LETTER • OPEN ACCESS

Using perceived impacts, governance and social indicators to explain support for protected areas

To cite this article: Nikoleta Jones *et al* 2023 *Environ. Res. Lett.* **18** 054011

View the article online for updates and enhancements.

You may also like

ENVIRONMENTAL RESEARCH
LETTERS

LETTER

Using perceived impacts, governance and social indicators to explain support for protected areas

Nikoleta Jones[1,*] , Chrisovaladis Malesios[1], James McGinlay[1], Sebastian Villasante[2] , Juraj Svajda[3] ,
Andreas Kontoleon[4], Alfie Begley[1], Vassilis Gkoumas[4] , Anne Cadoret[5] ,
Panayiotis G Dimitrakopoulos[6] , Victoria Maguire-Rajpaul[1,7] and Kalev Sepp[8]

[1] Institute for Global Sustainable Development, The Ramphal Building, University of Warwick, Coventry CV4 7AL, United Kingdom
[2] CRETUS-Department of Applied Economics, Faculty of Economic and Business Sciences, University of Santiago de Compostela, 15782 Santiago de Compostela, Spain
[3] Faculty of Natural Sciences, Matej Bel University, 97401 Banska Bystrica, Slovakia
[4] Department of Land Economy, University of Cambridge, 16-21 Silver St, Cambridge CB3 9EP, United Kingdom
[5] Aix Marseille Univ, CNRS, TELEMMe UMR 7303, 13094 Aix en Provence, France
[6] Department of Environment, University of the Aegean, University Hill, 81100 Mytilene, Lesvos, Greece
[7] Global Sustainability Institute, Anglia Ruskin University, 183 East Road, Cambridge CB1 1PT, United Kingdom
[8] Institute of Agricultural and Environmental Sciences, Estonian University of Life Sciences, Fr. R. Kreutzwaldi 1, 51006 Tartu, Estonia
[*] Author to whom any correspondence should be addressed.

E-mail: Nikoleta.Jones@warwick.ac.uk

Keywords: national parks, acceptability, benefits, Europe, place attachment, values, social norms

Supplementary material for this article is available online

Abstract
Protected areas (PAs) are the foremost policy tool for biodiversity conservation internationally. In order for PAs to deliver desired conservation outcomes effectively, equitably, and for the long-term, they require a high level of support from local communities. A mosaic of factors have been proposed aiming to explain the level of support for PAs focusing mainly on governance indicators, perceived social impacts and social attributes, such as personal norms and values. However, these factors are often explored in isolation and in studies of small scale within the scientific literature. To cover this research gap we run a structural equation model exploring how the interconnections between these factors can lead to higher levels of support for PAs using data from 3239 local residents in 10 PAs in Europe. Our analysis shows that the mediation effects of governance indicators, such as trust in institutions and level of public engagement, are important in explaining associations between an individual's social profile and their perceived social impacts with public support. Our findings also provide a useful and operational framework for PA practitioners and researchers illuminating pathways to increase the level of public support for a PA.

1. Introduction

Globally, there is a growing recognition that in order to assess the conservation effectiveness and sustainability of protected areas (PAs) (the main policy tool for biodiversity conservation), both ecological and socio-economic targets need to be taken into consideration (Hockings and Phillips 1999, Ostrom 2009, Watson *et al* 2014, Cadoret and Beuret 2016, Dehens and Fanning 2018, Fidler *et al* 2022). PA management effectiveness can be considered to consist of ecological effectiveness, that is the ability to deliver on nature conservation goals, and social effectiveness, that is the ability to deliver objectives and benefits for

local communities in and around the PA (Naidoo *et al* 2019, Ghoddousi *et al* 2022). However, social effectiveness is often neglected or absent in PA planning and management processes (Ban *et al* 2019).

Improving our understanding on how local communities interact with PAs can significantly contribute in assessing social effectiveness while meeting biodiversity conservation targets (Maxwell *et al* 2020). One critical step in order to capture the social effectiveness of PAs is to explore whether local communities living near or inside these areas support them. This is important as higher levels of public support can lead to more positive ecological outcomes via minimization of conflicts (Engen *et al*

2018), compliance with regulations (Chaigneau and Daw 2015), higher levels of participation in decision-making, more responsible environmental behaviour by users (Chaigneau and Daw 2015), increase of trust and higher transparency and democratization of decision making processes (Villasante *et al* 2021).

More importantly it is key to understand the determinants of people's level of support towards PAs to gain insights into what factors heighten or attenuate these perceptions. Support can be divided into stated and active support, the former referring to positive attitudes for the PA and the latter to actual behaviour (e.g. responsible environmental behaviour when using the PA) (Jones *et al* 2022). A mosaic of factors have been proposed aiming to explain the level of support for PAs ranging from sociodemographic characteristics to governance aspects (Carrus *et al* 2005, Fiall and Jacobson 2009, Bennett *et al* 2019, Jones *et al* 2022). Contributions from behavioural sciences emphasize that it is mainly individual factors that influence the level of stated and active support for environmental policies (Ajzen 1985, Stern *et al* 1999). Empirical studies have shown that personal values (Lépez-Mosquera and Sánchez 2012, Wynveen *et al* 2015) and pro-environmental attitudes (Carrus *et al* 2005) are key explanatory factors in explaining the level of support for PAs. Furthermore, individual place values, such as place attachment, are strongly connected with perceptions regarding PAs (Lin and Lockwood 2014). Social norms that exist within a community can also exert a significant role in understanding perceptions towards a PA (Stern *et al* 1995). If pro-environmental behavioural expectations are high, then a higher level of support would be expected by an individual for the PA.

Recent literature from conservation social science also highlights that perceptions of costs and benefits deriving from the designation of a PA (West *et al* 2006, Oldekop *et al* 2016, Jones *et al* 2017, Franks *et al* 2018, Bennett *et al* 2019, Keane *et al* 2020) influence the level of public support (Chaigneau and Brown 2016, Matseketsa *et al* 2018, McNeill *et al* 2018, Bennett *et al* 2019). The general assumption is that the higher the benefits perceived by locals the more positive attitudes and responsible behaviour the public will have, leading also to more ecologically effective PAs (Bennett and Dearden 2014). These impacts may refer to a variety of aspects including human wellbeing (MEA 2005, Jones *et al* 2020a), income (Estifanos *et al* 2020) and social relations (Jones *et al* 2020b). The distribution of these impacts between different stakeholders can significantly affect how ecologically effective and socially equitable a PA is (Zafra-Calvo *et al* 2019).

Recent research has also revealed that governance-the interactions among structures, processes and traditions that determine how power and responsibilities are exercised, how decisions are take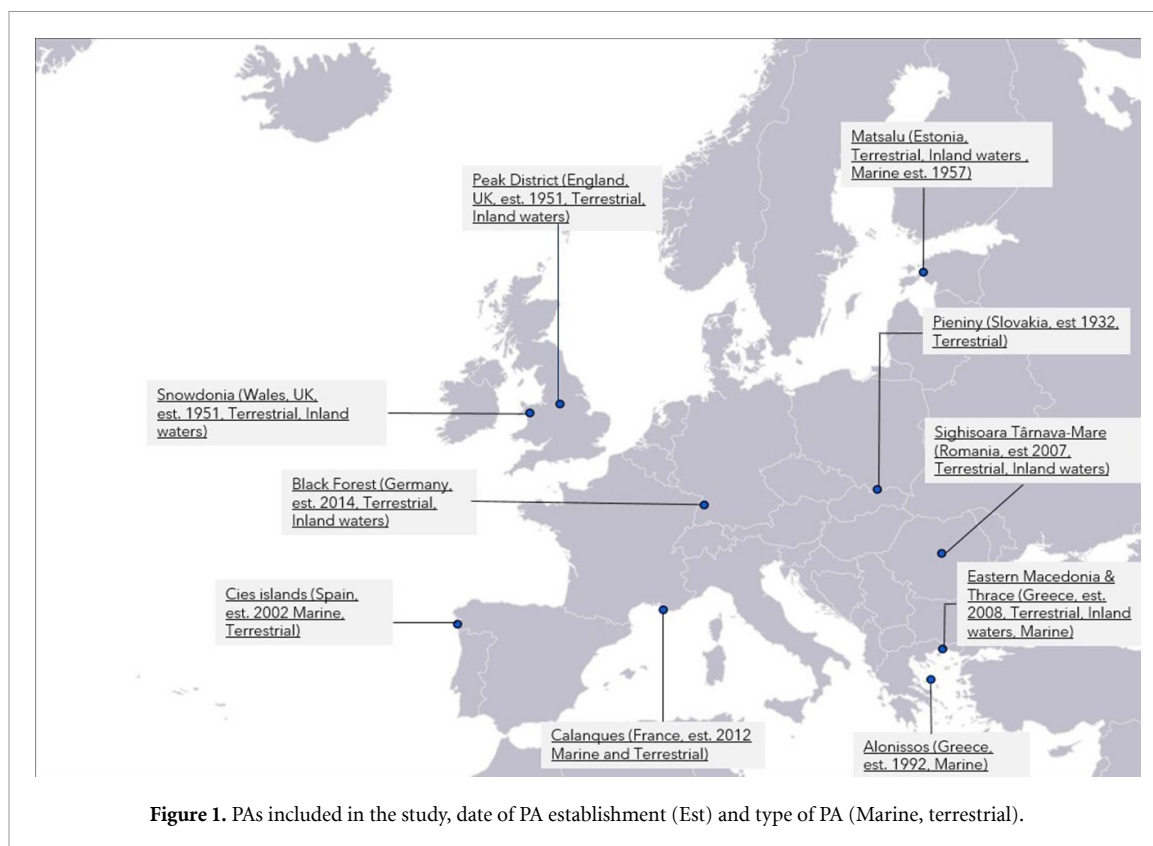n and how citizens and other stakeholders have their say (Borrini-Feyerabend *et al* 2013)-has significant impacts on the effectiveness of PAs (Fidler *et al* 2022). The Convention of Biological Diversity and Aichi Target 11 also highlight social equity and governance as crucial factors influencing the effectiveness of PAs (CBD 2010, Lockwood 2010, Schreckenberg *et al* 2016, Ban *et al* 2019, Bennett *et al* 2020). Aspects of governance have been directly linked to public support for PAs including the level of trust for management authorities (Cherry *et al* 2018, Bennett *et al* 2019) which is also strongly connected with issues of transparency in PA management (Gall and Rodwell 2016, Engen *et al* 2018). Similarly, whether people have enough opportunities to support a PA has been proven to influence both the level of support and public engagement activities (Grodzinska-Jurczak and Cent 2011, Di Franco *et al* 2016, Gall and Rodwell 2016).

Despite the above valuable contributions, the data gathered in existing studies are often fragmented and at small scale while the study of the relationships between the different factors which explain public support for PAs has not been considered empirically. We address this key research gap by developing and testing a new conceptual framework to analyse and consider the level of stated support by local communities living inside or near PAs looking into the interactions between individual social characteristics, governance indicators (trust in institutions, level and opportunities for public engagement) and people's perceptions of social impacts of the PA. We test a structural equation model using 19 explanatory indicators that also consider the interconnections between different factors. Using primary data from 3239 individuals living inside or near 10 European PAs we explore three key questions: (a) what is the level of stated public support for these PAs? (b) Which are the main factors influencing the level of public support? and (c) what are the links between social characteristics, governance indicators and perceived social impacts? By exploring these interconnections our large-scale study captures not just the influence of different factors on people's perceptions for PAs but also the interactions between these different elements providing a useful framework for practitioners that cuts across research areas in order to develop policy pathways to increase the level of support for PAs.

2. Methods

2.1. Description of sample and questionnaire

In order to analyse the level of support for PAs we developed a structured questionnaire which was distributed to local communities living inside or near the borders of these 10 European PAs, estimated to affect approximately 1.5 million local residents (figure 1). Main characteristics of the research areas are presented in table S1, in the supplementary material.

Figure 1. PAs included in the study, date of PA establishment (Est) and type of PA (Marine, terrestrial).

Table 1. Sample size included in the analysis.

Research areas	Country	Frequency	Percent	Cumulative percent
Peak District	England (UK)	367	11.4	11.4
Matsalu	Estonia	94	2.9	14.3
Calanques	France	523	16.1	30.4
Black Forest	Germany	498	15.4	45.8
Alonissos	Greece	162	5	50.8
National Park of Eastern Macedonia and Thrace	Greece	279	8.6	59.4
Sighisoara Tarnava Mare	Romania	198	6.1	65.5
Pieniny	Slovakia	221	6.8	72.3
CIES islands	Spain	284	8.8	81.1
Snowdonia	Wales (UK)	613	18.9	100
Total		3239	100	

Questionnaires were distributed between Autumn 2019 and Spring 2021 to a random sample of the local populations that are affected directly by the designation of the PAs: communities living both inside or near the boundaries of the PAs. After excluding missing answers the total sample was 3239 (table 1). The research areas were selected based on a number of criteria allowing us to explore key factors explaining support within different social-ecological contexts: (a) established PAs with a specific designation status (e.g. NATURA 2000 network, national parks); (b) PAs with dedicated management authorities, (c) PAs with different designation dates, and (d) PAs directly affecting local communities providing them with benefits but also having potential negative impacts. All research areas are from Europe, the region with the largest number of PAs in the world. The authors selected this specific region as they have done extensive work and have established a wide network of collaborations with park authorities which facilitated significantly the collection of a large number of primary data. All research areas are managed by central or regional governmental authorities.

The structured questionnaire was initially created based on a literature review regarding which factors have been identified as potential determinants of public support (see Jones *et al* 2022) and was then translated with the support of park authorities to ensure that all questions were meaningful for the local participants. Below we describe the selection of the main indicators included in our analysis (see also table 2):

Table 2. Questions included in the questionnaire and abbreviations used.

Category		Question and abbreviation	Scale of measurement
Public Support		Stated level of agreement regarding the existence of the PA and protection of the area (Stated Support)	5-point Likert scale: 1-lowest agreement, 5-highest agreement
Social impacts	How has the designation of the PA impacted you regarding the following issues in the past years?	Impact on personal income (Impact_income) Impact on quality of life (Impact_QoL) Impact on recreational activities (Impact_Rec)	5-point Likert scale: 1-very negative impact, 5- very positive impact,
Governance aspects	Trust in governance institutions: How much do you trust the following institutions:	PA management authority (Trust_MA) Local government (Trust_Gov)	5-point Likert scale: 1-lowest level of trust, 5-highest level of trust)
	Behavioural control: How much do you agree with the following statements?	I have enough time, money and opportunities to support the PA (Opportunities) I find it easy to support the PA (Easy)	5-point Likert scale: 1-lowest level of agreement, 5-highest level of agreement
	Engagement	I have volunteered in an activity supporting the PA in the past years (Volunteered)	
Social profile	Demographics	Gender	Male/female/other
		Education	Primary, secondary and vocational, higher education
		Age	Up to 35, 36–45, 46–55, 56–65, 66+, 0 (N/A)
		Income	No income, low, middle, high
	Values: Which degree of importance do you attach to the following values in your life?	Respecting the Earth: living in harmony with other species (Respect earth) Being Helpful to others (Helpful) Being influential: having an impact on people and events (Influential) Equality: equal opportunities for all (Equality)	5-point Likert scale: 1-lowest degree of importance, 5-highest degree of importance
	Social norms	Most people expect me to behave responsibly when I use the PA (Expect me) I expect other people to behave responsibly when using the PA (Expect others)	5-point Likert scale: 1-lowest level of agreement, 5-highest level of agreement
	Place attachment	The area of…means a lot to me (Place attachment)	5-point Likert scale: 1-lowest level of agreement, 5-highest level of agreement

Public support: Respondents were asked whether they agree or disagree (5-point Likert scale) with the designation of the PAs. This question captured attitude support for the PA.

Social impacts: Three indicators of social impacts were assessed focusing on the impact of the PA on personal income, quality of life and recreation (Jones *et al* 2020b). These three indicators were selected as they

represent the most common impacts of PAs in Europe (Jones *et al* 2020b). Respondents were asked what has been the impact of the PA on these issues on a 5-point scale ranging from very negative to very positive.

Governance indicators: In order to capture attitudes related to the governance system we selected four indicators used in previous studies. We asked participants: (a) how much they trust institutions involved in PA management following OECD guidelines of measuring trust (OECD 2017); (b) whether they have enough money, time and opportunities to support the PA (using Ajzen's question-Theory of Planned Behaviour, 1988), (c) whether they find it easy to support the PA (Ajzen 1985), and finally (d) we captured the actual level of engagement by asking participants whether they have volunteered in some activity supporting the PA in the past years (Dehens and Fanning 2018).

Social profile: indicators included four sets of questions: (a) environmental and social values of the respondents assessed using the widely used value belief norm (VBN) scale (Stern *et al* 1999), (b) place attachment using one question which has been commonly used in past studies capturing place attachment (Devine-Wright 2011, Steg *et al* 2018), (c) social norms referring mainly to what an individual expects from other users of the PA with regards to their behaviour and also what others expect from them, the questions drawn again from the VBN scale (Stern *et al* 1999, De Groot and Steg 2008) and (d) key demographic characteristics were also captured including gender, educational, income level and age. Education was captured based on the national categories and then transformed into key categories of primary, secondary and higher education. Similarly, income was captured in categories that reflect the local income levels and then transformed into four categories: no income, low, medium and high income. Average wage statistics were obtained from the relevant OECD database. Wages were used instead of income because the wages database is more up to date and does not equivalize (adjustments allowing for post-tax figures and household size). Once the average wage was calculated per country, thresholds were derived to accommodate participants' responses: 0.6 below the average (low), 0.6 below-1.4 above average (medium), 1.4 and above the average (high). In Sighisoara Tarnava Mare wage statistics were obtained from the Romanian government's statistics institute as they were not available at the OECD database) (https://insse.ro/cms/en). The figures were then placed in the threshold framework. Sample characteristics across all case studies are available in the supplementary material (table S2).

In all research areas the sampling frame included those who live inside the parks and in a maximum radius of 10 km. This resulted in a total sampling frame of over 1.5 million households. The reason for selecting communities both inside and outside the PA boundaries is because after initial site visits and discussions with local stakeholders we noted that in all of our sites the impacts of the PAs on income, quality of life and recreation are experienced not only by communities living inside the boundaries of the PA but also from those that live near their boundaries. In Sighisoara (Autumn 2019) and the National Park of Eastern Macedonia and Thrace (Summer 2020) the distribution was completed face to face by trained researchers following a cluster geographical sampling. In Snowdonia (Summer 2020), Black Forest (Spring 2021), Peak District (Summer 2020) and Matsalu (Autumn 2020) questionnaires were distributed online (using Qualtrics) due to COVID-19 restrictions. In Cies Islands of Galicia, Alonissos, the Calanques and Pieniny (Summer 2021) a combination of face-to-face and online distribution was conducted. For the online surveys postcards were sent to a representative sample of local households (average 5%–10% of the total sampling frame) using available mailing lists. Only in Matsalu due to lack of mailing lists the questionnaires were non-randomly distributed via local social networks. In the online surveys the questionnaires were also advertised online via social media and responses were cross-checked for statistical significant differences between the two sub-samples (those who received postcards and those who stated that they were informed of the survey online).

2.2. Statistical analysis

2.2.1. Ordinal logistic regression modelling

An ordinal logistic regression model (McCullagh 1980, Greene 2012) of the following form is fitted to the data in order to examine for differences between sites on the Likert scale variable of public support:

$$
\left\{
\begin{array}{l}
Y_i = 1 \text{ if } Y_i^* \leqslant \mu_1 \\
Y_i = 2 \text{ if } \mu_1 < Y_i^* \leqslant \mu_2 \\
Y_i = 3 \text{ if } \mu_2 < Y_i^* \leqslant \mu_3 \\
Y_i = 4 \text{ if } \mu_3 < Y_i^* \leqslant \mu_4 \\
Y_i = 5 \text{ if } \mu_4 < Y_i^* \leqslant \mu_5
\end{array}
\right\}
$$

$$
Y_i^* = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \cdots + \beta_9 X_{i9} + \varepsilon_i
$$

where Y_i denotes the ith response value of 1–5 Likert scale of public support variable ($i = 1,2,\ldots,3239$) and in the ordinal logistic model, Y^* denotes a continuous, unmeasured latent variable which is assumed that gives rise to the observed categories $1, 2, 3, 4, 5$ (McCullagh 1980). As an independent variable we use the categorical factor of PA, with levels being the various research areas. As a reference category, the Alonissos area is utilized, hence a total of 9 explanatory dummy variables X_{ij} are included in the model ($j = 1,2,\ldots,9$). By fitting this model, one is able to examine the statistically significant differences between the various research areas on the response variable of support. Figure S1 in the supplementary material presents the 95% confidence intervals of

parameter estimates from the 10 sites, with Alonissos introduced as a reference for comparison reasons.

2.2.2. Structural equation modelling

A structural equation modelling (SEM) approach (Bollen 1989) was followed in order to test the influence of the different factors on the level of support (figure 4). We hypothesize that all three factors (governance, social attributes and perceived social impacts) influence the level of support (H1). We also hypothesize that social profile, will influence governance indicators (Buta *et al* 2014) (H2) and that governance indicators will influence perceived social impacts (H4) (Abukari *et al* 2020, Armitage *et al* 2020) while the level of support for the PA will be influenced both by social impacts and governance indicators (McNeil *et al* 2018, Bennett *et al* 2019, Ayivor *et al* 2020). We also test whether social characteristics influence perceived social impacts (H3). In addition, we also include a random effects term as a covariate in order to account for unobserved heterogeneity in the response variable of public support as a source of regional heterogeneity (e.g. Lefcheck 2016). This is due to the fact that the typical SEM model assumes the data to be independent, which potentially might not hold in the current dataset since there are likely PA-specific characteristics. To this end, we follow relevant research (e.g. Wooldridge 2002, Bollen and Brand 2010) and treat regional PA effects as a random effect variable, in the sense that the random term is assumed to be independent of all other model covariates.

A small portion of the final selected dataset for the analysis included missing data in few of the variables. In overall, the percentage of missing values did not exceed the 5% of overall data in a single variable. Missing data in at least one of the variables were included in all PAs. Multiple imputation (MI) methodology was applied to impute missing data in the sample, which is considered one of the most reliable processes for handling missing data in multivariate analysis (see Rubin 1996, Graham and Schafer 1999). To perform MI, the SPSS MI module was utilized (IBM Corp. Released 2020). The procedure for replacing missing values was conducted within each PA in order to ensure that the missing values will be replaced based on similar socioeconomic and regional profiles of the respondents. An exploratory factor analysis on the latent factors subsequently utilized for SEM was initially conducted (using SPSS 27.0) in order to measure the percentage of variance explained by each latent factor. In addition, to test for the factors' reliability and validity, the Cronbach's alpha was calculated (Bollen 1989).

The SEM models were fitted by the method of weighted least squares (Jöreskog 1994), which is most suitable for non-normal data types, such Likert scale measurements. In order to examine the validity of indirect associations, the bootstrap approach introduced by Preacher and Hayes (2004) is utilized. The AMOS statistical software (Arbuckle 2006) was used to fit the different structural equation models to the data.
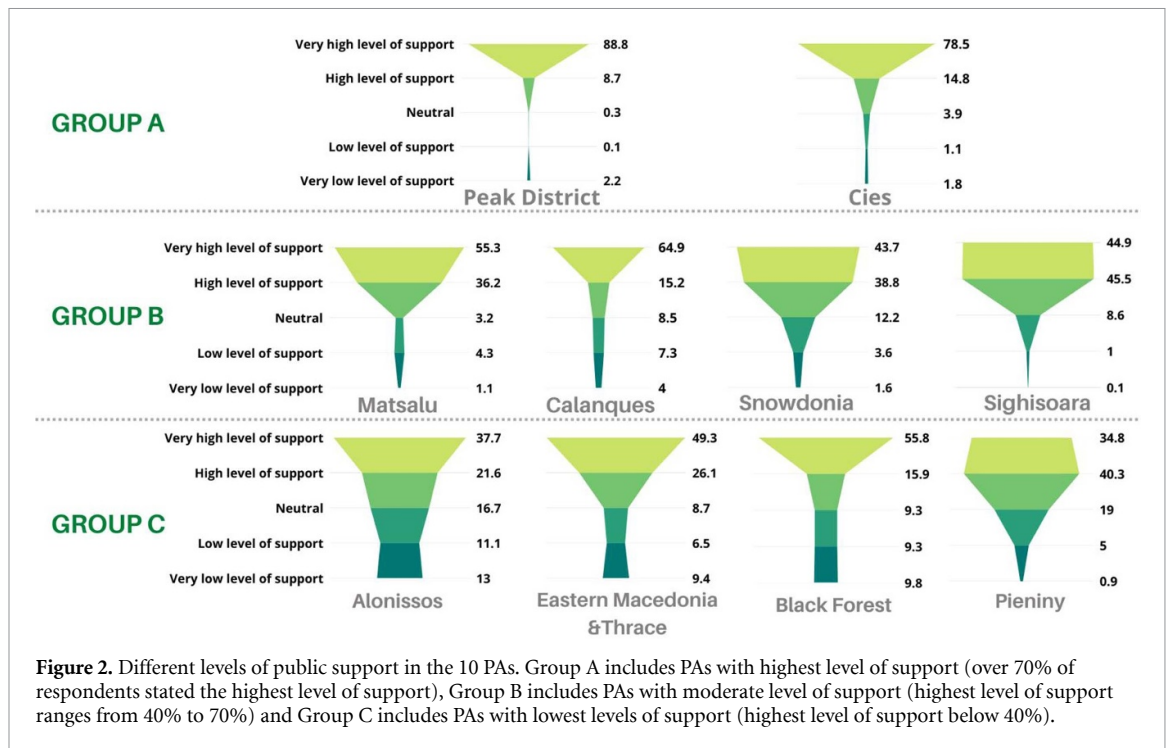
3. Results

We elicited the level of support in the 10 PAs by asking people whether they agree or not with their local natural beauty spot being designated as a PAs measured on a 5 point Likert scale (see also section 2). A relatively high level of support for the PAs was noted across all sites (figure 2, Funnel graphs); 57.1% of participants stated the highest level of support for the PA and approximately only 10% had negative perceptions (figure 2). The highest level of support was recorded in the Peak District and Cies Islands National Parks while support levels were lowest in the Black Forest and Alonissos National Parks.

When comparing the 10 research areas, the differences are statistically significant (chi-square: 617 800, $p < 0.01$). Using Alonissos as a reference category (due to having the lowest level of support) we run a Poisson log-linear regression model and observe that most areas differ with Alonissos, except for the three areas of Black Forest, National Park of Eastern Macedonia and Thrace and Pieniny where statistical difference is negligible. Based on these results, the 10 sites can be divided into three main groups (figure 2): Group A: it includes the areas with the highest levels of support: Peak District and Cies Islands. The Peak District is the most highly supported park in our sample and is also one of the oldest parks in the sample having been established in the 1950s, Group B, which includes areas with a moderate level of support: Matsalu, Calanques, Sighisoara, and Snowdonia and, finally Group C, including areas with a lower level of support such as the Black Forest, National Park of Eastern Macedonia and Thrace, Pieniny and Alonissos.

3.1. Explaining differentiated levels of support for PAs

A correlation analysis (Spearman Rho) was initially conducted with 19 potential public support determinants (see section 2 for full details of indicators selected) including: (a) governance indicators (trust in management authority, how easy it is to support the PA, whether the individual has enough opportunities to support the PA, whether they have volunteered to support the PA); (b) perceptions of social impacts relating to income, recreational activities and quality of life and (c) social characteristics including personal values, place attachment, social norms (behavioural control) and key demographics including income, gender, education and age). All indicators in our questionnaires have been used in past studies mainly in the behavioural sciences literature (see section 2).

Figure 2. Different levels of public support in the 10 PAs. Group A includes PAs with highest level of support (over 70% of respondents stated the highest level of support), Group B includes PAs with moderate level of support (highest level of support ranges from 40% to 70%) and Group C includes PAs with lowest levels of support (highest level of support below 40%).

The level of support was positively correlated with all indicators included in the analysis apart from age. The strongest correlations (Rho > 0.3) found were between public support and impact on quality of life and recreation, importance of respecting the Earth (environmental values), trust in the management authority of the PA and place attachment (figure 3).

3.2. Governance indicators, social impacts and social characteristics

Having examined the links between public support and different determinants the next step is to explore how these different elements interact while simultaneously capturing their influence on the level of support for PAs.

The empirical realization of the theoretical model exploring interactions between governance indicators, social impacts and the social profile is performed by the fit of a SEM, using the data from all 10 PAs. Factors utilized for SEM analysis have been tested for reliability and validity (see table S2 in the supplementary material). Results reveal that the utilized latent constructs fulfil the reliability and validity prerequisites. Also, no common method bias was noted in the collected data with variance explained by each construct being higher than 50%, with few minor exceptions near the borderline.
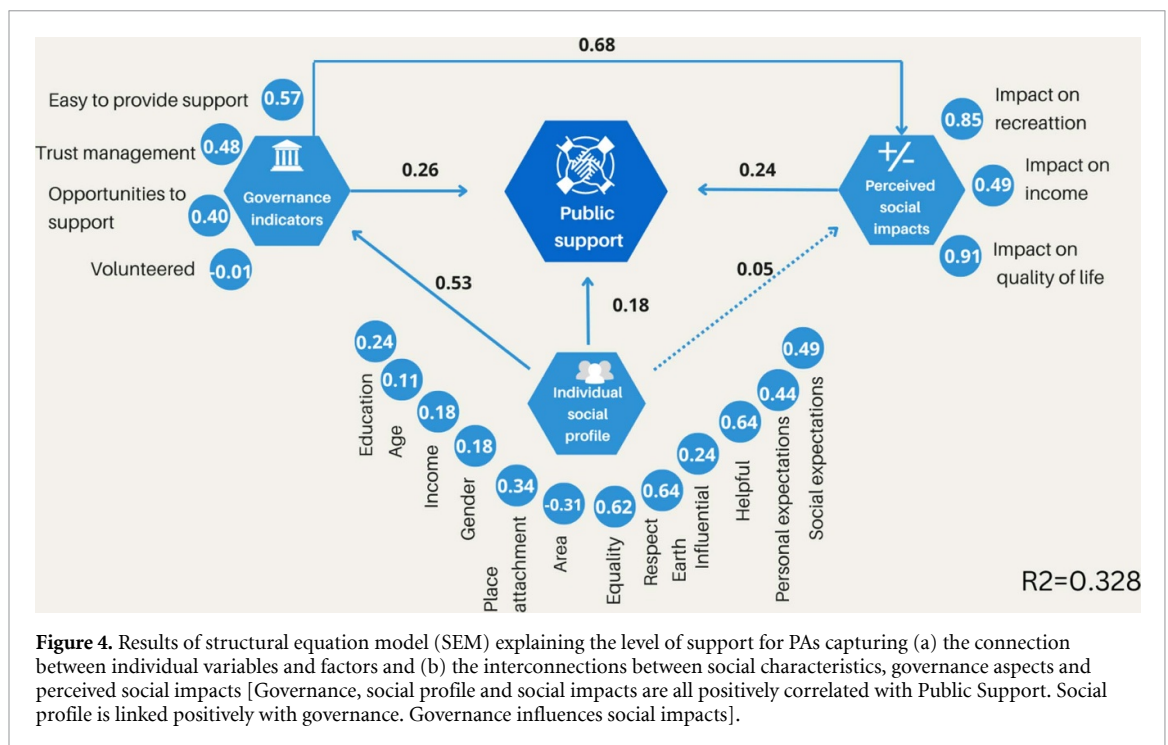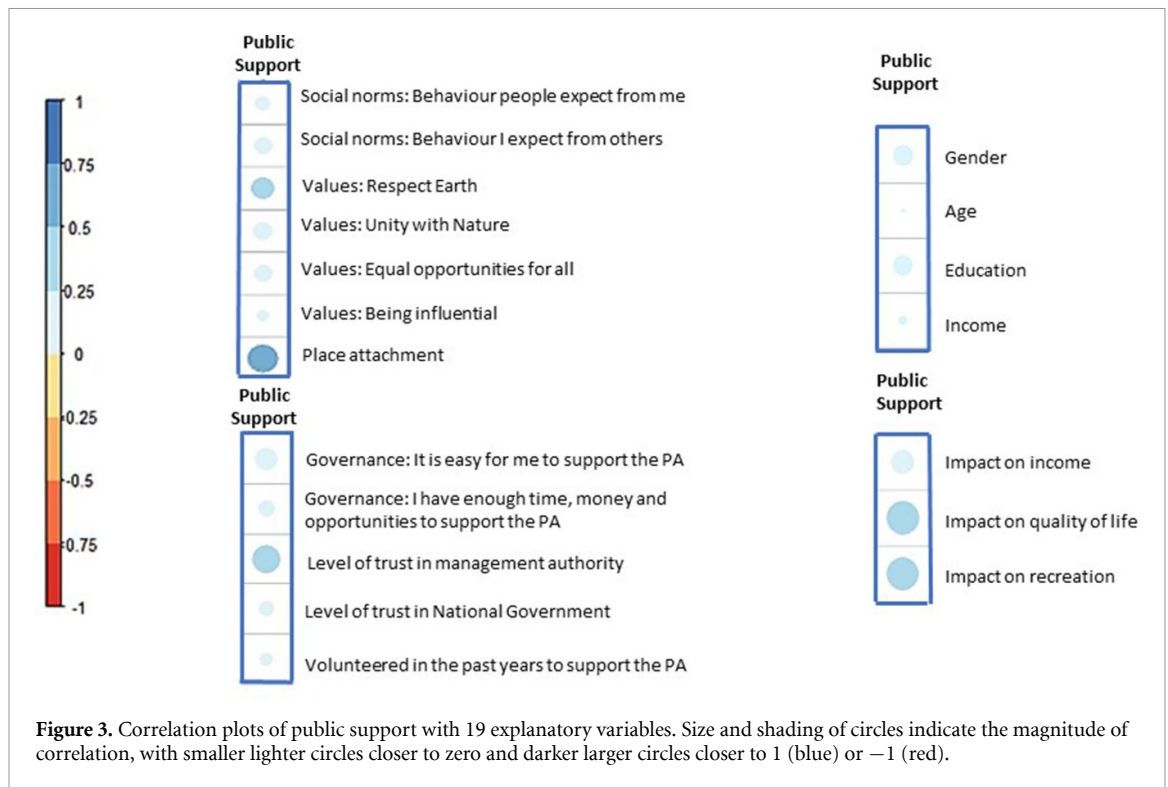
3.3. Goodness-of-fit of the SEM models

The ability of the SEM model to reproduce the data or alternatively the ability of a good fit between the model and the sample's data is checked through well-established goodness-of-fit indices revealing that our model has on average a good fit (see section 2).

The robustness and validity of the SEM models was checked through a number of goodness-of-fit statistics (Marsh and Balla 1994), including the root mean square residual (RMR), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI) and the root mean square error of approximation (RMSEA), with AGFI adjusting the GFI for the complexity (e.g. for increased number of observed variables in the model) of the fitted model. Typically, for a good fit the indices GFI and AGFI should be above 0.9, and accordingly RMSEA should be generally below 0.08 which is the case for our model, however these cut-off thresholds have been often criticized (see e.g. Sideridis *et al* 2014, Shi *et al* 2019). The model fit indicators are generally above the acceptable limits for a valid SEM model (i.e. RMR: 0.08; GFI: 0.901; AGFI: 0.868; PMSEA: 0.089). These results are indicative of a moderate to good fit, given the number of included variables in the model and data.

3.4. Results of the SEM model

In the SEM model all 19 explanatory variables were added in order to test the four hypotheses. Three main factors were created from the 19 initial variables representing the social profile, governance and social impacts. All connections in the path diagram were statistically significant apart from the link between social impacts and social profile. Full results of the SEM model are presented in figure 4 which shows estimated standardized path coefficients. All values were significant with a *p*-value < 0.001 except the connection between socio-demographic profile-social impacts and Governance factor and volunteering.

Figure 3. Correlation plots of public support with 19 explanatory variables. Size and shading of circles indicate the magnitude of correlation, with smaller lighter circles closer to zero and darker larger circles closer to 1 (blue) or −1 (red).

Figure 4. Results of structural equation model (SEM) explaining the level of support for PAs capturing (a) the connection between individual variables and factors and (b) the interconnections between social characteristics, governance aspects and perceived social impacts [Governance, social profile and social impacts are all positively correlated with Public Support. Social profile is linked positively with governance. Governance influences social impacts].

The 19 explanatory indicators were merged via the SEM in the three broad factors capturing an individual's social profile (values, norms, place attachment, demographics), governance indicators (institutional trust, engagement and opportunities to support) and perceived social impacts (impact on income, quality of life and recreation). When exploring the simultaneous influence of these three factors on the level of support, our findings show that all three factors are important in explaining the level of support with a stronger influence from perceived social impacts (beta = 0.241, $p < 0.01$) and governance indicators (beta = 0.258, $p < 0.01$) (figure 4). The influence of individual social characteristics is slightly lower (beta = 0.178, $p < 0.01$). All connections are positive, meaning that higher values in all

Table 3. Mediation bootstrap test of indirect associations between factors.

Association	Effects	Standardized estimates	*p*-value
Social profile →	Direct effect	0.178	<0.001[a]
Governance indicators →	Indirect effect	0.137	<0.001[a]
Public support	Total effect	0.315	<0.001[a]
Social profile →	Direct effect	0.05	n.s.
Governance indicators →	Indirect effect	0.362	<0.001[a]
Social impacts indicators	Total effect	0.413	<0.001[a]
Social profile → Social	Direct effect	0.178	<0.001[a]
impacts indicators →	Indirect effect	0.012	n.s.
Public support	Total effect	0.190	<0.001[a]

a: *p*-value < 0.01; n.s.: non-significant.

three factors (individual social profile, governance indicators and perceived impacts) lead to higher levels of support.

It is also relevant to examine potential indirect (mediation effects) associations between the three main explanatory factors and public support. The bootstrap test for mediation effects was utilized in order to test for potential statistically significant mediation effects of governance factor and social impacts on the relation between 'social profile' and 'public support', and the mediation effects of governance factor on the relation between social profile and social impacts (see table 3). The analysis revealed that the two mediation effects (mediation effect of governance on the association between the social profile with social impacts and social profile with public support) are statistically significant (indirect effects are 0.362 and 0.137, respectively). The mediation effect of social impacts on the relation between an individual's social profile and public support is not important (indirect effect = 0.012). Especially for the relation between social profile and public support we found that the indirect mediation effect of the governance system (beta = 0.137; *p*-value < 0.01), significantly enhances the direct effect (at an overall effect of the value of 0.31).

In summary, the mediation effects of governance systems seem to be important in explaining associations between an individual's social profile with their perceived social impacts and public support for a PA. This means that higher values in the individual's social profile (e.g. an individual with stronger environmental values and place attachment) would result in higher levels of trust in governance institutions and higher willingness to engage with activities supporting the PA. Also, those individuals who tend to score higher in governance indicators (higher level of trust and public engagement) perceive higher benefits from the PA.

These results show that the social profile of a respondent influences mainly their level of trust in governance institutions and their engagement with supporting activities for the PA. Thus, individual social profiles have an impact on how much people are willing to engage with PA supporting activities

but do not influence how they perceive social impacts of the PA. Social impacts are mainly affected by governance attributes (beta = 0.69, *p* < 0.05). Thus the level of trust towards management institutions, whether someone is able to support a PA and also whether they feel that they have opportunities to support influences strongly how they perceive the impacts of the PA. This finding suggests that higher levels of engagement within the governance system can also lead to lower perceived costs for local communities.

4. Discussion

When examining the level of support for the 10 PAs included in our study we found significant differentiations, ranging from very high levels (Peak District and Cies Islands National Parks) to low levels of support (Alonissos National Park) (see also figure S1 in the supplementary material). Considering that PAs are often designated in order to meet a variety of targets, covering both ecological and socio-economic outcomes, our study reveals that in the PAs with the low level of support significant steps need to be undertaken in order to increase their social effectiveness and equitability.

An important step in this direction is to identify which are the most important factors influencing people's perceptions. Positive correlations were noted in our study in 18 out of the 19 indicators considered revealing that there is a very broad range of factors that influence the level of support. For example, in our study, trust in institution has a key role in explaining public support which has also been identified as a potential explanatory parameter for low levels of support for PAs across the world (e.g. Ordonez-Gauger *et al* 2018, Cadoret 2021) and in some of our case studies (e.g. Dikou and Dionysopoulou 2011). Social impacts also play a key role in determining the level of support and previous studies have shown that fears regarding the impact of a PA on the local economy, local culture and quality of life are key concerns leading to negative perceptions from locals (Hoffmann 2015). An important finding is that correlation with impact on income is not as strong as the correlations

with the impact on quality of life and impact on recreation. Previous studies have focused on the important role that PAs may have on livelihoods (Naidoo *et al* 2019). Our study shows that, at least within the European context, other impacts may have a more important role in explaining people's level of support for a PA. We would like to note, however, that although our study is based on a large sample size in Europe, the region with the largest number of PAs in the world, our findings might not be necessarily applicable in certain locations with highly restrictive regimes, or in areas with presence of indigenous peoples and local communities (e.g. PAs where local communities are displaced or excluded completely from the governance processes).

Considering the broad range of indicators that can potentially explain the level of support, we propose in this study a new conceptual framework to improve our understanding of how different indicators are connected and explain the level of support for PAs. Our research advances existing studies which examine the impact of individual parameters on the level of public support for a PA (Carrus *et al* 2005, Fiallo and Jacobson 2009, Bennett *et al* 2019). Our results show that public support is explained by the combined influence of the PA's perceived social impacts, an individual's socio-demographic attributes and governance indicators relating to the individual (trust in management authorities and public engagement). The influence from social impacts and the governance system proved stronger. Our findings indicate that individual socio-demographics bear only a limited effect on perceived social impacts, but do exert a key role on how much people trust the management authority, whether they feel they are able to support the PA and if they engage with supporting activities. Thus our analysis demonstrates that the mediation effects of governance indicators, such as trust in institutions and level of public engagement, are important in explaining associations between an individual's social profile and their perceived social impacts with public support.

5. Conclusion

In this study we explored the level of support for 10 European PAs by the communities living near or inside them. We found that in order to improve our understanding of the level of support for PAs we need to consider the interactions between governance aspects, perceived social impacts and the social profile of the community where the PA is established. These results offer key insights for national, European and international biodiversity conservation policies and for practitioners involved in their implementation. Future policies (e.g. the EU 2030 Biodiversity Strategy and the Kunming-Montreal Global Biodiversity Framework which set targets to protect a minimum of 30% of the world's land and sea areas) that will be able to take into account these interconnections may more accurately reflect how people experience PAs, so as to then design more effective actions to increase the level of support for PAs leading also in turn to more responsible behaviour and higher levels of public engagement. We propose that future efforts to increase the level of support for a PA need to focus first on key local social characteristics such as environmental values, social norms, and place attachment. Policy actions would benefit by moving away from policies aiming solely to mitigate negative economic impacts of PAs and instead researching and understanding the local population and their communities to then be able to better negotiate common understandings about pro-environmental behaviour, place value and collective social norms. Changes on this level of the social system can result in increased public engagement and trust, higher perceived benefits and as a consequence lead to higher levels of support for a PA.

Data availability statement

The data cannot be made publicly available upon publication because they contain sensitive personal information. The data that support the findings of this study are available upon reasonable request from the authors.

Conflict of interest

The authors declare no competing interest.

ORCID iDs

Nikoleta Jones ⬤ https://orcid.org/0000-0003-2899-2075
Sebastian Villasante ⬤ https://orcid.org/0000-0001-6296-4479

Juraj Svajda ⬤ https://orcid.org/0000-0003-4528-9963

Vassilis Gkoumas ⬤ https://orcid.org/0000-0002-0501-7392

Anne Cadoret ⬤ https://orcid.org/0000-0003-1074-5252

Panayiotis G Dimitrakopoulos ⬤ https://orcid.org/0000-0002-8374-4392

Victoria Maguire-Rajpaul ⬤ https://orcid.org/0000-0001-7896-0077

Kalev Sepp ⬤ https://orcid.org/0000-0002-8076-7943

References

Abukari H and Mwalyosi R B 2020 Local communities' perceptions about the impact of protected areas on livelihoods and community development *Glob. Ecol. Conserv.* **22** e00909

Ajzen I 1985 From intentions to actions: a theory of planned behavior *Action Control* ed J Kuhl and J Beckmann (Berlin: Springer) pp 11–39

Arbuckle J L 2006 *Amos 70 User's Guide* (Chicago, IL: SPSS)

Armitage D, Mbatha P, Muhl E-K, Rice W and Sowman M 2020 Governance principles for community centered conservation in the post 2020 global biodiversity framework *Conserv. Sci. Pract.* **2** e160

Ayivor J S, Nyametso J K and Ayivor S 2020 Protected area governance and its influence on local perceptions, attitudes and collaboration *Land* **9** 310

Ban N C *et al* 2019 Well-being outcomes of marine protected areas *Nat. Sustain.* **2** 524–32

Bennett N J *et al* 2020 Social equity and marine protected areas: perceptions of small scale fishermen in the Mediterranean Sea *Biol. Conserv.* **244** 108531

Bennett N J and Dearden P 2014 Why local people do not support conservation: community perceptions of marine protected area livelihood impacts, governance and management in Thailand *Mar. Policy* **44** 107–16

Bennett N J, Di Franco A, Calò A, Nethery E, Niccolini F, Milazzo M and Guidetti P 2019 Local support for conservation is associated with perceptions of good governance, social impacts and ecological effectiveness *Conserv. Lett.* **12** e12640

Bollen K A 1989 *Structural Equations with Latent Variables* (New York: Wiley)

Bollen K and Brand J 2010 A general panel model with random and fixed effects: A structural equations approach *Soc. Forces* **89** 1–34

Borrini-Feyerabend G, Dudley N, Jaeger T, Lassen B, Pathak Broome N, Phillips A and Sandwith T 2013 Governance of protected areas: from understanding to action *Best Practice Protected Area Guidelines Series No 20* (Gland: IUCN) pp xvi + 124

Buta N, Holland S M and Kaplanidou K 2014 Local communities and protected areas: the mediating role of place attachment for pro-environmental civic engagement *J. Outdoor Recreat. Tour.* **5** 1–10

Cadoret A 2021 Conflicts and acceptability of visitation management measures for marine protected areas: the case of Porquerolles Port-Cros National Park *Ocean Coast. Manage.* **204** 105547

Cadoret A and Beuret J-E 2016 Aire Marine Protégée, intérêt général environnemental et territoire, un rendez-vous manqué ? Le cas de Mayotte *VertigO—la revue électronique en sciences de l'environnement* **16**

Carrus G, Bonaiuto M and Bonnes M 2005 Environmental concern, regional identity, and support for protected areas in Italy *Environ. Behav.* **37** 237–57

CBD-Convention on Biological Diversity 2010 Aichi 11 Convention on Biological Diversity (CBD) *Aichi Target 11—Technical Rationale Extended* COP/10/INF/12/Rev1 (available at: wwwcbdint/sp/targets/rationale/target-11/)

Chaigneau T and Brown K 2016 Challenging the win-win discourse on conservation and development: analyzing support for marine protected areas *Ecol. Soc.* **21** 36

Chaigneau T and Daw T M 2015 Individual and village-level effects on community support for marine protected areas (MPAs) in the Philippines *Mar. Policy* **51** 499–506

Cherry C, Scott K, Barrett J and Pidgeon N 2018 Public acceptance of resource-efficiency strategies to mitigate climate change *Nat. Clim. Change.* **8** 1007–12

De Groot J I M and Steg L 2008 Value orientations to explain beliefs related to environmental significant behavior-how to measure egoistic, altruistic and biospheric value orientations *Environ. Behav.* **40** 330–54

Dehens L A and Fanning L 2018 What counts in making marine protected areas (MPAs) count? The role of legitimacy in MPA success in Canada *Ecol. Indic.* **86** 45–57

Devine-Wright P 2011 Enhancing local distinctiveness fosters public acceptance of tidal energy: a UK case study *Energy Policy* **39** 83–93

Di Franco A *et al* 2016 Five key attributes can increase marine protected areas performance for small-scale fisheries management *Sci. Rep.* **6** 38135

Dikou A and Dionysopoulou N 2011 Communicating a marine protected area through the local press: the case of the National Marine Park of Alonissos, Northern Sporades, Greece *Environ. Manage.* **47** 777–88

Engen S, Runge C, Brown G, Fauchald P, Nilsen L and Hausner V 2018 Assessing local acceptance of protected area management using public participation GIS (PPGIS *J. Nat. Conserv.* **43** 27–34

Estifanos T K, Polyakov M, Pandit R, Hailu A and Burton M 2020 The impact of protected areas on the rural households' incomes in Ethiopia *Land Use Policy* **91** 104349

Fiall E and Jacobson S 2009 Local communities and protected areas: attitudes of rural residents towards conservation and Machalilla National Park, Ecuador *Environ. Conserv.* **22** 241–9

Fidler R Y *et al* 2022 Participation, not penalties: community involvement and equitable governance contribute to more effective multiuse protected areas *Sci. Adv.* **8** eabl8929

Franks P, Broker F and Roe D 2018 Understanding and assessing equity in protected area conservation: a matter of governance, rights, social impacts and human wellbeing *IIED Issue Paper* (London: IIED) (available at: http://pubsiiedorg/14671IIED)

Gall S C and Rodwell L D 2016 Evaluating the social acceptability of marine protected areas *Mar. Policy* **65** 30–38

Goddhousi A, Loos J and Kuemmerle T 2022 An outcome-oriented social-ecological framework for assessing protected areas effectiveness *Bioscience* **72** 201–12

Graham J W and Schafer J L 1999 On the performance of multiple imputation for multivariate data with small sample size *Statistical Strategies for Small Sample Research* ed R Hoyle (Thousand Oaks, CA: Sage) p 1–29

Greene W H 2012 *Econometric Analysis* 5th edn (Hoboken, NJ: Prentice-Hall) pp 740–52

Grodzinska-Jurczak M and Cent J 2011 Expansion of nature conservation areas: problems with Natura 2000 implementation in Poland? *Environ. Manage.* **47** 11–27

Hockings M and Phillips A 1999 How well are we doing?—some thoughts on the effectiveness of protected areas *Parks* **9** 5–14

Hoffmann A 2015 Much ado about doing nothing: the conflicts about the Black Forest national park as a call for integrating forgotten understanding of nature *Master Thesis Series in Environmental Studies and Sustainability Science no 2015: 037* (Lund University Centre for Sustainability Studies) (available at: https://lup.lub.lu.se/luur/download?func=downloadFile&recordOID=8259957&fileOID=8259958)

IBM Corp Released 2020 *IBM SPSS Statistics for Windows* (Armonk, NY: IBM Corp) Version 270

Jones N, Graziano M and Dimitrakopoulos P G 2020b Social impacts of European protected areas and policy recommendations *Environ. Sci. Policy* **112** 134–40

Jones N, Malesios C, Kantartzis A and Dimitrakopoulos P G 2020a The role of location and social impacts of protected areas on subjective wellbeing *Environ. Res. Lett.* **15** 114030

Jones N, McGinlay J, Kontoleon A, Maguire-Rajpaul V A, Dimitrakopoulos P G, Gkoumas V, Riseth J A, Sepp K and Vanclay F 2022 Understanding public support for European protected areas: a review of the literature and proposing a new approach for policy makers *Land* **11** 733

Jones N, McGinlay J and Dimitrakopoulos P G 2017 Improving social impact assessment of protected areas: a review of the literature and directions for future research *Environ. Impact Assess. Rev.* **64** 1–7

Joreskog K G 1994 *PRELIS 2 User's Guide* (London: Routledge)

Keane A, Lund J F, Bluwstein J, Burgess N D, Nielsen M R and Homewood K 2020 Impact of Tanzanias's wildlife management areas on household wealth *Nat. Sustain.* **3** 226–33

Lefcheck J S 2016 Piecewisesem: piecewise structural equation modelling in R for ecology, evolution, and systematics *Methods Ecol. Evol.* **7** 573–9

Lin C-C and Lockwood M 2014 Forms and sources of place attachment: evidence from two protected areas *Geoforum* **53** 74–81

Lockwood M 2010 Good governance for terrestrial protected areas: a framework, principles and performance outcomes *J. Environ. Manage.* **91** 754–66

Lopez-Mosquera N and Sanchez M 2012 The role of satisfaction and emotional response in the choice mechanisms of suburban natural-areas users *Environ. Manage.* **49** 174–91

Marsh H W and Balla J 1994 Goodness of fit in confirmatory factor analysis: the effects of sample size and model parsimony *Qual. Quant.* **28** 185–217

Matseketsa G, Chibememe G, Muboko N, Gandiwa E and Takarinda K 2018 Towards an understanding of conservation-based costs, benefits and attitudes of local people living adjacent to Save Valley conservancy, Zimbabwe *Scientifica* **2018** 6741439

Maxwell S L *et al* 2020 Area-based conservation in the twenty-first century *Nature* **586** 217–27

McCullagh P 1980 Regression models for ordinal data *J. R. Stat. Soc. Ser. B Methodol.* **42** 109–42

McNeill A, Clifton J and Harvey E S 2018 Attitudes to a marine protected area are associated with perceived social impacts *Mar. Policy* **94** 106–18

MEA, Millennium Ecosystem Assessment 2005 *Ecosystems and Human Well-Being: Synthesis* (Washington, DC: Island Press)

Naidoo R *et al* 2019 Evaluating the impacts of protected areas on human well-being across the developing world *Sci. Adv.* **5** eaav3006

OECD 2017 *OECD Guidelines on Measuring Trust* (Paris: OECD Publishing)

Oldekop J A, Holmes G, Harris W E and Evans K L 2016 A global assessment of the social and conservation outcomes of protected areas *Conserv. Biol.* **30** 133–41

Ordonez-Gauger L, Richmond L, Hackett S and Chen C 2018 It's a trust think: assessing fishermen's perceptions of the California North Coast marine protected area network *Ocean Coast. Manage.* **158** 144–53

Ostrom E A 2009 General framework for analyzing sustainability of social-ecological systems *Science* **325** 419–22

Preacher K J and Hayes A F 2004 SPSS and SAS procedures for estimating indirect effects in simple mediation models *Behav. Res. Meth. Instrum. Comput.* **36** 717–31

Rubin D B 1996 Multiple imputation after 18+ years *J. Am. Stat. Assoc.* **91** 473–89

Schreckenberg K, Franks P, Martin A and Lang B 2016 Unpacking equity for protected area conservation *Parks* **22** 11–26

Shi D, Lee T and Maydeu-Olivares A 2019 Understanding the model size effect on SEM fit indices *Educ. Psychol. Meas.* **79** 310–34

Sideridis G, Simos P, Papanicolaou A and Fletcher J 2014 Using structural equation modeling to assess functional connectivity in the brain: power and sample size considerations *Educ. Psychol. Meas.* **74** 733–58

Steg L 2018 Theories to explain environmental behavior *Environmental Psychology: An Introduction* 2nd edn, ed L Steg and J I M de Groot (Toronto: Wiley) pp 218–27

Stern P C, Dietz T, Abel T, Guagnano G A and Kalof L 1999 A value-belief-norm theory of support for social movements: the case of environmentalism *Hum. Ecol. Rev.* **6** 81–97

Stern P C, Dietz T and Guagnano G A 1995 The new environmental paradigm in social psychological perspective *Environ. Behav.* **27** 723–45

Villasante S, Tubio A, Gianelli I, Pita P and Garcia-Allut A 2021 Ever changing times: sustainability transformations of Galician small-scale fisheries *Front. Mar. Sci.* **8** 712819

Watson J E M, Dudley N, Segan D and Hockings M 2014 The performance and potential of protected areas *Nature* **515** 67–73

West P, Igoe J and Brockington D 2006 Parks and peoples: the social impact of protected areas *Annu. Rev. Anthropol.* **35** 251–77

Wooldridge J 2002 *Econometric Analysis of Cross Sectional and Panel Data* (Cambridge, MA: The MIT Press)

Wynveen C J, Wynveen B J and Sutton S G 2015 Applying the value-belief-norm theory to marine contexts: implications for encouraging pro-environmental behavior *Coast. Manage.* **43** 84–103

Zafra Calvo N, Garmendia E, Pascual U, Palomo I, Gross-Camp N, Brockington D, Cortes-Vazquez J-A, Coolsaet B and Burgess N D 2019 Progress toward equitably managed protected areas in Aichi target 11: a global survey *BioScience* **69** 191–7