment Agency (PBL) until the present day. Data was collected from representative panels from commercial survey agencies approximately every five years and every time reported in policy reports in Dutch (authors removed for anonymity; 1997, 2001, 2007, 2014, 2018, 2022).

While these studies aimed for longitudinal comparisons, some adaptations occurred in response to emerging insights, changes in social context, and advancements in the field. As a result, our analysis is limited to those questions that were consistent across the surveys to ensure comparability. Consequently, we focused our longitudinal analysis on the surveys administered in 2006, 2013, 2017 and 2021 (the wording of the items can be found in Table 3). As different groups of respondents are included in each survey, this project employs a cross-sectional design for the analysis of continuity and change. Results should be treated with some care, as changes over time may also be related to cross-sectional nature of the data. Meanwhile, the large sample size may limit such effects. It is important to note that the surveys were not originally designed with the specific objectives of this paper in mind. This also meant that the conceptual framework developed is based on a combination of theoretical insights and available data. Ethical approval for the study was given by the Wageningen Research Ethics Committee for nonmedical studies involving human subjects (WUR-REC-2024-114). An overview of the number and characteristics of the respondents in each survey is described in Table 1.

2.2. Conceptual model: Understanding public support

Public support for nature conservation is often understood as a combination of stated and active support, with stated support being related to pro-conservation attitudes and perceptions, and active support being related to pro-conservation behaviors (McGinlay et al., 2023). Based on previous research, we argue that attitudes and perceptions are influenced by the availability and use of natural areas as a resource for meaningful nature experiences (Zaradic et al., 2009), which in turn may be related to sociodemographic variables.

2.2.1. Attitudes and perceptions

Conservation attitudes measure whether people have a positive attitude towards the need for conservation of natural areas, independent of specific policy instruments (three items, measured through 5-point Likert scales; Completely disagree to completely agree, and do not

Table 1
Number and socio-demographic characteristics of respondents.

	2006	2013	2017[†]	2021
Number of participants (Total = 7037)	1485	1500	2525[†]	1527
Gender				
Male	48.8 %	49.6 %	51.2 %	50.8 %
Female	51.2 %	50.4 %	48.8 %	49.2 %
Age (average years)	43.3	45.9	48.0	47.8
Income				
Below National average	34.1 %	34.8 %	40.1 %	44.9 %
Around National Average	16.3 %	22.4 %	19.0 %	19.0 %
Above National average	49.6 %	42.8 %	40.9 %	36.1 %

[†] 2017 shows higher sample size due to a temporary additional focus on analyzing regional differences.

know (treated as missing value)). *Policy support* is measured in relation to five specific policy measures (one item each, measured through 5-point Likert scales; Not unimportant at all to very important, do not know) as well as by a one-item multiple choice priority question (*Policy Priority)*, asking people to prioritize nature conservation policy vis-à-vis other policy ambitions (such as unemployment, migration, and health policies, Which of the following should according to you be a top 4 priority? (out of 11 items; including "none of the above")).

Conservation attitudes may be related to perceptions of how nature should be managed, including the preferred level of active management (Buijs et al., 2009). Dutch conservation strategies that increasingly focus on rewilding may find little support with people preferring more managed or cultural landscapes (Bauer and von Atzigen, 2019). We analyze these perceptions through the concept of *images of nature*. Among others, images of nature differentiate between preferences for rewilding versus preferences for more managed or "Arcadian" landscapes, such as cultural landscapes (Keulartz et al., 2004). Images of nature can be defined as comprehensive cognitive, normative and expressive meanings of nature that direct and structure the perception and appreciation of natural landscapes (Buijs et al., 2009). To measure images of nature we used five items from the existing images of nature scale (Ibid.).

2.2.2. Resource use and availability

Nature experiences have been identified as important motivators for pro-environmental attitudes and behaviors (van Heel et al., 2023; Zaradic et al., 2009), and a lack of these experiences are considered a major threat for the future of public support for nature conservation (Beery et al., 2024; Soga and Gaston, 2016; van Heel et al., 2023). Following Soga and Gaston (2016), the current study draws on (a) the perceived availability of natural areas as a potential resource for nature experiences and (b) the actual use of natural areas as explanatory variables for attitudes. *Perceived resource availability* is measured by a subjective evaluation of the amount of nature in their local neighborhood and in the Netherlands at large (two items). *Nature experience* is measured the frequency of visits to natural areas in urban green and parks or in larger natural areas, such forests, heather, dunes (two items).

2.2.3. Behavior

To measure pro-conservation behavior, we follow previous classifications distinguishing between behavior in the private sphere and in the public sphere (Stern, 2000; Kleespies et al., 2024). The private sphere -that we have named 'individual behavior'- includes three items: being member of a nature organization, financially supporting nature projects, and buying organic products. Behavior in the public sphere refers to actions in communal or societal contexts. This public-sphere behavior is measured as volunteering in stewardship practices and environmental activism (two single items). Finally, gender, age and income have been included as socio-demographic variables in the research (see Appendix for an overview of all variables and items).

This results in the following hypothesis and conceptual model (Fig. 1):

H1. Attitudes on nature conservation and perceptions of nature change over time.

H2. Attitudes and perceptions are related to resource use and perceived resource availability.

H3. Pro-conservation behaviors are influenced by attitudes and perceptions.

2.3. Statistical analyzes

Statistical analyzes progressed through several steps, using IBM SPSS (version 29.0.2.0) for dimension reduction and cluster analysis and R for the path analysis.

2.3.1. Dimension reduction

The first step explored the underlying structure of the data using Principal Component Analysis (PCA) to reduce the dimensionality and identify the most significant components. These components were treated as latent dimensions that describe the underlying constructs in the data. Two PCAs with varimax rotation were carried out. The PCA of the attitude items resulted in two components (eigenvalues >1; component loadings >0.45), reflecting our two attitude variables, i.e., 'Conservation attitudes' and attitudes towards concrete policies for nature conservation ('Policy support'). The item nature as a 'Policy priority' was a separate third component, but with an eigenvalue of 0.937. It was included as it raised the explained variance by 10 % to a total of 66 %. For nature images, the PCA resulted in two components (eigenvalues >1; component loadings >0.4) explaining 61 % of the variance. These two components were labelled managed nature (representing a preference for tidied natural areas) and wilderness nature (representing a preference for rewilding of natural areas, independent of human influence). In social science research—particularly in studies using psychological and attitudinal measures—variance explained in the range of 60–70 % is commonly accepted and considered adequate, especially
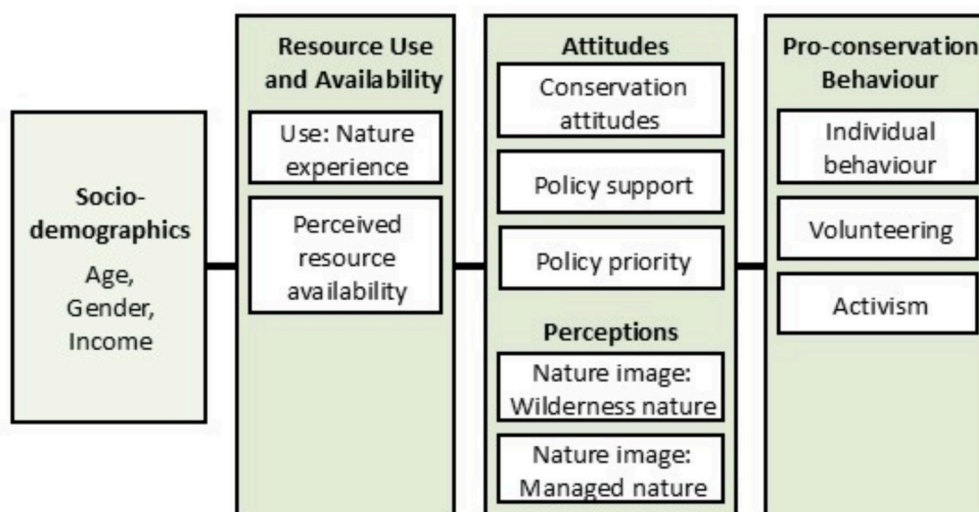

Fig. 1. Conceptual model.

when constructs are inherently complex and multidimensional (e.g. Hair et al. 2014; p. 107; and Hair et al., 2019). These components were further tested for internal consistency using Cronbach's α, to assess whether the items associated with each component exhibited reliable correlation. For follow-up analysis and to ease interpretation we created composite scales by calculating the mean of included items.

Table T2 in the appendix provides an overview of the PCA results and internal reliability testing. In both PCAs, the Kaiser-Meyer-Olkin (KMO) score was above our critical threshold of 0.5, with Bartlett's Test of Sphericity significant at <0.001 level, confirming that the selected items were related and suitable for factor analysis. Scale reliability was not always above 0.6, which is often considered a minimum value in social science exploratory research (Hair et al., 2019). However, these are still within an acceptable range for exploratory work, considering that for components with only two or three items, lower values are acceptable (Schnell, 2011).

2.3.2. Cluster analysis

The second step included the creation of clusters to determine groups showing different attitudes and perceptions towards nature, using the five standardized regression-based components (Conservation attitudes, Policy support, Policy priority, wilderness nature, and managed nature). Two-step cluster analysis was used, using the log-likelihood measure, for the whole data set. Cluster analyses were run with three to six groups. We selected four clusters based on the average silhouette score (0.4 = fair), the distinctness of the clusters using the mean scores, and the relative number of cases in each cluster. Discriminant analysis showed four well-defined clusters with 95 % of respondents correctly classified.

Profiling of the clusters focused on the mean scores and significant differences between the factors and the other variables in our conceptual frame. Depending on the type of variable, either the Kruskal-Wallis test (Likert-scale items) or the Chi-square test (categorical item) were used to determine differences between the variables across clusters, as well as between subsequent years to assess significant changes in clusters over time. The naming of each cluster was developed in extensive discussions between co-authors as well as with colleagues from Wageningen University and the Dutch Environmental Assessment Agency to optimally reflect the outcomes of the analysis and prevent misinterpretation of the names.

2.3.3. Path analysis

The third step in our analysis was to test the relationship between Resource use and Availability, Attitudes and Perceptions and Pro-conservation behavior via a confirmatory path analysis. Path analysis is a form of structural equation modelling, assuming causal relationships between the variables. Thus it allowed us to simultaneously estimate the effect of Resource Use and Availability on Attitudes and perceptions and the effect of Attitudes and perceptions on Pro-conservation Behavior. We used the previously calculated mean scores for each attitude and perception factor (see sections 2.3.2 and Table 3) and calculated in a similar manner mean scores for Nature experience and Perceived resource availability. For pro-conservation behavior we created a summated score for all individual behaviors (membership of nature organizations, financial support and green consumerism). To test if the preconditions for path analysis are given, we assessed multicollinearity and multivariate normality of the created mean variables. While the degree of multicollinearity was acceptable (VIF < 2 and all Spearman correlations below 0.5, see Appendix T9) multivariate normality was not given. Thus, we decided to account for this by using a robust estimator (WLSMV -Weighted Least Squares Mean and Variance Adjusted) which adjust for variables with skewed distribution and at the same time allowed us to combine continuous and ordinal data (Rosseel, 2012). To assess the goodness of our assumed model we inspected the Chi-square (χ2) results for testing the exact fit hypothesis and several relative and absolute goodness of fit measures, namely the Comparative Fit Index (CFI, $\geq$ 0.90), the Normed fit Index (NFI, $\geq$ 0.90), Root Mean Square

Error of Approximation (RMSEA, $\leq$ 0.08), and the Standardized Root Mean Square Residual (SRMR, $\leq$ 0.05)(Hair et al., 2019). All analyses were conducted in R (R Core Team, 2019) using the lavaan package (Rosseel, 2012), a covariance-structure analysis package, using 0.05 as cut-off for statistical significance.

3. Results

3.1. Public attitudes over time

Pro-conservation attitudes, i.e. policy support and conservation attitudes, are generally high across all years and most have increased between 2006 and 2021, especially in the last years (see Table 2). Respondents support nature conservation in general (mean score for all years was 3.46 on a 1–5 scale) as well as specific conservation policy measures (mean score for all years of 3.99 on a 1–5 scale). Despite strong support for nature conservation and conservation policy, the priority of conservation policy vis-à-vis other policy issues (e.g. unemployment or migration) is relatively low. Across time, on average 19 % (0.19 on a 0–1 scale) of the respondents prioritize conservation policies as a top-4 priority (out of 10 policy issues) indicating the relatively higher priority of other policy fields (especially healthcare, education and employment). In additional, people consistently expressed higher preferences for wilderness nature compared to managed nature (mean score 3.64, and 2.98; 1–5 scale, all years) and this preference is increasing over the years.

The most significant changes in attitudes occurred between 2013 and 2017, when all components increased except policy priority. Meanwhile, policy priority significantly increased between 2017 and 2021. Some smaller significant changes occurred between 2017 and 2021; policy priority increased and the preferences for managed nature decreased. While all attitudes significantly changed between 2021 and 2006, effect sizes are generally moderate to small, with exception of changes in policy priority, increasing very significantly between 2017 and 2021.

As reported in the methods section, reliability of the scales was acceptable to good, with the wilderness image scoring lowest ($\alpha = 0.50$; which is considered acceptable due to limited number of items included in the scale (see methods section). Reliability of outcomes is further substantiated by looking into longitudinal developments for individual items, which show similar patterns across time (Table 3).

Table 3 provides an overview of the means scores per item per component, for all years and for the survey years. The table shows that all three items for nature conservation attitude have a mean score for all years above 3 (1–5 scale; based on rescoring as items were negatively phrased). The item on 'attention to nature is not exaggerated' scores highest (mean 3.84 for all years), while the item on nature as an obstacle for economy had the lowest mean score of 3.07. All three items show a significant increase in mean, comparing 2021 with 2006.

All items for nature policy support also score (well) above 3 in all years; especially the protection of existing nature areas, and of rare plants and animals and special nature areas score particularly high (both items above the 4 in all years). The lowest scores of the five items are given to the question concerning the government spending too little money on nature conservation (varying between 3.26 and 3.63 in the different years). Comparing 2021 with 2006 shows that none of the items showed a significant decrease, but remained stable or significantly increased.

All items for the wilderness image of nature scored above 3 (mean for all years), with the item on preferring not to encounter buildings in nature having the highest average score (3.83). The other two items showed a significant increase 2006–2021. The average item scores for managed nature were somewhat mixed, with more agreement on the need to mow roadside edges (average score: 3.28) than clearing dead wood from forest areas (average score: 2.68). The latter was only the item significantly decreasing over time.

Table 2

Development of attitudes and perceptions over time, based on mean scores of the underlying factors, including sample size (N) and Cronbach's alpha (α); Mean and standard deviation (SD), and Mean differences with test values (H, z or χ^2, p and η^2, r, or Cramer's V). All factors on a 5-point Likert scale, except for nature policy priority, a 0 (no) /1 (yes) score.

	Overall sample N (α)	2006 Mean (SD)	2006–2013 Mean difference & test statistics	2013 Mean (SD)	2013–2017 Mean difference & test statistics	2017 Mean (SD)	2017–2021 Mean difference & test statistics	2021 Mean (SD)	2006–2021 Mean difference & test statistics
Conservation attitudes	6752 (0.70)	3.41 (0.73)	−0.04 z = −1.51	3.37 (0.80)	+0.12*** z = 4.98 r = 0.08	3.49 (0.77)	+0.07*** z = 4.98 r = 0.08	3.56 (0.92)	+0.15*** H = 61.903 df = 3 η^2 = 0.01
Policy support	6023 (0.80)	3.90 (0.55)	+0.01 z = 0.73	3.91 (0.61)	+0.12*** z = 5.05 r = 0.08	4.03 (0.56)	+0.03	4.06 (0.62)	+0.16*** H = 72.314 df = 3 η^2 = 0.01
Policy priority	7037 (n/a)	0.21 (0.41)	−0.02 $\chi2(1)$ = 2.14	0.19 (0.39)	−0.05** $\chi2(1)$ = 18.7 Cramer's V = 0.07	0.14 (0.35)	+0.12*** $\chi2(1)$ = 99.7 Cramer's V = 0.16	0.26 (0.44)	+0.05** $\chi2(3)$ = 101.7 Cramer's V = 0.12
Nature image: Wilderness nature	6567 (0.50)	3.55 (0.64)	+0.02 z = 0.53	3.57 (0.67)	+0.12*** z = 5.31 r = 0.09	3.69 (0.62)	+0.05	3.74 (0.66)	+0.19*** H = 84.6970 df = 3 η^2 = 0.01
Nature image: Managed nature	6692 (0.58)	3.02 (0.92)	−0.07* z = −2.10	2.95 (0.91)	+0.08*** z = 3.55 r = 0.06	3.05 (0.87)	−0.19***	2.86 (0.99)	−0.18*** H = 40.097 df = 3 η^2 = 0.01

* Significant difference at p < 0.05 level.
** significant difference at p < 0.01 level.
*** significant difference at p < 0.001 level.

3.2. Cluster analyses

3.2.1. Four clusters

As a second step in our analysis, we conducted a cluster analysis with the five components to statistically cluster respondents with comparable perceptions and attitudes. This resulted in four clusters with statistically distinct characteristics in most variables. Table 4 describes the distribution of clusters, the mean scores for each constituting factor per cluster, as well as cluster averages for the other variables in our conceptual model.

Cluster 1 (14.7 %) is named "unconcerned". This cluster describes a group of people with more critical attitudes compared to the other three clusters. They seem rather unconcerned about nature and nature conservation, not only because people within this cluster score low on most attitude items (scoring neutral to not important on the importance of nature conservation and almost never choosing conservation a top policy-item), but also they visit natural areas significantly less than average. A further analysis of the different policy measures shows that while this group generally endorses conservation of existing natural areas, they are quite critical about expanding natural areas (endorsed by only 25.5 % compared to 72.6 % for all respondents). In addition, they are very critical about increasing government spending for conservation (supported by only 13 % compared to 46,2 % for all respondents). This group of people is most satisfied with the availability of natural areas (and a very small percentage even feel too much nature is available in the Netherlands). They spend little money on nature and green products, despite having (together with cluster 3) the highest income. Volunteering for nature is rare in this group and they also spend less leisure time outdoors. Based on these characteristics, we have labelled this group the *unconcerned*.

Cluster 2 (35.8 %) describes a group of people who score considerably higher on the attitude scales than cluster 1 (but lower than cluster 3 and 4). Support for conservation policy is much higher than cluster 1 (4.01 versus 3.19, 1–5 scale). Meanwhile, policy priority for nature is somewhat higher than clusters 1 and 3, but still very low. They score high on both wilderness and managed nature. Compared to cluster 1, they are somewhat more active in and for nature, but less than the people in clusters 3 and 4. The same goes for spending money on nature and green products and perceptions of nature availability. Based on these characteristics, we have labelled this group as *passive supporters*.

Cluster 3 (29.8 %) describes a group that strongly supports nature conservation and policy measures and favors wilderness nature above managed nature. Like in cluster 1 there is no policy priority for nature policy, indicating a focus on other policy domains. Respondents in this cluster are somewhat older than those in the other clusters and have a relatively high income. Compared to clusters 1 and 2, they spend more money on nature and green products and are more active in and for nature. Based on these characteristics, we have labelled this group the *active supporters* of nature conservation in the Netherlands.

Cluster 4 (19.7 %) has the strongest pro-conservation attitudes and behaviors of all groups. They strongly support nature policy measures, are concerned with (the future of) nature, and favor wilderness nature above managed nature. It is also the only cluster that prioritized nature policy priority above many other policy issues (40 % in the Top-4 priorities). We named them "pillars" as their membership, volunteering and activism is significantly higher than the other groups and, together with cluster 3, they spend the largest amount of money on nature and green products, despite having on average a lower income. They spent more time in nature then other groups and are the most concerned about a lack of available natural areas. Based on these characteristics, we have labelled this group the *pillars* of nature conservation in the Netherlands.

3.2.2. Longitudinal analysis of clusters

We also analyzed developments of the relative size of the clusters over time. Fig. 2 presents an overview of the distribution of clusters in the different survey years over time. The chi-square test for all years shows that there are differences in the distribution of the clusters over time (χ^2 = 168.690, $p < 0.001$), indicating changes in the distribution over time.

The cluster *passive supporters* is the largest group in 2006, followed by the *active supporters* and the *pillars*, with cluster *unconcerned* being the smallest group. Tests show that clusters did not change between 2006 and 2013 (χ^2 = 2.289, $p = 0.515$). Between 2013 and 2017 significant changes occurred (χ^2 = 51.267, p < 0.001, Cramer's V = 0.12); cluster distribution changes significantly, with clusters *unconcerned* and *pillars* decreasing in favor of especially cluster *passive supporters*. Significant changes also occurred between 2017 and 2021 (χ^2 = 123.481, p < 0.001, Cramer's V = 0.19); the cluster *passives supporters* decreased

Table 3
Development of individual items over the years, based on mean scores, with mean and standard deviation in each cell, and test values (H or χ^2, p and η^2 or Cramer's V).

	All years	2006	2006–2013	2013	2013–2017	2017	2017–2021	2021	2006–2021	Test values 2006–2021
Respondents (N)[†]	6941	1472		1483		2501		1485		6941
Conservation attitudes (1= completely agree, to 5 = completely disagree (after rescoring[†]))										
All attention to nature is exaggerated.[+]	3.84 (0.93)	3.80 (0.86)	−0.02	3.78 (0.93)	+0.06	3.84 (0.90)	+0.12***	3.96 (1.01)	+0.16***	H = 64.046 p < 0.001 η2 = 0.01
We worry too much about the future of nature in the Netherlands. [+]	3.46 (1.08)	3.37 (1.01)	−0.03	3.34 (1.05)	+0.22***	3.56 (1.04)	−0.06	3.50 (1.19)	+0.13**	H = 64.832 p < 0.001 η2 = 0.0
Nature should not hinder economic progress. [+]	3.07 (1.05)	3.04 (1.01)	−0.06	2.98 (1.06)	+0.08	3.06 (1.01)	+0.15***	3.21 (1.12)	+0.17***	H = 36.852 p < 0.001 η2 = 0.006
Policy support (1 = not important at all to 5 = very important)										
I support policy protecting existing nature areas.	4.43 (0.62)	4.40 (0.60)	+0.09***	4.49 (0.64)	−0.06*	4.43 (0.59)	−0.04	4.39 (0.65)	−0.01	H = 30.930 p < 0.001 η2 = 0.006
I support policy to establish new or expand existing nature areas.	3.93 (0.69)	3.90 (0.74)	−0.12***	3.78 (0.87)	+0.22***	4.00 (0.77)	+0.01	4.01 (0.79)	+0.11**	H = 83.583 p < 0.001 η2 = 0.01
I support policy to connect nature areas.	3.80 (0.68)	3.62 (0.84)	+0.15***	3.77 (0.91)	+0.09**	3.86 (0.81)	+0.03	3.89 (0.83)	+0.27***	H = 96.089 p < 0.001 η2 = 0.02
I support policy to protect rare plants, animals and special nature areas.	4.31 (0.70)	4.25 (0.71)	+0.03	4.28 (0.75)	+0.08**	4.36 (0.67)	−0.06	4.30 (0.72)	+0.05	H = 19.717 p < 0.001 η2 = 0.002
The government spends too little on nature conservation.	3.43 (0.92)	3.31 (0.84)	−0.05	3.26 (0.94)	+0.21***	3.47 (0.92)	+0.16***	3.63 (0.92)	+0.32***	H = 145.94 p < 0.001 η2 = 0.03
Policy priority (no = 0/yes = 1)										
In Top-4	0.19 (0.39)	0.21 (0.41)	−0.02	0.19 (0.39)	−0.05***	0.14 (0.35)	+0.12***	0.26 (0.44)	+0.05**	χ2(3) = 101.77 p < 0.001 Cramer's V = 0.12
Nature image: Wilderness nature (1 = completely disagree to 5 = completely agree)										
The longer a natural area has been left undisturbed by people, the greater the value of the area.	3.70 (0.87)	3.61 (0.87)	+0.03	3.64 (0.92)	+0.10**	3.74 (0.85)	+0.07	3.81 (0.84)	+0.20***	H = 48.490 p < 0.001 η2 = 0.01
I would prefer not to encounter buildings in nature	3.83 (0.87)	3.74 (0.86)	−0.06	3.68 (0.90)	+0.29***	3.97 (0.75)	−0.15***	3.82 (0.84)	+0.08	H = 122.31 p < 0.001 η2 = 0.02
High-voltage pylons and wind turbines make natural areas less valuable.	3.39 (1.05)	3.30 (1.00)	+0.10	3.40 (1.03)	−0.06	3.34 (1.04)	+0.22***	3.56 (1.09)	+0.26***	H = 64.402 p < 0.001 η2 = 0.01
Nature image: Managed nature (1 = completely disagree to 5 = completely agree)										
Dead trees in the forest should be cleared.	2.68 (1.09)	2.69 (1.08)	−0.09	2.60 (1.07)	+0.15***	2.75 (1.05)	−0.09	2.66 (1.16)	−0.03	H = 21.835 p < 0.001 η2 = 0.003
Roadside verges should be neatly mowed.	3.28 (1.10)	3.35 (1.12)	−0.04	3.31 (1.11)	+0.04	3.35 (1.04)	−0.30***	3.05 (1.13)	−0.30***	H = 76.018 p < 0.001 η2 = 0.01

[+] Rescoring applied due to negative scales used.
[†] With slight variations per question, due to missing values (<5 %).
[*] Significant at $p < 0.05$ level.
[**] Significant at $p < 0.01$ level.
[***] significant at p < 0.001 level.

considerably, whereas the cluster *pillars* increased.

3.3. Relationships between variables

The path analysis model estimated 56 parameter and used 6855 observations, while the chi-square test was statistically significant ($\chi^2(6) = 288.805$, p < 0.001), indicating that the model does not provide a perfect fit; the large sample size is likely inflated this result. In line with this all other goodness of fit measure showed an acceptable fit of our model (scaled CFI = 0.929, scaled NFI = 0.928, scaled RMSEA = 0.085, and SRMR = 0.020). Unstandardized estimates, standard errors, and results of significance testing for all estimated parameters are presented in the supplementary material (Appendix T10). This includes also the covariance estimates between variables within Resource Use and

Table 4

Mean scores and standard deviation of the four clusters ($N = 6096$), including tests for significant differences between clusters.

	Cluster 1 Unconcerned	Cluster 2 Passive Supporters	Cluster 3 Active Supporters	Cluster 4 Pillars	Test for significant differences between clusters
Distribution of clusters	14.7 % (N= 896)	35.8 % (N = 2185)	29.8 % (N = 1814)	19.7 % (N = 1201)	
ATTITUDES AND PERCEPTIONS					
Conservation attitudes[+] (1 = no to 5 = much support)	2.84[a]*** (0.76)	3.19[b]*** (0.66)	3.83[c]** (0.67)	3.77[d]** (0.83)	H(3) = 1362.979 $p < 0.001$ $\eta^2 = 0.22$
Policy support (1 = no to 5 = much support)	3.19[a]*** (0.52)	4.00[b]*** (0.44)	4.16[c]*** (0.47)	4.28[d]*** (0.49)	H(3) = 1741.409 $p < 0.001$ $\eta^2 = 0.31$
Policy priority (1 = yes in top 4)	0.00a* (0.04)	0.00b* (0.00)	0.00a* (0.00)	1.00*** (0.40)	$\chi2(3) = 6083.402$ $p < 0.001$ Cramer's V = 0.12
Wilderness nature (1 = no to 5 = much support)	2.89[a]*** (0.52)	3.75[b]** (0.52)	3.76[c]** (0.59)	3.83[d]** (0.65)	H(3) = 1333.194 $p < 0.001$ $\eta^2 = 0.22$
Managed nature (1 = no to 5 = much support)	3.27[a]*** (0.72)	3.63[b]*** (0.59)	2.20[c]*** (0.55)	2.72[d]*** (0.98)	H(3) = 2837.062 $p < 0.001$ $\eta^2 = 0.47$
RESOURCE USE AND AVAILABILITY					
Visits to urban green and parks (1 = (almost) never to 5 = very often (daily))	2.16[a]*** (1.06)	2.47[b]** (1.02)	2.59[c]** (1.17)	2.71[d]** (1.17)	H(3) = 126.316 $p < 0.001$ $\eta^2 = 0.02$
Visits to nature areas (forests, heather, dunes, lakes and ponds) (1 = (almost) never to 5 = very often (daily))	2.59[a]*** (0.96)	2.75[b]*** (0.97)	2.95[c]** (0.98)	3.08[d]** (1.00)	H(3) = 160.186 $p < 0.001$ $\eta^2 = 0.03$
Perceived availability nature in the neighborhood (1 = too little to 5 = too much)	3.06[a]*** (0.82)	2.66[b]** (0.71)	2.41[c]** (0.89)	2.15[d]*** (0.94)	H(3) = 214.008 $p < 0.001$ $\eta^2 = 0.04$
Perceived availability nature in the Netherlands (1 = too little to 5 = too much)	3.22[a]*** (0.76)	2.93[b]*** (0.67)	2.85[c]*** (0.82)	2.65[d]*** (0.88)	H(3) = 698.577 $p < 0.001$ $\eta^2 = 0.12$
PRO-CONSERVATION BEHAVIOR					
Membership of nature organization (0 = no, 1 = yes)	0.14[a]** (0.26)	0.18** (0.21)	0.35[b]* (0.39)	0.39[c]* (0.42)	$\chi2(3) = 334.620$ $p < 0.001$ $\eta^2 = 0.$
Financial support (0 = no, 1 = yes)	0.08[a]*** (0.36)	0.15[b]*** (0.28)	0.25[c]*** (0.43)	0.27[c]*** (0.44)	$\chi2(3) = 181.283$ $p < 0.001$ Cramer's V = 0.17
Green consumerism (0 = no, 1 = yes)	0.22[a]*** (0.22)	0.27[b]*** (0.32)	0.46[c]*** (0.37)	0.49[c]*** (0.41)	$\chi2(3) = 318.763$ $p < 0.001$ Cramer's V = 0.23
Volunteering (# of activities, at max 4)	0.12[a]*** (0.35)	0.14[a]*** (0.40)	0.20[b]*** (0.47)	0.28[c]*** (0.59)	H(3) = 87.223 $p < 0.001$ $\eta^2 = 0.01$
Activism (# of activities, at max 2)	0.05[a]** (0.23)	0.07[a]**,[b]** (0.27)	0.08[b]**,[c]** (0.29)	0.10[c]** (0.33)	H(3) = 20.698 $p < 0.001$ $\eta^2 = 0.003$
SOCIO-DEMOGRAPHIC CHARACTERISTICS					
Gender (1 = man, 2 woman)	1.46[a]* (0.50)	1.50[b]* (0.50)	1.46[a]* (0.49)	1.48[a]*,[b]* (0.50)	$\chi2(3) = 9.141$ $p < 0.05$ Cramer's V = 0.04
Age (years)	45.5[a]*** (15.3)	46.6[a]*** (15.9)	48.9[b]*** (15.1)	46.8[a]*** (15.6)	H(3) = 36.528 $p < 0.001$ $\eta^2 = 0.01$
Income (1 = below average to 3 = above average)	2.15[a]** (0.89)	1.99[b]*** (0.88)	2.16[a]** (0.90)	2.00[b]** (0.90)	$\chi2(3) = 42.742$ $p < 0.001$ Cramer's V = 0.07

[+] Rescoring applied due to negative scales used.

* Significant at $p < 0.05$ level.

** significant at $p < 0.01$ level.

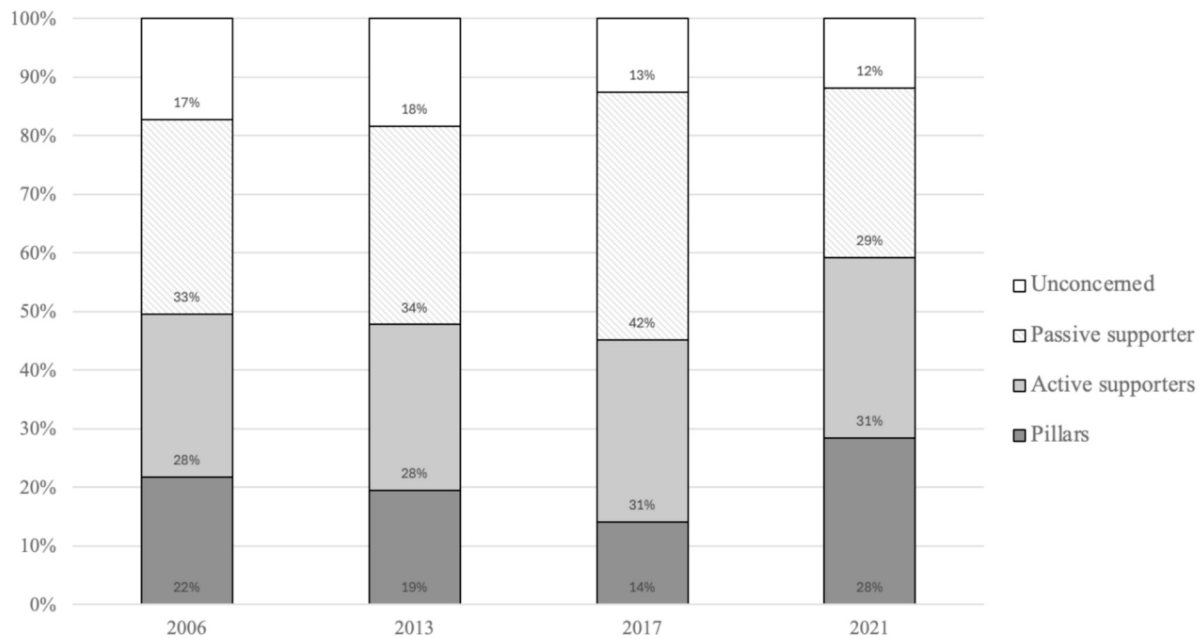*** significant at $p < 0.001$ level.

Fig. 2. Development of clusters over time.

Availability, Attitudes and Perceptions and Pro-conservation Behavior.

Fig. 3 visualizes the significant relationships between Resource Use and Availability, Attitudes and Perceptions and Pro-conservation Behavior. Perceived resource availability and Nature experience explain 23.3 % of the variation on Policy support, with those feeling that there is too little nature in their surrounding or the country (=low score) being more supportive of nature policies. Regarding conservation behavior, the included attitudes and perceptions explained nearly 20 % of individual conservation behavior. Respondents that preferred managed nature were less likely to engage in pro-conservation behavior while those that expressed support for more nature policies and the aim

to prioritize nature policies also showed individual conservation behavior. While most relationship proved significant, activism was not related to either nature images.

4. Discussion

4.1. Dynamics in attitudes towards nature conservation

This paper is the first longitudinal analysis of people's attitudes towards nature conservation on a national level, analyzing changes over a period of 15 years. Our results suggest temporal changes in attitudes
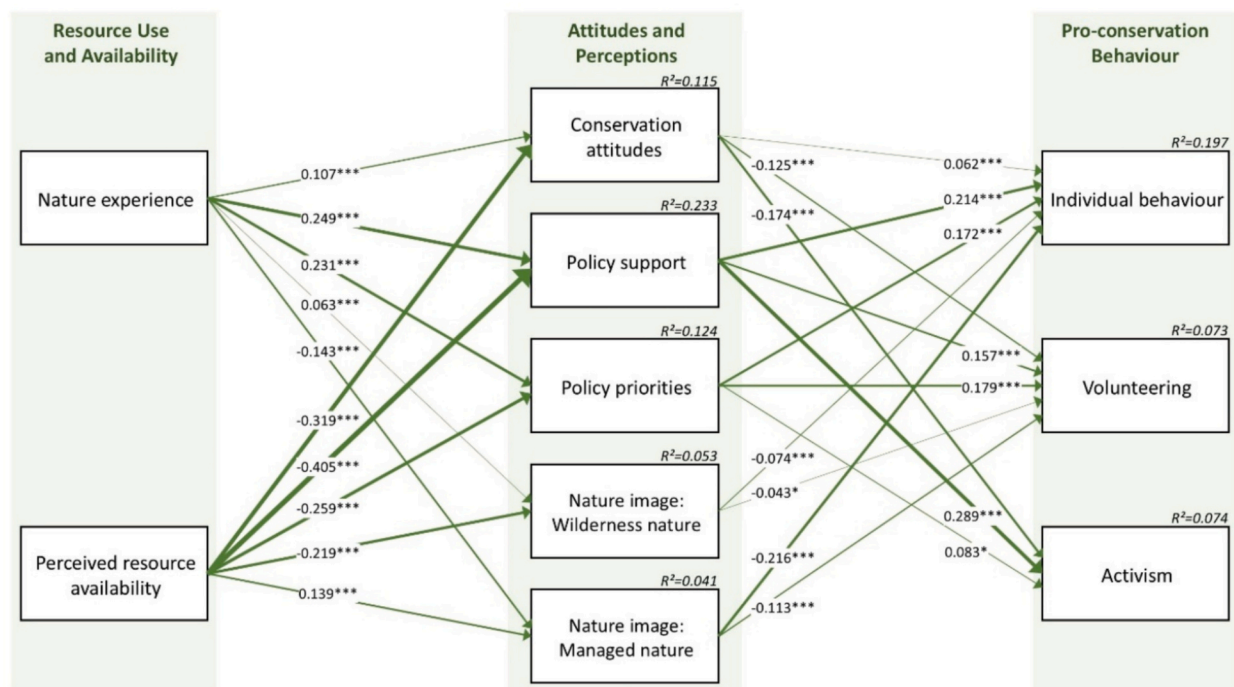

Fig. 3. *Path analysis model linking Resource Use and Availability, Attitudes and Perceptions, and Pro-conservation Behaviors*
* Significant at *p* < 0.05 level, ** significant at *p* < 0.01 level, ***significant at *p* < 0.001 level.

towards nature conservation and perceptions of nature, thus confirming hypothesis 1. Meanwhile, the relative stability of attitudes and perceptions is at least as relevant as the changes over time. Public support for nature conservation and for policy measures is generally high among the general public in The Netherlands. For example, 94 % of the respondents support the protection of exiting nature areas. From 2013 onward, a consistent tendency towards increased pro-conservation attitudes can be seen. In addition, nature images also change significantly over time, with support for a wilderness-oriented conservation further increasing over time. Meanwhile, preference for managed nature is lower and generally decreases over time.

While pro-conservation attitudes are generally high and further increasing, results also show the existence of an "attitude-priority gap". Positive attitudes towards nature conservation and towards conservation attitudes need not result in high priority for conservation policies. Only a small minority (up to 26 % in 2021) ranks nature conservation as a policy priority vis-à-vis other policy ambitions. To understand this potential gap between general attitudes and prioritization, we may learn from the research into the well-known attitude-behavior gap, suggesting many personal and contextual factors influence the manifestation of general pro-conservation attitudes into policy priorities and eventually voting behavior (e.g. Steg, 2016). Furthermore, it should be noted that high support for conservation policies at the national level do not need to result in high support for concrete conservation measures at the landscape level, especially when functional changes are implemented or when wildlife management is involved (Dressel et al., 2015; van Dijk and van der Wulp, 2010). Understanding these scaling issues of conservation attitudes is an important follow-up question of this research.

Although not investigated empirically, specific temporal changes in conservation attitudes and support for nature conservation policies suggest relationships to wider socioeconomic and cultural change. For example, the economic crises of 2009–2013 in the Netherlands may have influenced the reported decline of pro-conservation attitudes and even bigger decline in prioritization of nature conservation vis-à-vis other policy priorities, such as economic development and combatting unemployment, Indeed, priority for conservation policies increases significantly after 2017, in times of renewed economic growth. This is in line with literature suggesting that economic downfall usually not impact environmental attitudes directly, but may impact policy framings which in turn impact policy priorities by the general public (Mildenberger and Leiserowitz, 2017). These impacts of wider socio-economic, cultural (and scientific) changes are in line with a recent study on 30 years of policy discourses in nature conservation (Buijs and van Koppen, 2025). In addition, a well-known framing on nature conservation in the Netherlands during the economic crisis was that nature conservation was halting economic development ("the Netherlands are shutting down due to conservation measures"; Buijs et al., 2014).

The Covid-19 crisis may also have impacted attitudes and behaviors. Our study shows an increase in visits to natural areas during Covid-19, confirming previous studies on the impacts of the Covid-19 crises (e.g. Hansen et al., 2022). The significant increase in pro-conservation attitude and priorities during Covid-19 reported in this research also strengthens previous suggestions that Covid-19 may not only have impacted outdoor recreation, but may also have strengthened pro-conservation attitudes and behaviors (e.g. da Schio et al., 2021).

Next to population averages, we also looked at specific subgroups in the population, using cluster analysis. Cluster analysis reveals four distinct cohorts of attitudes. Each cluster represents a unique combination of conservation attitudes and perceptions of nature, ranging from a segment in the population being rather unconcerned, and sometimes skeptical about nature conservation (14.7 % of the respondents) to a segment identified as the 'pillars' (19.7 %). The latter group most typically engages in stewardship volunteering or citizen initiatives as well as activism to counter threats to nature and biodiversity. Meanwhile, the unconcerned people are rather skeptical about current nature policies measures. While 73 % of the people in this cluster endorse the

conservation of existing natural areas, they are very critical of the expansion of natural areas (endorsed by only 25.5 %, compared to 72.6 % for all respondents). Furthermore, they are also very critical of increasing government spending on conservation (supported by only 13.0 % compared to 53.8 % for all respondents).

The background of this criticism, especially on enlarging protected areas, may be relevant in light of the opposition from societal actors against the recently adopted 30 × 30 aims adopted at COP-15 (CBD, 2022) as well as the intended restoration of at least 20 % of EU's land areas by 2030 as targeted in the recently adopted Nature Restoration Regulation (European Commission, 2024). Meanwhile, this unconcerned group is a rater small group, and its critical attitudes are outweighed by the pro = conservation attitudes from the other groups. It is important to note however, that these relative small numbers of critical citizens are based on studies conducted before the recent polarization in public and political debates on nature conservation. It would be interesting to repeat the study to understand the impact of recent farmer protests and critical framings in media and politics arguing nature conservation is a threat to agriculture or economic development (Finger et al., 2024).

4.2. Explaining attitudes and behaviors

The second and third hypotheses focus on the relationships between attitudes and i) resource use and perceived availability (H2) and ii) pro-conservation behaviors (H3). Both hypotheses are confirmed in the analysis, thereby supporting the conceptual model as presented in Section 2.1. Meanwhile, effect sizes, especially for the relationships with behavior, are only small to moderate.

Conservation attitudes, and especially policy support and priority, are influenced by resource use and perceived recourse availability. The relationship between resource use through outdoor recreation or other experiences in nature found here is in line with previous studies suggesting nature experiences relate positively to pro-conservation attitudes (e.g. Buijs and Jacobs, 2021; Soga and Gaston, 2016). Interestingly, attitudes towards conservation policies ("policy support" and "policy priority") are much stronger related to resource use and availability and also have stronger predictive power towards behaviors than more general "conservation attitudes". In addition, also images of nature are related to outdoor experiences, with the wilderness image having a positive -but weak- relationship to outdoor experiences, and managed nature image a negative relationship.

Attitudes are also related to most of the pro-conservation behaviors included in this study. Meanwhile, effect-size is usually small. While the attitude-behavior relationship has been extensively confirmed in pro-environmental behaviors in general (Bouman and Steg, 2019; Steg, 2016), it has been much less studied in relation to conservation behavior (Barbett et al., 2020). Our study confirms but also nuances insights from environmental psychology about attitudes informing pro-environmental or pro-conservation behavior. In line with environmental studies (Steg, 2016), pro-conservation attitudes correlate positively with private-sphere behaviors, such as membership, purchase behavior and financial support. However, public-sphere behavior such as stewardship volunteering and activism were mostly not or only weakly related to pro-conservation attitudes. This is somewhat contrary to previous studies into stewardship behavior, suggesting a positive relationship between civil society actions and attitudes, values or connectedness to nature (e.g. Ganzevoort and van den Born, 2020). Meanwhile, also Barbett et al. (2020) found much lower correlations between pro-conservation attitudes and stewardship action compared to individual consumer behavior.

4.3. Limitations and improvements

Longitudinal research offers unique insights into how conservation attitudes towards nature change over time. At the same time, this kind of

research also presents significant challenges. Evolving insights, for example in research, such as the emergence of the concept or relational values from 2016 onwards, in combination with socio-political developments, for example policy shifts such as the Nature Restoration Law, may require adjustments in the topics included in the research and the conceptualization of these topics. This results in continuous trade-offs to be made between maintaining compatibility to ensure consistent comparisons over time and staying up to date with evolving issues to reflect current realities. For example, before the final survey in this study, the Pro-Nature Conservation Behavior Scale has been published (Barbett et al., 2020), which could have been a nice addition to the behavior questions already included in the survey. Because this longitudinal study is using only those variables that have been included in all four surveys, using identical questions and answer categories, such potential improvements could not be implemented.

Because the general public is often more focused on nature and natural areas, and less on biodiversity and its protection (Turnhout et al., 2012), we explicitly focused our surveys on attitudes towards nature and nature conservation, and not on biodiversity conservation. Consequently, the rise in pro-nature conservation attitudes does not need to equate with a rise in attitudes towards biodiversity conservation. The general public usually has a much wider definition of nature conservation than conservationists. For many, focus is more on the beauty of natural areas, accessibility for recreation or relaxation and well-being (Bratman et al., 2019). Meanwhile, attitude score on protection of rare species is also high for all but the unconcerned cluster, suggesting also attitudes for biodiversity protection is generally high, but with a subgroup being critical about biodiversity protection.

Methodologically, analyzing longitudinal data across different years and respondents may be challenging. In our factor analyses, some results were only just above the threshold for acceptance, primarily due to low reliability (see appendix). In addition, longitudinal analysis with independent samples involves examining changes and trends over time using different cohorts across various years, preventing assessing whether observed changes over time are due to individual transitions or are merely reflections of different groups at different points in time. Here, cluster analysis helped to understand how different groups within a population evolve over time, which was crucial for interpreting changes in pro-conservation attitudes. We considered performing cluster analyses separately for each year. However, upon closer examination, it became evident that the five attitude and perceptions factors underlying these clusters remained consistent across all years. We assumed that while individual factors can vary over time, the fundamental relationships and structures underpinning these factors tend to be stable and conducting separate cluster analyses per year would not significantly alter the overall insights. Moreover, by aggregating the data over all years, we were able to provide a clearer comparison over the entire study period.

4.4. Conclusions

In times of social and political struggles over suggested policies to reverse biodiversity loss, understanding public attitudes and perceptions is important to ground conservation policies, strategies, and narratives in society. While conservation attitudes have been widely studied at the local and regional level, attitudes at the national level and their development over time is critically lacking. In this paper, we show that in the Netherlands, the majority of citizens is supportive of nationally formulated conservation policies. Furthermore, at least until 2021, pro-conservations attitudes and behaviors are increasing. However, when looking into the details of critical voices in society, several key issues of recent policies, such as the expansion of natural areas in the European Nature Restoration Regulation and the CBD 30 × 30 target, as well as strict species protection is contested among these groups, and is seen as a threat to economic development. In addition, these groups prefer managed landscapes, such as cultural landscapes, over more natural and

wilder landscapes. To navigate the political and media framing about these conservation policies and their implementation at the national level, it is crucial to understand and navigate the critical minority among the general public and the plurality of values and perceptions they may hold. Meanwhile, the high public support among the majority of respondents as reported in this study may also strengthen confidence of conservationists, policymakers, and NGOs that their ambitions to strengthen nature conservation policies resonates with significant segments of the general public.

CRediT authorship contribution statement

Arjen Buijs: Writing – original draft, Funding acquisition, Conceptualization. **Marjanke Hoogstra-Klein:** Writing – original draft, Formal analysis, Data curation. **Tineke de Boer:** Writing – review & editing, Data curation, Conceptualization. **Sabrina Dressel:** Writing – review & editing, Formal analysis. **Fransje Langers:** Writing – review & editing, Investigation, Data curation, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Arjen Buijs reports financial support was provided by Netherlands Environmental Assessment Agency. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.biocon.2025.111239.

Data availability

Data will be made available on request.

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