



# Citizen preferences for supporting farmers in sustainable rural management: An analysis of five biogeographically differentiated European countries

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## ABSTRACT

Farmers' adoption of sustainable practices is important if rural management is to deliver against environmental targets. Developing policies that enable such practices requires the support of broader society, including citizens with differing priorities and values related to e.g. food production and environmental protection. The aim of this research was to investigate European citizens' attitudes towards different approaches to promoting sustainable practices among farmers (financial incentivisation for adopters, technical advice regarding traditional methods, and technical advice regarding innovative technological approaches) as well as personal and environmental drivers of these attitudes from a Social Cognitive Theory perspective. Online survey data were analysed from 3,190 citizens in the Czech Republic (n = 649), Spain (n = 623), Sweden (n = 645), Switzerland (n = 641), and the UK (n = 632). These countries represented biogeographical regions with different habitat conditions and roles for agriculture within their national economies. The results indicated that participants from all of the five countries expressed a moderate to high level of support for financial incentivisation, with Swiss participants showing the lowest level of support. A similar range of moderate to high support was shown for technical advice on traditional methods and innovative technological approaches, with traditional methods receiving greater support than innovative approaches in all countries except for Spain. A two-step cluster analysis based on participants' perceptions of ecosystem service benefits in, and threats to, rural areas identified four segments within the participant sample: 'rural ES benefits-focused citizens', 'citizens moderately engaged in rural multifunctionality', 'citizens highly engaged in rural multifunctionality', and 'ecocentric citizens'. Multiple regression analyses showed that highly engaged citizens tended to have the highest levels of support for all three approaches to promoting sustainable practices, whereas moderately engaged citizens demonstrated the lowest levels of support. Individuals with stronger preservationist environmental attitudes, and with higher trust in farmers and landowners, were associated with greater support. The results provide evidence for guiding future citizen engagement and policymaking related to pro-environmental rural management initiatives.

## 1. Introduction

Climate change and environmental degradation represent challenges to the environmental and economic sustainability of European rural areas, which may result in the abandonment of large areas of agricultural land (Tindale et al., 2024) and negative impacts on biodiversity and soil health (Reif et al., 2024; Xue et al., 2022). Societal concerns regarding the sustainability of current farming practices and the

long-term health of rural ecosystems are reflected through policy interventions, such as the European Green Deal and the EU Biodiversity Strategy for 2030, which aim to restore and enhance rural multifunctionality through the lens of ecosystem services (ES) (Kosenchuk et al., 2019; Nowack et al., 2022; Y. Zhang et al., 2023). These ES include provisioning services, e.g. production in relation to food, regulatory and supporting services, such as soil fertility, water regulation, and carbon sequestration, and cultural services, including tourism, education, and

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aesthetic value (Bengtsson et al., 2019; Haines-Young and Potschin-Young, 2023). Rural areas are providers of a range of public goods and services within multifunctional rural landscapes (Gómez-Limón et al., 2012; Shi et al., 2022).

Farmers and land managers are important stakeholders who make decisions about agricultural practices and influence the manifestation of agricultural land use change (Lastra-Bravo et al., 2015; Prager and Freese, 2009). European policies increasingly support farmers and land managers through subsidies for pro-environmental agronomic actions. The rationale driving European agri-environmental subsidies is the recognition that farmers need to be compensated for income lost, and additional costs incurred, as a consequence of 'green transitions', as well as to incentivise change in current practices to achieve environmental objectives (Brown et al., 2021). Over 70 % of the EU Common Agricultural Policy (CAP) budget goes to direct payments under Pillar I, which grants farmers income support based on the number of hectares farmed (Cuadros-Casanova et al., 2023). Within the framework of CAP, farmers are no longer only producers affected by, but also active managers of, the environment and climate (Civera et al., 2019). Similar directions of travel can be observed in national policy portfolios. For example, the UK Environmental Land Management scheme (ELM) aims to reduce subsidies for inefficient farm production and redirect funds towards provision of environmental and other public goods by farmers (Department for Environment, Food & Rural Affairs, 2023; Kam and Potter, 2024). Similarly, Switzerland's Swiss Federal Act defines the multifunctional role of agriculture, providing a foundation for public support of the sector (El Benni et al., 2024).

As many agri-environmental and rural land management schemes are publicly funded and embedded within democratic governance structures, citizen support plays an important role in their legitimacy, uptake, and long-term success (Chen et al., 2015; Schaffer et al., 2022). Understanding how citizens perceive rural ES, and whether citizens endorse both the protection of (potentially different) ES and the policy mechanisms used to achieve the protection of the ES, is therefore essential for effective policy implementation in relation to ES provision. With the growing prominence of ES as an outcome of European policy frameworks, stakeholder perspectives (particularly of farmers, land managers and other agricultural actors) regarding rural ES have been considered in recent research, with a focus on how these perspectives can be integrated into policy and translated into pro-environmental rural land management practices (Csurgó and Smith, 2021; Gullino et al., 2018; Leite et al., 2019; Rogge et al., 2007). However, comparatively little research attention has been paid to how citizens, who are both taxpayers and beneficiaries, perceive different types of rural ES, and how these perceptions shape their support for agri-environmental measures (Balázs et al., 2021; Schirpke et al., 2022). These gaps limit our understanding of the broader social acceptability and potential trade-offs involved in developing multifunctional rural landscapes. Furthermore, the lack of multi-country evidence hinders the identification of potential similarities and differences across nations that could inform the development of both common and country-specific approaches to citizen engagement activities and policies (Dittrich et al., 2017; Thiemann et al., 2022).

This research aims to address these gaps through a secondary analysis of data from the SUPER-G project (<https://www.super-g.eu/>), in which a survey was used to assess citizen perceptions and attitudes related to the general environment and rural areas, across five countries in different biogeographical zones of Europe: the Czech Republic (Continental), Sweden (Boreal), Spain (Mediterranean), Switzerland (Alpine), and the UK (Atlantic). Specifically, citizens' perceptions and preferences regarding rural ES within their national socio-ecological contexts were assessed. The five biogeographically distinct regions differ in terms of habitat and species conservation status, and in each of the countries, agriculture has a varying role in the national economy (European Environment Agency, 2020; Stewart-Knox et al., 2024). For example, of the five zones, the Atlantic and Continental regions have the

most threatened conservation status of habitats and species, while the Mediterranean region has the largest areas of degraded forests, grasslands, scrub, and heath, requiring substantial improvement (European Environment Agency, 2020). In 2022, agriculture contributed a higher percentage to GDP in Spain (2.4 %) and the Czech Republic (2.1 %) compared to the other countries, where contributions ranged from 0.61 % to 1.4 % (O'Neill, 2023).

## 2. Theoretical foundation and research model development

Bandura's Social Cognitive Theory posits that human functioning results from dynamic and reciprocal interactions between personal, environmental, and behavioural factors. This relationship is conceptualised as triadic reciprocal determinism, a foundational framework within the theory that emphasises the bidirectional influence each factor exerts on the others (Bandura, 1986, 1991). Given that attitudes and intention are considered antecedents of behaviour (Ajzen, 1991), a theoretical framework has been developed in this research to explain citizens' attitudes towards pro-environmental rural management initiatives, including farming practices which support potential pro-environmental land use (see Fig. 1). An attitude is defined as '*a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour*' (Eagly and Chaiken, 1993, p. 1). The framework is designed to incorporate personal and environmental factors which explain the extent to which individuals favour or oppose specific pro-environmental initiatives.

Individuals' general environmental attitudes (a general psychological tendency to favour or disfavour the natural environment) have been selected as representing a personal cognitive factor in the framework (Milfont and Duckitt, 2010). Underlying values related to environmental attitudes may differ since some individuals place greater value on preserving nature and the diversity of natural species in their original natural states (i.e. preservationist environmental attitudes), while others tend to believe that it is right, appropriate, and necessary for nature and all natural phenomena and species to be used and altered to align with human needs, such as hedonic or utilitarian benefits (Milfont and Duckitt, 2010). Stronger preservationist environmental attitudes are often associated with greater support for environmental protection and restoration plans, such as biodiversity enhancement and peatland ES restoration (Bartczak, 2015; Faccioli et al., 2020). However, having a more utilitarian attitudinal focus may have a positive (Lee et al., 2021; Nosrati et al., 2023) or negative (van Riper et al., 2019) impact on acceptance of pro-environmental initiatives, depending on whether the initiatives are perceived to enhance or compromise the environment's utility in relation to human exploitation.

Perceived benefits associated with rural ES represent another personal factor in the framework. Drawing on the definition of perception as the process by which people interpret and organise stimuli to produce a meaningful experience of the world (Eagly and Chaiken, 1993), we define benefit perceptions in this context as the ways in which individuals recognise and assign value to the different functions provided by ecosystems in rural areas (Asah et al., 2014; Sagie et al., 2013). Provisioning ES may be valued less by the public compared to regulating, supporting, and cultural ES in Europe (Fagerholm et al., 2019; Thiemann et al., 2022). Individuals who recognise and appreciate non-provisioning ES are generally more likely to support pro-environmental actions aimed at the protection and restoration of these ES (Asah et al., 2014; Goodson et al., 2023). For example, H. Zhang et al. (2023) found that visitors who perceive greater benefits from the cultural services provided by a national park are more likely to engage in pro-environmental behaviours, such as reporting environmental damage and picking up litter in the park. However, assigning higher value to provisioning ES has shown mixed effects on public responses to pro-environmental initiatives, which may be dependent on the perceived trade-offs and synergies these initiatives create between provisioning and other ES (Kinnoumè et al., 2024; Martín-López et al.,

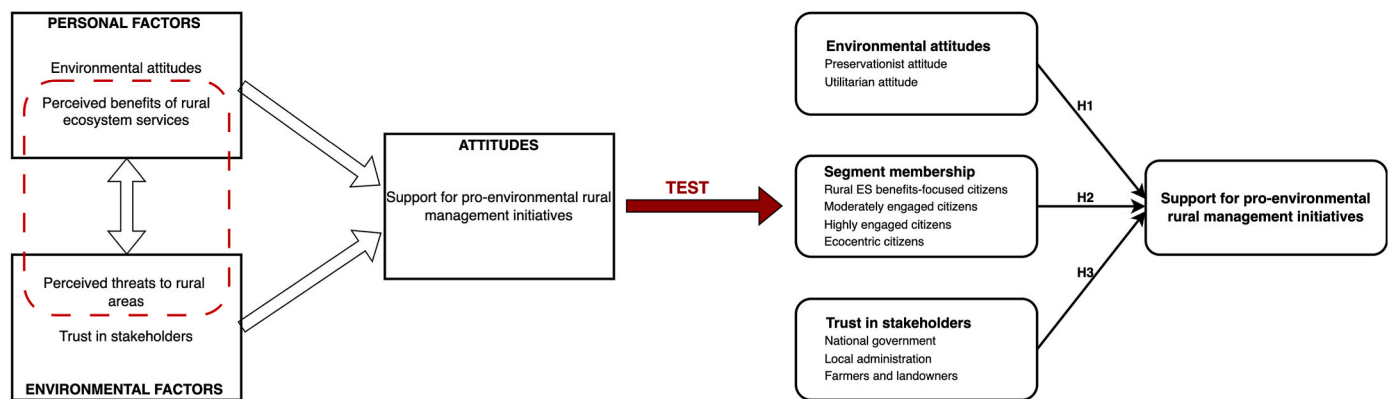


Fig. 1. Theoretical framework and research model.

2012; Miller et al., 2021; Plieninger et al., 2019).

Environmental factors within our theoretical framework consider both the physical and social environment. Perceived threats to rural areas are conceptualised as indicators of environmental influences, capturing individuals' appraisals of ecological and socio-economic pressures affecting rural areas, such as environmental degradation and shifting societal demands for rural products. People who perceive greater threats to a place-based environment are more likely to engage in pro-environmental behaviour (Bijani et al., 2022; Bockarjova and Steg, 2014; Kothe et al., 2019; Shafiei and Maleksaeidi, 2020). Trust in stakeholders who are involved in rural management, another key social environmental factor, may act as a heuristic, helping individuals make judgments about pro-environmental initiatives in rural areas by reducing perceived uncertainty and complexity, especially under conditions where people may have limited knowledge or experience (Gray et al., 2012; Ross et al., 2014; Young et al., 2016). Research has shown mixed results regarding the effects of trust in stakeholders with responsibility for environmental protection on attitudes towards pro-environmental initiatives. For example, people's trust in government institutions is a positive predictor of support for environmental protection measures and climate policies (Jones et al., 2009; Kulin and Johansson Sevä, 2021). However, over-reliance on trust in institutions may obviate people's risk perceptions associated with environmental hazards and decrease their engagement in actions aimed at mitigating the risks (Bichard and Kazmierczak, 2012; Lafuente et al., 2018).

Grounded in Bandura's Social Cognitive Theory and based on the findings of empirical studies, it is assumed that personal factors (i.e. general environmental attitudes and benefit perceptions of specific rural ES) and environmental factors (i.e. perceived threats to rural areas, and trust in stakeholders involved in rural management) shape citizens' support for pro-environmental rural management initiatives (see also Erfanian et al., 2024; Guo et al., 2022). The extent to which these (potentially heterogeneous) preferences and priorities translate into support for pro-environmental initiatives may depend on contextual environmental factors such as the perceived severity of threats to the environment in a given area (Fockaert et al., 2023; Lim and Moon, 2020; Toma and Mathijs, 2007). This necessitates simultaneous consideration of heterogeneous citizen preferences and the joint potential influence of personal and environmental factors, which cannot be adequately addressed by including these factors in regression models. To capture this complexity, we aimed to identify citizen segments based on individual benefit perceptions of specific rural ES and perceived threats in rural areas. Segment membership will then be incorporated into regression models to explain support for pro-environmental rural management initiatives. As such, the following hypotheses have been proposed (Fig. 1).

**H1.** Stronger preservationist environmental attitudes are associated with greater support for pro-environmental rural management

initiatives; utilitarian environmental attitudes are correlated with support for pro-environmental rural management initiatives, either positively or negatively.

**H2.** Support for pro-environmental rural management initiatives varies across citizen segments.

**H3.** Trust in stakeholders is correlated with support for pro-environmental rural management initiatives.

By segmenting citizens based on their perceptions of rural ES and perceived threats to rural areas, and linking segment membership to understand attitudes towards policies, citizen participation in rural policy design can be enhanced, since this approach allows policymakers to engage more effectively with groups of citizens who differ in their attitudes and priorities towards rural and environmental management, and to tailor communication strategies to their specific values and concerns (Hong et al., 2012). Differences between citizen segments, alongside the ES preferences of other stakeholder groups (e.g. farmers, government, and food retailers), can help identify where disagreements over rural development policies are most likely to arise between different identifiable groups in the population. When combined with information about the extent to which other factors influence preferences and priorities for environmental rural management (e.g. trust in influential actors), segmentation can inform the development of effective strategies to strengthen multi-actor governance. Understanding citizens' priorities and preferences will also improve the transparency and credibility of efforts supporting farmers' transition to sustainable agricultural practices, contributing to the reduction of potential conflicts associated with rural development (e.g. land use change) between citizens, farmers, and other stakeholders (Kerselaers et al., 2013).

### 3. Methods

This research is based on survey data collected as part of the European Horizon 2020-funded SUPER-G project. Ethical approval for the survey study was granted by Newcastle University on 21/08/2020 [Ref 20-TIN-029]. The survey data are publicly available on Zenodo at <https://zenodo.org/records/12819487>.

#### 3.1. Survey design

The survey included established scales (see Supplementary Material Table A) and new items informed by focus group discussions<sup>2</sup> (Tindale et al., 2023). The discussions ensured that the questions included in the survey were relevant to all national contexts where the survey data were

<sup>2</sup> The focus groups included citizens from the same countries involved in the survey. Data were collected between June 2020 and January 2021.

collected. The survey assessed personal factors related to the natural environment in general and rural areas in particular, including participants' environmental attitudes<sup>3</sup> (Milfont and Duckitt, 2010) and perceptions regarding provisioning, regulating, supporting, and cultural ES (Casado-Arzuaga et al., 2013; La Notte et al., 2017; Martín-López et al., 2012; Zoderer et al., 2019). The survey captured social and environmental contextual factors, such as perceived socio-economic and ecological threats to rural areas (European Environment Agency, 2019; Marquart-Pyatt, 2012), and social trust in various stakeholder groups involved in rural management (farmers and landowners, local administration, and national government), with a focus on trust in their capabilities and intentions (de Jonge et al., 2008; Earle, 2010). In addition, participants' attitudes towards three specific approaches to supporting farmers in adopting sustainable practices were measured: (1) financial incentivisation for adopters, (2) technical advice regarding traditional methods, and (3) technical advice regarding innovative technological approaches. All items were rated by participants on five-point scales (1 = "strongly disagree" to 5 = "strongly agree" or 1 = "not at all important" to 5 = "extremely important"). Demographic information was collected including age, gender, education level, place of residence and employment status (see Supplementary Material Table A for detailed measurement items).

The survey was initially developed in English. To ensure consistent measurement of constructs across different languages, the survey underwent a rigorous process of translation and back-translation into the local languages of each country involved in the data collection. Native speakers and language experts reviewed the translations to further enhance accuracy and cultural relevance. The survey was pre-tested in each country before formal data collection. The online survey was conducted in November 2021 by the social research agency (Qualtrics LLC<sup>4</sup>) in five European countries representing distinct biogeographic zones: the Czech Republic (Continental), Sweden (Boreal), Spain (Mediterranean), Switzerland (Alpine), and the UK (Atlantic). Quotas for age, gender and education were set to ensure a nationally representative sample of each country's adult population. Based on these selection criteria, a total of 3,190 responses were included in the final analysis. Participant characteristics including age, gender, socio-economic class, employment status, rural residency, trust in stakeholders and environmental attitudes are summarised by country in Table 1.

### 3.2. Data analysis

Principal component analysis (PCA) with varimax rotation was conducted to quantify the main multivariate interrelationships between perceived ES benefits and threats in rural areas to reduce data dimensionality (Ben-Hur and Guyon, 2003). Factor loadings of 0.50 and above were considered practically significant (Hair et al., 2013). Kaiser–Meyer–Olkin (KMO) values between 0.80 and 1.00 indicate adequate sampling and high suitability of the data for PCA (Kaiser, 1974). The internal reliability and consistency of the identified multi-item factors, along with other target factors in the research model, were evaluated using Cronbach's alpha. Values of 0.65 or higher were considered indicative of an acceptable level of internal consistency reliability (Taber, 2018). A two-step cluster analysis (hierarchical and

*k*-means clustering) was used to identify participant segments based on their perceptions of ES benefits and threats with significant associations. Hierarchical and *k*-means clustering has been successfully applied to define ES bundles and categorise ES into pre-defined number of groups by minimising within-group variability (Mouchet et al., 2014). In addition, ANOVA and post hoc analysis were performed to compare cluster distributions across socio-demographic groups and participants' attitudes toward supporting farmers in rural management. Finally, multiple linear regression analyses were conducted to test how different factors influence participants' attitudes toward three methods for supporting farmers' sustainable practices across countries. All the data analyses were undertaken using SPSS Statistical Package for the Social Sciences (Version 27).

## 4. Results

### 4.1. Exploration of segmentation and other target factors

PCA was used to extract factors regarding twenty items measuring participants' perceptions associated with rural ES benefits and thirteen items measuring perceived threats to rural areas. The KMO test result for perceptions of rural ES benefits was 0.937 for the respective measurements, indicating high sampling adequacy and suitability for PCA. Three factors were extracted from the items measuring perceptions of ES benefits, including benefit perceptions associated with regulating and maintenance ES (factor 1), cultural ES (factor 2) and provisioning ES (factor 3). Three factors were extracted from the items measuring perceived threats in rural areas, with a KMO value of 0.852, including activities linked to rural environmental degradation (factor 4), socio-economic risks in agri-food supply chains (factor 5) and improper land use (factor 6). The PCA procedure was then repeated, resulting in three-factor solutions for perceptions of ES benefits, which explained 58.39 % of the total variance, and threats in rural areas which explained 55.69 % of the total variance (detailed factor loadings are provided in Supplementary Material, Table B). Items measuring the six factors, along with the 'preservationist' and 'utilitarian' dimensions of environmental attitudes and social trust in stakeholders (national government, local administration, and farmers and landowners), demonstrated acceptable internal consistency reliability, with Cronbach's alpha values ranging from 0.65 to 0.89 (see Table B) (Taber, 2018).

Overall, regulating and maintenance ES were ranked by participants as being the most important, followed by cultural ES. Provisioning ES was rated as being the least important. Activities that may cause environmental degradation were perceived to represent higher threats compared to improper land use and socio-economic risks associated with agri-food supply chains (see Supplementary Material Appendix Table B). Participants from Spain and the UK reported the highest preservationist environmental attitudes, and participants from the Czech Republic reported the lowest utilitarian environmental attitudes among the nations included in the survey. Participants from the Czech Republic, Spain, Sweden, and the UK had medium to high levels of trust in farmers and landowners, which were greater than both national government and local administration. In contrast, Swiss participants expressed medium levels of trust across all three stakeholder groups (details see Table 1).

### 4.2. Citizen segmentation and segment profiling

Based on the extracted factors, a two-step cluster analysis was applied to identify citizen segments. Hierarchical clustering determined that four clusters were optimal, after which *k*-mean cluster analysis was performed upon these four clusters. Participants who were relatively homogenous in their ratings of perceived rural ES benefits or perceived threats to rural areas were categorised into one segment. This enabled four distinct segments to be identified (Table 2). The first segment was named 'rural ES benefits-focused citizens', in which participants

<sup>3</sup> The survey assessed preservationist attitudes and utilitarian attitudes. Preservationist attitudes assess belief that it is important to preserve nature and the diversity of natural species in their original natural states, and to protect nature and biodiversity from human exploitation and change. Utilitarian attitudes assess the extent to which a person believes that it is right, appropriate, and necessary for nature and all natural phenomena and species to be used and altered to align with human needs.

<sup>4</sup> Qualtrics. (2021). Qualtrics XM. Retrieved from: Qualtrics XM: The Leading Experience Management Software.



**Table 1**

Sample description for sample included in the analysis.

	Czech Rep (n = 649)	Spain (n = 623)	Sweden (n = 645)	Switzerland (n = 641)	UK (n = 632)	Total (N = 3,190)
<b>Gender</b>						
Female	49.92 %	43.18 %	42.48 %	54.60 %	52.06 %	48.46 %
Male	50.08 %	56.82 %	56.90 %	44.62 %	47.94 %	51.25 %
Rather not to say	0.00 %	0.00 %	0.62 %	0.78 %	0.00 %	0.28 %
<b>Age</b>	46.12(15.39)	43.14(13.53)	47.44(16.49)	44.95(16.37)	46.40 (16.48)	45.63(15.76)
<b>Educational attainment</b>						
Secondary education or less	9.40 %	34.83 %	20.93 %	6.86 %	20.09 %	47.52 %
Upper-secondary education	69.65 %	27.13 %	34.26 %	50.55 %	37.50 %	30.97 %
Undergraduate degree or diploma and above	20.96 %	38.04 %	44.81 %	42.59 %	42.41 %	21.50 %
<b>Residency</b>						
Rural residents	49.92 %	45.75 %	47.91 %	45.40 %	48.58 %	47.52 %
Urban residents who frequently visit rural areas	28.35 %	29.05 %	26.36 %	43.06 %	28.01 %	30.97 %
Urban residents who don't frequently visit rural areas	21.73 %	25.20 %	25.74 %	11.54 %	23.42 %	21.50 %
<b>Employment status</b>						
Employed	63.33 %	62.28 %	59.07 %	65.68 %	62.03 %	62.48 %
Retired	20.03 %	8.03 %	24.81 %	19.19 %	16.30 %	17.74 %
Student	5.70 %	8.51 %	6.51 %	4.99 %	3.48 %	5.83 %
Unemployed	10.94 %	21.19 %	9.61 %	10.14 %	18.20 %	13.95 %
<b>Citizens' trust in different stakeholders</b>						
National government	2.64(0.92)	2.82(1.12)	2.85(1.06)	3.29(0.86)	2.97(0.99)	2.91(1.02)
Local administration	3.22(0.89)	2.98(1.05)	3.04(1.01)	3.31(0.88)	3.12(0.95)	3.14(0.96)
Farmers and landowners	3.61(0.87)	3.78(0.92)	3.75(0.83)	3.39(0.88)	3.62(0.84)	3.63(0.88)
<b>Environmental attitudes</b>						
Preservationist attitude	3.97(0.66)	4.15(0.70)	4.07(0.64)	3.89(0.67)	4.13(0.66)	4.04(0.67)
Utilitarian attitude	2.60(0.68)	2.88(0.75)	2.63(0.72)	2.68(0.85)	2.82(0.75)	2.72(0.76)

**Note:** This table is adapted from our previous SUPER-G project report by [Tindale et al. \(2022\)](#).

**Table 2**

Citizen segments and factor scores.

Factors	S1: Rural ES benefits-focused citizens (n = 760; 23.82 %)	S2: Citizens moderately engaged in rural multifunctionality (n = 680; 21.32 %)	S3: Citizens highly engaged in rural multifunctionality (n = 837; 26.24 %)	S4: Ecocentric citizens (n = 913; 28.62 %)	Total
Provisioning ES	4.05 <sup>a</sup>	3.07 <sup>b</sup>	4.10 <sup>a</sup>	3.11 <sup>b</sup>	3.59
Regulating and maintenance ES	4.49 <sup>b</sup>	3.28 <sup>d</sup>	4.67 <sup>a</sup>	4.12 <sup>c</sup>	4.17
Cultural ES	4.24 <sup>b</sup>	3.06 <sup>d</sup>	4.44 <sup>a</sup>	3.60 <sup>c</sup>	3.86
Improper land use	2.54 <sup>c</sup>	2.91 <sup>b</sup>	3.67 <sup>a</sup>	3.61 <sup>a</sup>	3.22
Activities linked to rural environmental degradation	2.98 <sup>c</sup>	3.06 <sup>c</sup>	4.51 <sup>a</sup>	4.17 <sup>b</sup>	3.74
Socio-economic risks in agriculture	3.30 <sup>d</sup>	3.04 <sup>c</sup>	4.17 <sup>a</sup>	3.69 <sup>b</sup>	3.58

**Note:** <sup>a-d</sup> Values with the same letter as superscript indicate means are not significantly different. Different superscripts indicate significantly different means between the segments (ANOVA post hoc Tukey tests at  $p < 0.05$ ).

perceived high levels of benefits of ES delivered by rural areas but perceived relatively low levels of different threats facing rural areas (i.e. rural environmental degradation, improper rural land use, and socio-economic risks associated with agri-food supply chains). The second segment was named 'citizens moderately engaged in rural multifunctionality' (named hereafter 'moderately engaged citizens'), in which participants perceived medium levels of both rural ES benefits and different threats facing rural areas. The third segment was named 'citizens highly engaged in rural multifunctionality' (named hereafter 'highly engaged citizens'), in which participants perceived high levels of both rural ES benefits and different threats facing rural areas. The fourth segment was named 'ecocentric citizens', in which segment members reported high levels of perceived benefits associated with regulating and maintenance ES and of perceived threats associated with environmental

degradation and medium levels regarding the other benefits and threats issues.

Participants in different segments were associated with different socio-demographic attributes ([Table 3](#); detailed statistical tests see Supplementary Material Appendix Table C). The first segment, i.e. 'rural ES benefits-focused citizens', accounted for 23.82 % of the sample. Rural residents, those with secondary education or less, being older, and those who are retired and from Spain accounted for a significantly higher proportion compared to the other segments, while those having undergraduate degree or higher, being students, and from the UK accounted for a significantly smaller proportion. The 'moderately engaged citizens' segment (the smallest) included 21.32 % of the participants. Male retired and Spanish participants accounted for a significantly smaller proportion in this segment compared to the other segments. Compared

**Table 3**  
Profiling of citizen segments.

Factors	S1: Rural ES benefits-focused citizens	S2: Citizens moderately engaged in rural multifunctionality	S3: Citizens highly engaged in rural multifunctionality	S4: Ecocentric citizens
<b>Gender</b>				
Female	46.32 %	53.97 %	46.59 %	47.86 %
Male	53.29 %	45.44 %	53.17 %	52.14 %
Rather not to say	0.39 %	0.59 %	0.24 %	0 %
<b>Age</b>	49.16(15.75) <sup>a</sup>	40.69(15.48) <sup>c</sup>	49.16(14.79) <sup>a</sup>	43.12(15.4) <sup>b</sup>
<b>Educational attainment</b>				
Secondary education or less	24.74 %	16.47 %	19.24 %	13.47 %
Upper-secondary education	46.32 %	47.35 %	40.50 %	42.72 %
Undergraduate degree or diploma and above	28.95 %	36.17 %	40.26 %	43.81 %
<b>Residency</b>				
Rural residents	53.16 %	45.88 %	46.95 %	44.58 %
Urban residents who frequently visit rural areas	27.89 %	29.26 %	31.18 %	34.61 %
Urban residents who don't frequently visit rural areas	18.95 %	24.85 %	21.86 %	20.81 %
<b>Employment status</b>				
Employed	58.16 %	67.79 %	59.02 %	65.28 %
Retired	24.08 %	12.21 %	22.22 %	12.49 %
Student	3.55 %	8.09 %	2.87 %	8.76 %
Unemployed	14.21 %	11.91 %	15.89 %	13.47 %
<b>Environmental attitudes</b>				
Preservationist attitude	4.04(0.63) <sup>c</sup>	3.44(0.68) <sup>d</sup>	4.39(0.49) <sup>a</sup>	4.17(0.54) <sup>b</sup>
Utilitarian attitude	2.74(0.65) <sup>a</sup>	2.81(0.59) <sup>a</sup>	2.79(0.91) <sup>a</sup>	2.59(0.78) <sup>b</sup>
<b>Trust in stakeholders</b>				
Trust in national government	2.82(1.03) <sup>b</sup>	2.83(0.81) <sup>b</sup>	3.08(1.19) <sup>a</sup>	2.89(0.95) <sup>b</sup>
Trust in local administration	3.10(0.97) <sup>b</sup>	2.95(0.77) <sup>c</sup>	3.33(1.11) <sup>a</sup>	3.12(0.91) <sup>b</sup>
Trust in farmers and landowners	3.75(0.86) <sup>b</sup>	3.22(0.76) <sup>d</sup>	3.98(0.87) <sup>a</sup>	3.51(0.83) <sup>c</sup>
<b>Country</b>				
Czechia	23.95 %	20.74 %	17.92 %	19.28 %
Spain	26.05 %	12.65 %	27.12 %	12.27 %
Sweden	18.55 %	20.74 %	18.88 %	22.45 %
Switzerland	18.95 %	26.76 %	14.81 %	20.92 %
United Kingdom	12.50 %	19.12 %	21.27 %	25.08 %

**Note:** <sup>a-d</sup> Values with the same letter as superscript indicate means were not significantly different, and different superscripts indicate significantly different means between the segments, following ANOVA post hoc Tukey tests at  $p < 0.05$ ; 'Urban residents who frequently visit rural areas' here refer to the residents that visit countryside at least once a month.

to the other segments, moderately engaged citizens tended to be younger, have weaker 'preservationist' attitudes and stronger 'utilitarian' attitudes, and have lower trust in different stakeholder groups. Participants in the third segment ('highly engaged citizens') accounted for 26.24 % of the sample. Participants who were retired and from Spain comprised a larger proportion in this segment compared to the other segments, while students and those from Switzerland comprised a smaller proportion. Participants in this segment tended to be older, have greater trust in different stakeholder groups and have stronger 'preservationist' and 'utilitarian' attitudes compared to the other segments. The 'ecocentric citizens' segment was the biggest (28.62 %) of the four segments. Participants who were retired and from Spain constituted a significantly smaller proportion, while students, those with upper-secondary education and from the UK accounted for a significantly higher proportion compared to the other segments. The mean age of ecocentric citizens was significantly higher than moderately engaged citizens, but lower than the other two segments. Ecocentric citizens held the second strongest 'preservationist' attitudes (second only to 'highly engaged citizens') and weakest 'utilitarian' attitudes among the four citizen segments.

#### 4.3. Attitudes towards approaches to supporting farmers' sustainable practices

Overall, participants across the five countries included in this research expressed medium to high levels of support for the three approaches (financial incentivisation for adopters, technical advice regarding traditional methods, and technical advice regarding innovative technological approaches) to supporting farmers' sustainable practices. Participants in 'highly engaged citizens' segment expressed the highest levels of support for all three approaches, while those in the 'moderately engaged citizens' segment expressed the lowest levels of support among the four citizen segments (Table 4). In addition, there were differences in participants' attitudes towards the approaches to supporting farmers' sustainable practices across the countries (see Supplementary Material Appendix Table D).

In Spain, Sweden and the UK, participants tended to express higher levels of support for government provision of financial incentivisation for adopters of sustainable practices when compared to technical advice regarding traditional methods and innovative technological approaches. Czech participants expressed higher levels of support for financial incentivisation and technical advice on traditional methods compared to government provision of technical advice on innovative technological approaches. Swiss participants, however, tended to express greater

**Table 4**

Citizens' attitude towards approaches to supporting sustainable practices.

Attitudes towards approaches to supporting farmers' sustainable practices	S1: Rural ES benefits-focused citizens	S2: Citizens moderately engaged in rural multifunctionality	S3: Citizens highly engaged in rural multifunctionality	S4: Ecocentric citizens	Total
Financial incentivisation	4.10(0.95) <sup>b</sup>	3.32(0.90) <sup>c</sup>	4.58(0.68) <sup>a</sup>	4.13(0.83) <sup>b</sup>	4.07(0.94)
Technical advice on traditional methods	4.18(0.88) <sup>b</sup>	3.30(0.92) <sup>d</sup>	4.44(0.79) <sup>a</sup>	4.04(0.87) <sup>c</sup>	4.02(0.95)
Technical advice on innovative technological approaches	4.03(0.92) <sup>b</sup>	3.27(0.89) <sup>d</sup>	4.40(0.79) <sup>a</sup>	3.91(0.88) <sup>c</sup>	3.93(1.00)

**Note:** <sup>a-d</sup> Values with the same letter as superscript indicate means were not significantly different, and different superscripts indicate significantly different means between the segments, following ANOVA post hoc Tukey tests at  $p < 0.05$ .

support for government provision of technical advice on the use of traditional methods compared to financial incentivisation and technical advice on the use of innovative technological approaches.

#### 4.4. Factors affecting attitudes towards supporting farmers' sustainable practices

Multiple linear regressions were conducted to test the influence of different factors on participants' attitudes towards three approaches to supporting farmers' sustainable practices in each of the five countries

(Tables 5–7). The results showed that across the five countries, participants with stronger preservationist environmental attitudes tended to be more supportive of approaches to promoting sustainable agricultural practices among farmers. In contrast, holding utilitarian environmental attitudes tended to have negative influence on participants' support for financial incentivisation in the Czech Republic, Spain and Sweden, technical advice on the use of traditional methods in the Czech Republic and Switzerland, and technical advice on the use of innovative technological approaches in Switzerland. However, a positive effect of utilitarian attitudes on support for technical advice on the use of innovative

**Table 5**

The multiple linear regression results related to attitudes to supporting farmers' sustainable practices through financial incentivisation.

Factors		(1) Czech Rep	(2) Spain	(3) Sweden	(4) Switzerland	(5) UK
<b>Environmental attitudes</b>	Preservationist attitude	0.352*** (6.408)	0.422*** (8.855)	0.398*** (6.885)	0.527*** (9.093)	0.358*** (6.594)
	Utilitarian attitude	-0.151*** (-3.046)	-0.091** (-2.258)	-0.117** (-2.495)	-0.027 (-0.604)	-0.053 (-1.165)
<b>Segment membership</b>	Base group: <i>Moderately engaged citizens</i>					
	Rural ES benefits-focused citizens	0.425*** (4.438)	0.448*** (4.411)	0.495*** (4.895)	0.315*** (3.140)	0.230** (2.249)
	Highly engaged citizens	0.716*** (6.835)	0.684*** (6.468)	0.880*** (8.148)	0.428*** (3.650)	0.615*** (6.219)
	Ecocentric citizens	0.425*** (4.401)	0.455*** (4.234)	0.670*** (7.039)	0.161* (1.734)	0.382*** (4.263)
<b>Trust in stakeholders</b>	Trust in national government	-0.051 (-1.200)	0.080* (1.941)	0.030 (0.631)	0.072 (1.222)	-0.086* (-1.820)
	Trust in local administration	0.084* (1.804)	-0.101** (-2.251)	0.017 (0.338)	0.234*** (3.487)	0.038 (0.798)
	Trust in farmers and landowners	0.157*** (3.685)	0.221*** (6.121)	0.151*** (3.758)	-0.035 (-0.587)	0.251*** (6.400)
<b>Socio-demographics</b>	Age	0.002 (0.586)	0.001 (0.204)	0.000 (0.106)	-0.011*** (-3.783)	-0.004* (-1.754)
	Baseline group: <i>Female</i>					
	Male	0.056 (0.885)	0.035 (0.574)	0.149** (2.307)	0.110 (1.522)	-0.079 (-1.375)
	Rather not to say	- -	- -	0.319 (0.803)	1.057*** (2.819)	- -
	Baseline group: <i>Urban residents who don't frequently visit rural areas</i>					
	Rural residents	-0.038 (-0.465)	0.175** (2.120)	0.118 (1.557)	-0.065 (-0.590)	-0.058 (-0.771)
	Urban residents who frequently visit rural areas	-0.100 (-0.798)	0.131 (0.557)	-0.071 (-2.526)	-0.125 (-0.800)	-0.056 (0.031)
	Baseline group: <i>Secondary education or less</i>					
	Upper-secondary education	0.077 (0.705)	0.119 (1.402)	0.071 (0.821)	-0.081 (-0.593)	-0.075 (-0.919)
	Undergraduate degree or diploma and above	0.099 (0.818)	0.069 (0.829)	0.074 (0.895)	-0.216 (-1.509)	-0.036 (-0.445)
	Base group: <i>Employment</i>					
	Retirement	-0.068 (-0.471)	-0.061 (-0.526)	-0.007 (-0.056)	-0.025 (-0.156)	0.092 (0.560)
	Student	0.057 (0.304)	0.102 (0.573)	-0.091 (-0.538)	0.100 (0.478)	0.215 (1.067)
	Unemployment	-0.067 (-0.412)	0.012 (0.088)	0.086 (0.536)	0.056 (0.288)	0.092 (0.524)
	_cons	1.757*** (5.430)	1.594*** (6.493)	1.491*** (4.250)	1.276*** (3.985)	1.841*** (5.644)
	N	649	623	645	641	632

**Note:** \*, \*\*, and \*\*\* denote significance at 10 %, 5 %, and 1 % level, respectively; the number without parentheses is the coefficient, and the number in parentheses is the  $p$ -value.

**Table 6**

The multiple linear regression results related to attitudes to supporting farmers' sustainable practices through technical advice on traditional farming methods.

Factors		(1)	(2)	(3)	(4)	(5)
		Czech Rep	Spain	Sweden	Switzerland	UK
<b>Environmental attitudes</b>	Preservationist attitude	0.274*** (5.031)	0.413*** (8.004)	0.188*** (2.856)	0.473*** (8.760)	0.278*** (4.531)
	Utilitarian attitude	-0.168*** (-3.413)	-0.057 (-1.297)	-0.010 (-0.185)	-0.072* (-1.721)	-0.018 (-0.360)
	Base group: <i>Moderately engaged citizens</i>					
<b>Segment membership</b>	Rural ES benefits-focused citizens	0.458*** (4.825)	0.592*** (5.384)	0.525*** (4.565)	0.488*** (5.228)	0.387*** (3.348)
	Highly engaged citizens	0.612*** (5.899)	0.730*** (6.381)	0.691*** (5.634)	0.504*** (4.618)	0.535*** (4.784)
	Ecocentric citizens	0.314*** (3.283)	0.443*** (3.812)	0.544*** (5.033)	0.516*** (5.962)	0.285*** (2.816)
<b>Trust in stakeholders</b>	Trust in national government	-0.021 (-0.512)	0.104** (2.351)	-0.014 (-0.264)	0.121** (2.218)	-0.025 (-0.463)
	Trust in local administration	0.026 (0.558)	-0.198*** (-4.085)	-0.052 (-0.897)	0.069 (1.105)	-0.012 (-0.223)
	Trust in farmers and landowners	0.256*** (6.071)	0.267*** (6.830)	0.225*** (4.912)	0.082 (1.468)	0.314*** (7.083)
<b>Socio-demographics</b>	Age	0.003 (1.190)	0.004 (1.182)	0.004 (1.282)	0.006** (2.099)	0.004 (1.296)
	Baseline group: <i>Female</i>					
	Male	-0.111* (-1.786)	0.084 (1.269)	0.107 (1.448)	0.001 (0.022)	-0.172*** (-2.637)
	Rather not to say	-	-	0.720 (1.597)	-0.698** (-2.001)	-
	Baseline group: <i>Urban residents who don't frequently visit rural areas</i>					
	Rural residents	0.001 (0.013)	0.169* (1.888)	0.092 (1.069)	-0.071 (-0.695)	0.096 (1.132)
	Urban residents who frequently visit rural areas	0.059 (0.695)	0.125 (1.440)	0.140 (1.423)	-0.215** (-2.068)	0.066 (0.715)
	Baseline group: <i>Secondary education or less</i>					
	Upper-secondary education	0.038 (0.354)	-0.088 (-0.957)	0.060 (0.612)	0.112 (0.887)	-0.032 (-0.339)
	Undergraduate degree or diploma and above	0.086 (0.717)	-0.008 (-0.085)	-0.131 (-1.400)	-0.124 (-0.929)	-0.161* (-1.765)
	Base group: <i>Employment</i>					
	Retirement	0.032 (0.221)	0.100 (0.794)	0.011 (0.077)	-0.149 (-0.983)	0.150 (0.810)
	Student	0.145 (0.773)	0.075 (0.391)	-0.155 (-0.811)	-0.410** (-2.116)	0.123 (0.540)
	Unemployment	0.163 (1.008)	0.081 (0.566)	0.047 (0.255)	-0.185 (-1.028)	0.233 (1.178)
	_cons	1.877*** (5.861)	1.191*** (4.483)	1.887*** (4.733)	1.035*** (3.475)	1.418*** (3.844)
	N	649	623	645	641	632

**Note:** \*, \*\*, and \*\*\* denote significance at 10 %, 5 %, and 1 % level, respectively; the number without parentheses is the coefficient, and the number in parentheses is the *p*-value.

technological approaches was observed for Swedish participants. The results supported Hypothesis 1.

The results of the regressions showed that rural ES benefits-focused citizens, highly engaged citizens, and ecocentric citizens were more positive towards approaches that aimed at promoting sustainable farming practices among farmers compared with moderately engaged citizens. The highly engaged citizens were overall more supportive than the rural ES benefits-focused citizens of all types of support for farmers to implement sustainable practices, which implied a potential synergistic effect of perceived ES benefits and perceived threats on societal support for policies aimed at optimising environmental management in rural areas. The results supported Hypothesis 2. The regression results showed that participants who reported higher trust in farmers and landowners expressed greater support for the approaches to promoting sustainable farming practices in all five countries, except in Switzerland, where no significant correlation was found. Trust in national government resulted in a positive impact on support for promoting sustainable practices through financial incentivisation among Spanish participants, but a negative impact among UK participants. Trust in national government also indicated positive impacts on the support for promoting sustainable practices through providing technical advice on the use of

traditional methods among both Spanish and Swiss participants. Trust in local administration had positive effects on the support for promoting sustainable practices through financial incentivisation among Czech and Swiss participants but negative impacts on Spanish participants' support for promoting sustainable practices through financial incentivisation as well as providing technical advice on the use of traditional methods. The results partly supported Hypothesis 3.

Additionally, older participants expressed lower levels of support for government provision of financial incentivisation for farmers to implement sustainable practices compared to younger participants in Switzerland and the UK, while older participants expressed a higher level of support for offering technical advice on the use of traditional farming methods in Switzerland. Men expressed a higher level of support for government provision of financial incentivisation compared to women in Sweden, while men had lower levels of support for offering technical advice on the use of traditional methods in the Czech Republic and UK. Rural residents in Spain had a higher level of support for government provision of financial incentivisation and technical advice on the use of traditional methods compared to urban residents who do not frequently visit rural areas. Participants with undergraduate degrees or diplomas and above had a lower level of support for government



**Table 7**

The multiple linear regression results of attitudes to supporting farmers' sustainable practices through technical advice on innovative technological approaches.

Factors		(1)	(2)	(3)	(4)	(5)
		Czech Rep	Spain	Sweden	Switzerland	UK
<b>Environmental attitudes</b>	Preservationist attitude	0.231*** (3.888)	0.372*** (6.699)	0.389*** (6.257)	0.366*** (6.309)	0.287*** (4.694)
	Utilitarian attitude	0.029 (0.545)	0.048 (1.009)	0.146*** (2.899)	−0.155*** (−3.441)	−0.020 (−0.388)
<b>Segment membership</b>	Base group: <i>Moderately engaged citizens</i>					
	Rural ES benefits-focused citizens	0.247** (2.379)	0.649*** (5.483)	0.373*** (3.432)	0.474*** (4.724)	0.398*** (3.462)
	Highly engaged citizens	0.627*** (5.531)	0.794*** (6.447)	0.692*** (5.966)	0.676*** (5.758)	0.545*** (4.898)
	Ecocentric citizens	0.219** (2.096)	0.560*** (4.473)	0.353*** (3.454)	0.377*** (4.048)	0.295*** (2.929)
<b>Trust in stakeholders</b>	Trust in national government	0.015 (0.332)	0.022 (0.471)	0.004 (0.076)	0.063 (1.061)	−0.004 (−0.083)
	Trust in local administration	0.073 (1.449)	−0.053 (−1.007)	−0.034 (−0.616)	0.059 (0.875)	−0.014 (−0.252)
	Trust in farmers and landowners	0.218*** (4.720)	0.208*** (4.936)	0.218*** (5.025)	0.095 (1.571)	0.281*** (6.350)
<b>Socio-demographics</b>	Age	0.003 (1.052)	0.000 (0.084)	−0.003 (−1.078)	0.001 (0.453)	−0.001 (−0.329)
	Baseline group: <i>Female</i>					
	Male	0.089 (1.305)	0.003 (0.037)	0.038 (0.546)	−0.061 (−0.844)	0.032 (0.489)
	Rather not to say	–	–	0.478 (1.122)	−0.417 (−1.111)	–
	Baseline group: <i>Urban residents who don't frequently visit rural areas</i>					
	Rural residents	−0.132 (−1.501)	0.125 (1.303)	−0.132 (−1.619)	0.041 (0.375)	−0.122 (−1.443)
	Urban residents who frequently visit rural areas	−0.180* (−1.930)	0.124 (1.331)	−0.107 (−1.148)	−0.066 (−0.591)	−0.056 (−0.605)
	Baseline group: <i>Secondary education or less</i>					
	Upper-secondary education	0.095 (0.801)	0.079 (0.792)	0.007 (0.080)	−0.069 (−0.503)	0.034 (0.371)
	Undergraduate degree or diploma and above	0.179 (1.361)	0.120 (1.224)	−0.040 (−0.456)	−0.243* (−1.700)	−0.064 (−0.704)
	Base group: <i>Employment</i>					
	Retirement	0.129 (0.818)	0.193 (1.416)	0.081 (0.569)	−0.052 (−0.317)	−0.024 (−0.133)
	Student	0.057 (0.278)	0.266 (1.281)	0.053 (0.294)	−0.247 (−1.183)	0.059 (0.261)
	Unemployment	0.186 (1.053)	0.299* (1.950)	0.125 (0.724)	0.037 (0.193)	−0.044 (−0.222)
	_cons	1.026*** (2.929)	0.987*** (3.451)	0.821** (2.178)	2.040*** (6.362)	1.542*** (4.197)
	N	649	623	645	641	632

**Note:** \*, \*\*, and \*\*\* denote significance at 10 %, 5 %, and 1 % level, respectively; the number without parentheses is the coefficient, and the number in parentheses is the *p*-value.

provision of technical advice on the use of traditional methods compared to those having received secondary education or less in the UK, and had a lower level of support for government provision of technical advice on the use of innovative technological approaches compared to those having received secondary education or less in Switzerland. Participants identifying as students in Switzerland had a lower level of support for government provision of technical advice on the use of traditional methods, while those who were unemployed in Spain had a higher level of support for government provision of technical advice on the use of innovative technological approaches compared to employed participants.

## 5. Discussion

Grounded in Bandura's Social Cognitive Theory (Bandura, 1986, 1991) and based on the findings of empirical studies (see also Erfanian et al., 2024; Guo et al., 2022), this study proposed and tested a model to examine how personal and environmental factors together shape citizens' attitudes towards various approaches to supporting farmers' adoption of sustainable practices across five biogeographically distinct European countries. Consistent with the theory, the results indicated

significant effects of environmental attitudes and trust in stakeholders on participants' support for sustainable farming practices. Furthermore, the influence of citizen segment membership emphasises the interaction between perceived benefits of rural ES (a personal factor) and perceived threats to rural areas (an environmental factor) in shaping attitudes across different groups. For example, participants identified as ecocentric citizens, who perceived high levels of benefits from regulating and supporting ES, as well as strong threats of environmental degradation to rural areas, demonstrated higher levels of support compared to moderately engaged citizens. Similarly, highly engaged citizens perceived rural multifunctionality as highly beneficial while recognising serious socio-economic and environmental challenges, which together led to the strongest support for sustainable practices among all segments.

Among the personal factors, participants with stronger preservationist environmental attitudes showed greater support for all the approaches included to help farmers to adopt sustainable practices across the five European countries, a finding consistent with previous research (Bartczak, 2015; Faccioli et al., 2020). As predicted (Lee et al., 2021; Nosrati et al., 2023; van Riper et al., 2019), mixed effects were associated with utilitarian environmental attitudes. Therefore, although both preservationist and utilitarian environmental attitudes reflect a general

concern for the natural environment, the underlying beliefs and values related to the two attitudinal dimensions played an important role in shaping perceptions of, and attitudes towards, pro-environmental management policies (El Benni et al., 2024). A stronger tendency to value preserving nature and the diversity of natural species in their original natural states (i.e. intrinsic values), rather than primarily as a resource for human use (i.e. instrumental values), is more likely to consistently predict citizens' greater support for such policies, particularly when those policies may limit human exploitation of the environment.

Participants perceived that all ES were of medium to high importance, suggesting that they were in favour of rural multifunctionality (Fagerholm et al., 2019; Thiemann et al., 2022). Environmental benefits, such as enhancing regulating and supporting ES and mitigating threats associated with rural environmental degradation, were prioritised over other countryside-related issues such as providing cultural ES. These personal preferences, combined with perceived threats to rural areas (an environmental factor included in the theoretical framework), enabled the identification of four citizen segments through cluster analysis. The regression results showed that, overall, rural ES benefits-focused citizens were more supportive of assisting farmers to adopt sustainable practices compared to moderately engaged citizens and ecocentric citizens. All three clusters were less supportive of the three approaches that support farmers' sustainable practices than highly engaged citizens. This suggests that, as is the case for perceived ES benefits, perceived threats to rural areas play an important role in shaping citizens' support for pro-environmental rural management initiatives. The findings are consistent with previous research which has suggested that perceived threats to the environment can act as important motivators for engaging in pro-environmental behaviours (Bockarjova and Steg, 2014; Shafiei and Maleksaeidi, 2020). The dual consideration of both benefits provided by, and the threats faced by, rural multifunctionality may have a stronger positive impact on citizens' support for future pro-environmental management initiatives than perceptions related to environmental issues alone.

As predicted, trust in government showed mixed effects on participants' support for different approaches that promote sustainable practices (Bichard and Kazmierczak, 2012; Jones et al., 2009; Kulin and Johansson Sevä, 2021; Lafuente et al., 2018). For example, trust in local administration had positive impacts on Czech and Swiss participants' support for government provision of financial incentivisation to promote sustainable practices among farmers. However, for Spanish participants, trust in local administration had a negative impact on support for government provision of both financial assistance and guidance on traditional methods, while trust in national government was positively associated with support for both approaches. Therefore, a high level of trust in local administration may be interpreted by Spanish participants as an indication of a satisfactory rural environment, thereby reducing the perceived need for additional pro-environmental actions, such as promoting sustainable farming practices. This is similar to the role of trust in national government among UK participants in relation to the reduced need for pro-environmental actions. However, trust in farmers and landowners, who are the main implementing actors regarding sustainable agricultural practices (Lastra-Bravo et al., 2015; Prager and Freese, 2009), tended to deliver positive effects on support for approaches that promote sustainable practices. Unexpectedly, trust in national government and in local administration had no effect on attitudes towards government provision of guidance on the use of innovative technologies in all countries. This may be because 'high-level' government bodies are very unlikely to be associated with providing technical advice on novel farming technologies compared to specific technical departments or experts (Goebel and Wardropper, 2024; Tonsor et al., 2009).

### 5.1. Implications for pro-environmental management in rural areas

Our results have some policy implications applicable across all included countries, given the similarities observed in the segmentation and modelling outcomes. First, moderately engaged and highly engaged citizens are more likely to disagree over prioritisation of pro-environmental initiatives in rural areas. Compared to other citizen segments, moderately engaged citizens may also be less inclined to actively participate in, and support, pro-environmental initiatives, which could result in their views being more easily overlooked during the initiatives' development. Thus, both moderately engaged and highly engaged citizens should be prioritised in future engagement efforts by aligning activities with the socio-demographic attributes of both segments (see Table 3 and Appendix Table C) and preferred information channels. Taking into consideration how the preferences and priorities of the two citizen segments can be integrated into consensus-building activities in relation to pro-environmental management may also enhance their motivation to participate in these initiatives and increase their acceptance of related emerging policies. Second, as preservationist environmental attitudes are a consistent positive predictor of support for sustainable practices, efforts to strengthen citizens' appreciation of nature and biodiversity in their original states rather than primarily as resources for human use may enhance support for pro-environmental initiatives. This could be achieved through strategies such as educational programmes, social media campaigns, and promoting more frequent contact with nature (Martin et al., 2020; Meng et al., 2023; Stewart-Knox et al., 2024). Additionally, urban-rural differences may need to be considered in future policy making. For example, rural residents are more likely to belong to the 'rural ES benefits-focused citizens' segment compared to urban residents, which suggests that rural residency may positively influence people's perceptions of rural ES benefits but not threats in rural areas. It may be useful to communicate information about threats facing rural areas to those living in rural areas, which could increase these residents' support for rural pro-environmental management strategies.

Differentiated strategies aimed at enhancing citizen support for pro-environmental rural management initiatives across countries could also be considered. First, the potential of pro-environmental initiatives to simultaneously enhance ES delivery and address threats to rural areas could be considered in policy design and clearly communicated to citizens in the Czech Republic, Spain, Sweden, and the UK, given the observed synergistic effect on public support in these countries. In contrast, emphasis may be placed on the potential enhancement of rural ES in Switzerland. Second, improving citizens' trust in farmers and landowners could positively influence citizens' attitudes towards supporting farmers' sustainable practices in the Czech Republic, Spain, Sweden, and the UK. In Switzerland, however, fostering greater trust in the roles of local administration and national government in rural management may be more effective in increasing citizens' support for approaches that facilitate farmers' sustainable practices. Furthermore, the varying effects of social trust in different stakeholders on citizen attitudes across countries suggests the need to engage the public and other stakeholders to co-define and effectively introduce the roles of various stakeholder groups in rural management through different approaches to promoting sustainable practices among farmers. This could enable a better perceived alignment between rural management responsibilities assigned to stakeholders and citizens' understanding of each stakeholder group's role in rural management, thereby fostering greater citizen engagement in, and support for, these management activities.

### 5.2. Limitations and future research

One potential limitation was that online surveys were used for data collection. Despite the quota sampling on age, gender and education in each country, citizens with limited access to the internet might have

been excluded from the sample, which could bias the results. Future research can use offline methods for data collection and triangulate the findings to better understand the validity and reliability of the results. Further, social desirability biases may exist when self-reporting socially acceptable behaviours, such as participants' support for promoting sustainable practices (Sarti et al., 2018). This suggests that participants' support for helping farmers adopt sustainable practices may have been overestimated when compared to real-world situations. Experimental and observational behavioural research needs to be conducted to validate the results of this research. Our study focuses on attitudes towards policies without measuring citizens' actual support behaviours. This limitation should be addressed by future research applying participatory methods which could offer valuable insights into how behavioural engagement reinforces or alters citizens' perceptions of rural ES and threats, and how these evolving perceptions, in turn, influence future behaviours, such as participation in any initiative promoting changes in agricultural policy.

## 6. Conclusion

This research investigates the heterogeneity of European citizens based on their perceptions of rural ES benefits and threats to rural areas across biogeographically distinct regions. Four citizen segments with distinct levels of benefit and threat perceptions were identified, which differed in their support for assisting farmers to adopt sustainable practices. The findings exhibited potential synergistic effects of perceived ES benefits and perceived threats on societal support for pro-environmental management policies. In addition, similarities and variations across five study countries regarding the impacts of segment membership, environmental attitudes, trust in different stakeholder groups and socio-demographic attributes on support for farmers' sustainable practices were investigated. The results contribute to future citizen engagement and policymaking related to pro-environmental rural management initiatives.

## CRedit authorship contribution statement

**Rao Fu:** Writing – review & editing, Writing – original draft. **Meng Yue:** Writing – original draft, Methodology, Formal analysis. **Shan Jin:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Conceptualization. **Lynn J. Frewer:** Writing – review & editing, Project administration, Funding acquisition.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jrurstud.2025.103779>.

## Data availability

The data and survey are available at: <https://zenodo.org/records/12819487>

## References

- Ajzen, I., 1991. The theory of planned behavior. *Organ. Behav. Hum. Decis. Process.* 50 (2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T).
- Asah, S.T., Guerry, A.D., Blahna, D.J., Lawler, J.J., 2014. Perception, acquisition and use of ecosystem services: human behavior, and ecosystem management and policy implications. *Ecosyst. Serv.* 10, 180–186. <https://doi.org/10.1016/j.ecoser.2014.08.003>.
- Balázs, Á., Dänhardt, J., Collins, S., Schweiger, O., Settele, J., Hartel, T., 2021. Understanding cultural ecosystem services related to farmlands: expert survey in Europe. *Land Use Policy* 100, 104900. <https://doi.org/10.1016/j.landusepol.2020.104900>.
- Bandura, A., 1986. *Social Foundations of Thought and Action: A Social Cognitive Theory*. Prentice Hall, Englewood Cliffs, NJ. ISBN 978-0-13-815614-5.
- Bandura, A., 1991. Social cognitive theory of moral thought and action. In: Kurtines, W. M., Gewirtz, J., Lamb, J.L. (Eds.), *Handbook of moral behavior and development*, Vol. 1. Lawrence Erlbaum Associates, Inc., pp. 45–103.
- Bartczak, A., 2015. The role of social and environmental attitudes in non-market valuation: an application to the Białowieża Forest. *For. Pol. Econ.* 50, 357–365. <https://doi.org/10.1016/j.forpol.2014.09.011>.
- Ben-Hur, A., Guyon, I., 2003. Detecting stable clusters using principal component analysis. *Functional Genomics: Methods Protoc.* 159–182. <https://doi.org/10.1385/1-59259-364-X:159>.
- Bengtsson, J., Bullock, J.M., Egoh, B., Everson, C., Everson, T., O'Connor, T., O'Farrell, P. J., Smith, H.G., Lindborg, R., 2019. Grasslands—More important for ecosystem services than you might think. *Ecosphere* 10 (2), e02582. <https://doi.org/10.1002/ecs2.2582>.
- Richard, E., Kazmierczak, A., 2012. Are homeowners willing to adapt to and mitigate the effects of climate change? *Clim. Change* 112 (3), 633–654. <https://doi.org/10.1007/s10584-011-0257-8>.
- Bijani, M., Mohammadi-Mehr, S., Shiri, N., 2022. Towards rural women's pro-environmental behaviors: application of protection motivation theory. *Global Ecology and Conservation* 39, e02303. <https://doi.org/10.1016/j.gecco.2022.e02303>.
- Bockarjova, M., Steg, L., 2014. Can protection motivation theory predict pro-environmental behavior? Explaining the adoption of electric vehicles in the Netherlands. *Glob. Environ. Change* 28, 276–288. <https://doi.org/10.1016/j.gloenvcha.2014.06.010>.
- Brown, C., Kovács, E., Herzon, I., Villamayor-Tomas, S., Albizua, A., Galanaki, A., Grammatikopoulou, I., McCracken, D., Olsson, J.A., Zinngrube, Y., 2021. Simplistic understandings of farmer motivations could undermine the environmental potential of the common agricultural policy. *Land Use Policy* 101, 105136. <https://doi.org/10.1016/j.landusepol.2020.105136>.
- Casado-Arzuaga, I., Madariaga, I., Onaandia, M., 2013. Perception, demand and user contribution to ecosystem services in the Bilbao metropolitan greenbelt. *J. Environ. Manag.* 129, 33–43. <https://doi.org/10.1016/j.jenvman.2013.05.059>.
- Chen, M., Qian, X., Zhang, L., 2015. Public participation in environmental management in China: status quo and mode innovation. *Environ. Manag.* 55 (3), 523–535. <https://doi.org/10.1007/s00267-014-0428-2>.
- Civera, C., de Colle, S., Casalegno, C., 2019. Stakeholder engagement through empowerment: the case of coffee farmers. *Bus. Ethics Eur. Rev.* 28 (2), 156–174. <https://doi.org/10.1111/beer.12208>.
- Csurgó, B., Smith, M.K., 2021. The value of cultural ecosystem services in a rural landscape context. *J. Rural Stud.* 86, 76–86. <https://doi.org/10.1016/j.jrurstud.2021.05.030>.
- Cuadros-Casanova, I., Cristiano, A., Biancolini, D., Cimatti, M., Sessa, A.A., Mendez Angarita, V.Y., Dragonetti, C., Pacifici, M., Rondinini, C., Di Marco, M., 2023. Opportunities and challenges for common agricultural policy reform to support the European green deal. *Conserv. Biol.* 37 (3), e14052. <https://doi.org/10.1111/cobi.14052>.
- de Jonge, J., van Trijp, J.C.M., van der Lans, I.A., Renes, R.J., Frewer, L.J., 2008. How trust in institutions and organizations builds general consumer confidence in the safety of food: a decomposition of effects. *Appetite* 51 (2), 311–317. <https://doi.org/10.1016/j.appet.2008.03.008>.
- Department for Environment, Food & Rural Affairs, 2023. Environmental Land Management (ELM) Update: How Government will Pay for Land-based Environment and Climate Goods and Services. <https://www.gov.uk/government/publications/environmental-land-management-update-how-government-will-pay-for-land-based-environment-and-climate-goods-and-services/environmental-land-management-elm-update-how-government-will-pay-for-land-based-environment-and-climate-goods-and-services> (accessed 8.13.2024).
- Dittrich, A., Seppelt, R., Václavík, T., Cord, A.F., 2017. Integrating ecosystem service bundles and socio-environmental conditions – a national scale analysis from Germany. *Ecosyst. Serv.* 28, 273–282. <https://doi.org/10.1016/j.ecoser.2017.08.007>.
- Eagly, A.H., Chaiken, S., 1993. *The Psychology of Attitudes*. Harcourt brace Jovanovich college publishers.
- Earle, T.C., 2010. Trust in risk management: a model-based review of empirical research. *Risk Anal.* 30 (4), 541–574. <https://doi.org/10.1111/j.1539-6924.2010.01398.x>.
- El Benni, N., Irek, J., Finger, R., Mack, G., Ammann, J., 2024. Citizens' perceptions of agricultural policy goals—evidence from Switzerland. *Food Policy* 125, 102643. <https://doi.org/10.1016/j.foodpol.2024.102643>.
- Erfanian, S., Maleknia, R., Halalisan, A.F., 2024. Application of social cognitive theory to determine shaping factors of environmental intention and behaviors of ecotourist in forest areas [Original Research]. *Frontiers in Forests and Global Change* 7. <https://doi.org/10.3389/ffgc.2024.1489170>, 2024.

- European Environment Agency, 2019. The European environment — state and outlook 2020: knowledge for transition to a sustainable Europe. <https://www.eea.europa.eu/en/analysis/publications/soer-2020>.
- European Environment Agency, 2020. State of nature in the EU – Results from reporting under the nature directives 2013–2018. <http://doi.org/10.2800/088178>.
- Faccioli, M., Czajkowski, M., Glenk, K., Martín-Ortega, J., 2020. Environmental attitudes and place identity as determinants of preferences for ecosystem services. *Ecol. Econ.* 174, 106600. <https://doi.org/10.1016/j.ecolecon.2020.106600>.
- Fagerholm, N., Torralba, M., Moreno, G., Girardello, M., Herzog, F., Aviron, S., Burgess, P., Crous-Duran, J., Ferreiro-Domínguez, N., Graves, A., Hartel, T., Măcișan, V., Kay, S., Pantera, A., Varga, A., Plieninger, T., 2019. Cross-site analysis of perceived ecosystem service benefits in multifunctional landscapes. *Glob. Environ. Change* 56, 134–147. <https://doi.org/10.1016/j.gloenvcha.2019.04.002>.
- Fockaert, L., Mathijs, E., Vranken, L., 2023. Citizen support for agri-environmental measures motivated by environmental consciousness. *Landsc. Urban Plann.* 232, 104675. <https://doi.org/10.1016/j.landurbplan.2022.104675>.
- Goebel, M., Wardropper, C.B., 2024. Trust and subjective knowledge influence perceived risk of lead exposure. *Risk Anal.* 44 (5), 1204–1218. <https://doi.org/10.1111/risa.14212>.
- Gómez-Limón, J.A., Vera-Toscano, E., Rico-González, M., 2012. Measuring individual preferences for rural multifunctionality: the importance of demographic and residential heterogeneity. *J. Agric. Econ.* 63 (1), 1–24. <https://doi.org/10.1111/j.1477-9552.2011.00325.x>.
- Goodson, D.J., van Riper, C.J., Andrade, R., Stewart, W., Cebrían-Piqueras, M.A., Raymond, C.M., 2023. Broad values as the basis for understanding deliberation about protected area management. *Sustain. Sci.* <https://doi.org/10.1007/s11625-023-01423-z>.
- Gray, S., Shwom, R., Jordan, R., 2012. Understanding factors that influence stakeholder trust of natural resource science and institutions. *Environ. Manag.* 49 (3), 663–674. <https://doi.org/10.1007/s00267-011-9800-7>.
- Gullino, P., Devecchi, M., Larcher, F., 2018. How can different stakeholders contribute to rural landscape planning policy? The case study of pralormo municipality (Italy). *J. Rural Stud.* 57, 99–109. <https://doi.org/10.1016/j.jrurstud.2017.12.002>.
- Guo, N., Hao, J.L., Zheng, C., Yu, S., Wu, W., 2022. Applying social cognitive theory to the determinants of employees' pro-environmental behaviour towards renovation waste minimization: in pursuit of a circular economy. *Waste and Biomass Valorization* 13 (9), 3739–3752. <https://doi.org/10.1007/s12649-022-01828-4>.
- Haines-Young, R., Potschin-Young, M., 2023. Revision of the common international classification for ecosystem services (News V5.1 update): a Policy brief. *One Ecosyst.* 145–157. <https://doi.org/10.3897/oneeco.3.e27108>.
- Hair, J.F., Ringle, C.M., Sarstedt, M., 2013. Partial least squares structural equation modeling: rigorous applications, better results and higher acceptance. *Long. Range Plan.* 46 (1–2), 1–12. <https://ssrn.com/abstract=2233795>.
- Hong, H., Hyojung, P., Youngah, L., Park, J., 2012. Public segmentation and government-public relationship building: a cluster analysis of publics in the United States and 19 European countries. *J. Publ. Relat. Res.* 24 (1), 37–68. <https://doi.org/10.1080/1062726X.2012.626135>.
- Jones, N., Malesios, C., Botetzagias, I., 2009. The influence of social capital on willingness to pay for the environment among EUROPEAN citizens. *Eur. Soc.* 11 (4), 511–530. <https://doi.org/10.1080/14616690802624168>.
- Kaiser, H.F., 1974. An index of factorial simplicity. *Psychometrika* 39 (1), 31–36. <https://doi.org/10.1007/BF02291575>.
- Kam, H., Potter, C., 2024. Who should deliver agri-environmental public goods in the UK? New land managers and their future role as public good providers. *Land Use Policy* 139, 107072. <https://doi.org/10.1016/j.landusepol.2024.107072>.
- Kerselaers, E., Rogge, E., Vanempen, E., Lauwers, L., Van Huylenbroeck, G., 2013. Changing land use in the countryside: stakeholders' perception of the ongoing rural planning processes in Flanders. *Land Use Policy* 32, 197–206. <https://doi.org/10.1016/j.landusepol.2012.10.016>.
- Kinnoué, S.M.D., Adomou, S., Gouwakinnou, G.N., Houéhanou, T.D., 2024. Community perception of riparian corridors ecosystem services and implications for environmental education in upper Oueme catchment in Benin, West Africa. *Open J. Ecol.* 14 (2), 125–147. <https://doi.org/10.4236/oje.2024.142008>.
- Kosenchuk, O., Shumakova, O., Zinich, A., Shelkovnikov, S., Poltarykhin, A., 2019. The development of agriculture in agricultural areas of Siberia: multifunctional character, environmental aspects. *Journal of Environmental Management and Tourism* 10 (5). [https://doi.org/10.14505/jemt.v10.5\(37\).06](https://doi.org/10.14505/jemt.v10.5(37).06), 2019): *JEMT Volume X Issue 5(37) Fall 2019*.
- Kothe, E.J., Mathew, L., Madelon, N., Anna, K., A. M. B., Novorodovskaya, L., 2019. Protection motivation theory and pro-environmental behaviour: a systematic mapping review. *Aust. J. Psychol.* 71 (4), 411–432. <https://doi.org/10.1111/ajpy.12271>.
- Kulin, J., Johansson Sevå, I., 2021. Who do you trust? How trust in partial and impartial government institutions influences climate policy attitudes. *Clim. Policy* 21 (1), 33–46. <https://doi.org/10.1080/14693062.2020.1792822>.
- La Notte, A., D'Amato, D., Mäkinen, H., Paracchini, M.L., Liqueste, C., Egoh, B., Geneletti, D., Crossman, N.D., 2017. Ecosystem services classification: a systems ecology perspective of the cascade framework. *Ecol. Indic.* 74, 392–402. <https://doi.org/10.1016/j.ecolind.2016.11.030>.
- Lafuente, R., Paneque, P., Vargas, J., 2018. The role played by environmental concern and institutional trust in changing public preferences for water management. *Environmental Policy and Governance* 28 (6), 441–452. <https://doi.org/10.1002/etl.1808>.
- Lastra-Bravo, X.B., Hubbard, C., Garrod, G., Tolón-Becerra, A., 2015. What drives farmers' participation in EU agri-environmental schemes?: results from a qualitative meta-analysis. *Environ. Sci. Pol.* 54, 1–9. <https://doi.org/10.1016/j.envsci.2015.06.002>.
- Lee, C.-K., Olya, H., Ahmad, M.S., Kim, K.H., Oh, M.-J., 2021. Sustainable intelligence, destination social responsibility, and pro-environmental behaviour of visitors: evidence from an eco-tourism site. *J. Hospit. Tourism Manag.* 47, 365–376. <https://doi.org/10.1016/j.jhtm.2021.04.010>.
- Lee, Y.-K., Choong-Ki, L., Woojin, L., Ahmad, M.S., 2021. Do hedonic and utilitarian values increase pro-environmental behavior and support for festivals? *Asia Pac. J. Tourism Res.* 26 (8), 921–934. <https://doi.org/10.1080/10941665.2021.1927122>.
- Leite, S.K., Vendruscolo, G.S., Renk, A.A., Kissmann, C., 2019. Perception of farmers on landscape change in southern Brazil: divergences and convergences related to gender and age. *J. Rural Stud.* 69, 11–18. <https://doi.org/10.1016/j.jrurstud.2019.04.008>.
- Lim, J.Y., Moon, K.-K., 2020. Perceived environmental threats and pro-environmental behaviors: investigating the role of political participation using a South Korean survey. *Int. J. Environ. Res. Publ. Health* 17 (9), 3244. <https://www.mdpi.com/1660-4601/17/9/3244>.
- Marquart-Pyatt, S.T., 2012. Environmental concerns in cross-national context: how do mass publics in central and eastern Europe compare with other regions of the world? *Sociologický časopis/Czech Sociological Review* 48 (3), 441–446. <https://www.cceol.com/search/article-detail?id=262922>.
- Martín-López, B., Inieta-Arandia, I., García-Llorente, M., Palomo, I., Casado-Arzuaga, I., Amo, D.G.D., Gómez-Baggethun, E., Oteros-Rozas, E., Palacios-Agundez, I., Willaerts, B., González, J.A., Santos-Martín, F., Onaindia, M., López-Santiago, C., Montes, C., 2012. Uncovering ecosystem service bundles through social preferences. *PLoS One* 7 (6), e38970. <https://doi.org/10.1371/journal.pone.0038970>.
- Martin, L., White, M.P., Hunt, A., Richardson, M., Pahl, S., Burt, J., 2020. Nature contact, nature connectedness and associations with health, wellbeing and pro-environmental behaviours. *J. Environ. Psychol.* 68, 101389. <https://doi.org/10.1016/j.jenvp.2020.101389>.
- Meng, Y., Chung, D., Zhang, A., 2023. The effect of social media environmental information exposure on the intention to participate in pro-environmental behavior. *PLoS One* 18 (11), e0294577. <https://doi.org/10.1371/journal.pone.0294577>.
- Milfont, T.L., Duckitt, J., 2010. The environmental attitudes inventory: a valid and reliable measure to assess the structure of environmental attitudes. *J. Environ. Psychol.* 30 (1), 80–94. <https://doi.org/10.1016/j.jenvp.2009.09.001>.
- Miller, E.F., Doolittle, A.A., Cerutti, P.O., Naimark, J., Rufino, M.C., Ashton, M.S., Mwangi, E., 2021. Spatial distribution and perceived drivers of provisioning service values across an East African montane forest landscape. *Landsc. Urban Plann.* 207, 103995. <https://doi.org/10.1016/j.landurbplan.2020.103995>.
- Mouchet, M.A., Lamarque, P., Martín-López, B., Crouzat, E., Gos, P., Byczek, C., Lavorel, S., 2014. An interdisciplinary methodological guide for quantifying associations between ecosystem services. *Glob. Environ. Change* 28, 298–308. <https://doi.org/10.1016/j.gloenvcha.2014.07.012>.
- Nosrati, S., Kim, S., Leung, J., 2023. Moderating effects of cultural values on the relationship between individual values and pro-environmental behavior. *J. Hospit. Tourism Manag.* 57, 158–169. <https://doi.org/10.1016/j.jhtm.2023.10.002>.
- Nowack, W., Schmid, J.C., Grethe, H., 2022. Social dimensions of multifunctional agriculture in Europe - towards an interdisciplinary framework. *Int. J. Agric. Sustain.* 20 (5), 758–773. <https://doi.org/10.1080/14735903.2021.1977520>.
- O'Neill, A., 2023. Economy & Politics. <https://www.statista.com/markets/2535/economy-politics/>.
- Plieninger, T., Torralba, M., Hartel, T., Fagerholm, N., 2019. Perceived ecosystem services synergies, trade-offs, and bundles in European high nature value farming landscapes. *Landsc. Ecol.* 34 (7), 1565–1581. <https://doi.org/10.1007/s10980-019-00775-1>.
- Prager, K., Freese, J., 2009. Stakeholder involvement in agri-environmental policy making – learning from a local- and a state-level approach in Germany. *J. Environ. Manag.* 90 (2), 1154–1167. <https://doi.org/10.1016/j.jenvman.2008.05.005>.
- Reif, J., Gamero, A., Holáková, A., Aunins, A., Chodkiewicz, T., Hristov, I., Kurlavicius, P., Levits, M., Szép, T., Voršek, P., 2024. Accelerated farmland bird population declines in European countries after their recent EU accession. *Sci. Total Environ.* 946, 174281. <https://doi.org/10.1016/j.scitotenv.2024.174281>.
- Rogge, E., Nevens, F., Gulinck, H., 2007. Perception of rural landscapes in Flanders: looking beyond aesthetics. *Landsc. Urban Plann.* 82 (4), 159–174. <https://doi.org/10.1016/j.landurbplan.2007.02.006>.
- Ross, V.L., Fielding, K.S., Louis, W.R., 2014. Social trust, risk perceptions and public acceptance of recycled water: testing a social-psychological model. *J. Environ. Manag.* 137, 61–68. <https://doi.org/10.1016/j.jenvman.2014.01.039>.
- Sagie, H., Morris, A., Rofe, Y., Orenstein, D.E., Groner, E., 2013. Cross-cultural perceptions of ecosystem services: a social inquiry on both sides of the Israeli-Jordanian border of the southern Arava valley desert. *J. Arid Environ.* 97, 38–48. <https://doi.org/10.1016/j.jaridenv.2013.05.007>.
- Sarti, S., Darnall, N., Testa, F., 2018. Market segmentation of consumers based on their actual sustainability and health-related purchases. *J. Clean. Prod.* 192, 270–280. <https://doi.org/10.1016/j.jclepro.2018.04.188>.
- Schaffer, L.M., Oehl, B., Bernauer, T., 2022. Are policymakers responsive to public demand in climate politics? *J. Publ. Pol.* 42 (1), 136–164. <https://doi.org/10.1017/S0143814X21000088>.
- Schirpke, U., Scolozzi, R., Tappeiner, U., 2022. Not too small to benefit society: insights into perceived cultural ecosystem services of mountain lakes in the European Alps. *Ecol. Soc.* 27 (1), 6. <https://doi.org/10.5751/ES-12987-270106>.
- Shafiei, A., Maleksaeidi, H., 2020. Pro-environmental behavior of university students: application of protection motivation theory. *Global Ecology and Conservation* 22, e00908. <https://doi.org/10.1016/j.gecco.2020.e00908>.
- Shi, Z., Ma, L., Zhang, W., Gong, M., 2022. Differentiation and correlation of spatial pattern and multifunction in rural settlements considering topographic gradients:



- evidence from Loess Hilly Region, China. *J. Environ. Manag.* 315, 115127. <https://doi.org/10.1016/j.jenvman.2022.115127>.
- Stewart-Knox, B.J., Bunting, B.P., Jin, S., Tindale, S., Vicario-Modroño, V., Miškolci, S., Ojo, M., Sánchez-Zamora, P., Gallardo-Cobos, R., Newell-Price, P., Sonneveld, M., Hunter, E., Frewer, L.J., 2024. Citizen attitudes towards the environment and association with perceived threats to the countryside: evidence from countries in five European biogeographic zones. *PLoS One* 19 (10), e0311056. <https://doi.org/10.1371/journal.pone.0311056>.
- Taber, K.S., 2018. The use of cronbach's alpha when developing and reporting research instruments in science education. *Res. Sci. Educ.* 48 (6), 1273–1296. <https://doi.org/10.1007/s11165-016-9602-2>.
- Thiemann, M., Riebl, R., Haensel, M., Schmitt, T.M., Steinbauer, M.J., Landwehr, T., Fricke, U., Redlich, S., Koellner, T., 2022. Perceptions of ecosystem services: comparing socio-cultural and environmental influences. *PLoS One* 17 (10), e0276432. <https://doi.org/10.1371/journal.pone.0276432>.
- Tindale, S., Cao, Y., Jin, S., Green, O., Burd, M., Vicario-Modroño, V., Alonso, N., Clingo, S., Gallardo-Cobos, R., Sanchez-Zamora, P., Hunter, E., Miskolci, S., Mack, G., El Benni, N., Spoerri, M., Outhwaite, S., Elliott, J., Price, P.N., Frewer, L.J., 2024. Tipping points and farmer decision-making in European permanent grassland (PG) agricultural systems. *J. Rural Stud.* 110, 103364. <https://doi.org/10.1016/j.jrurstud.2024.103364>.
- Tindale, S., Ojo, M., Jin, S., Vicario-Modroño, V., Gallardo-Cobos, R., Sanchez-Zamora, P., Hunter, E., Simona, Miskolci, Sonneveld, M., Price, P.N., Frewer, L.J., 2022. Super-g Sustainable Permanent Grassland: Deliverable 4.3 – Citizen Priorities and Preferences for Ecosystem Services in Relation to Permanent Grassland. <https://www.super-g.eu/2024/02/20/deliverable-4-3-citizen-priorities-and-preferences-for-ecosystem-services-in-relation-to-permanent-grassland/>.
- Tindale, S., Vicario-Modroño, V., Gallardo-Cobos, R., Hunter, E., Miškolci, S., Price, P.N., Sánchez-Zamora, P., Sonneveld, M., Ojo, M., McInnes, K., Frewer, L.J., 2023. Citizen perceptions and values associated with ecosystem services from European grassland landscapes. *Land Use Policy* 127, 106574. <https://doi.org/10.1016/j.landusepol.2023.106574>.
- Toma, L., Mathijs, E., 2007. Environmental risk perception, environmental concern and propensity to participate in organic farming programmes. *J. Environ. Manag.* 83 (2), 145–157. <https://doi.org/10.1016/j.jenvman.2006.02.004>.
- Tonsor, G.T., Schroeder, T.C., Pennings, J.M.E., 2009. Factors impacting food safety risk perceptions. *J. Agric. Econ.* 60 (3), 625–644. <https://doi.org/10.1111/j.1477-9552.2009.00209.x>.
- van Riper, C., Winkler-Schor, S., Foelske, L., Keller, R., Braitto, M., Raymond, C., Eriksson, M., Golebie, E., Johnson, D., 2019. Integrating multi-level values and pro-environmental behavior in a U.S. protected area. *Sustain. Sci.* 14 (5), 1395–1408. <https://doi.org/10.1007/s11625-019-00677-w>.
- Xue, R., Wang, C., Zhao, L., Sun, B., Wang, B., 2022. Agricultural intensification weakens the soil health index and stability of microbial networks. *Agric. Ecosyst. Environ.* 339, 108118. <https://doi.org/10.1016/j.agee.2022.108118>.
- Young, J.C., Searle, K., Butler, A., Simmons, P., Watt, A.D., Jordan, A., 2016. The role of trust in the resolution of conservation conflicts. *Biol. Conserv.* 195, 196–202. <https://doi.org/10.1016/j.biocon.2015.12.030>.
- Zhang, H., Cai, L., Bai, B., Yang, Y., Zhang, J., 2023. National forest park visitors' connectedness to nature and pro-environmental behavior: the effects of cultural ecosystem service, place and event attachment. *Journal of Outdoor Recreation and Tourism* 42, 100621. <https://doi.org/10.1016/j.jort.2023.100621>.
- Zhang, Y., Long, H., Chen, S., Ma, L., Gan, M., 2023. The development of multifunctional agriculture in farming regions of China: convergence or divergence? *Land Use Policy* 127, 106576. <https://doi.org/10.1016/j.landusepol.2023.106576>.
- Zoderer, B.M., Tasser, E., Carver, S., Tappeiner, U., 2019. Stakeholder perspectives on ecosystem service supply and ecosystem service demand bundles. *Ecosyst. Serv.* 37, 100938. <https://doi.org/10.1016/j.ecoser.2019.100938>.