

Understanding residents' engagement for the protection of urban green spaces by enriching the value-belief-norm theory with relational values—A case study of Munich (Germany)

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Abstract

1. Urban green spaces (UGS) provide mechanisms through which people connect and interact with each other, strengthening social relationships as well as human-nature connections, both of high relevance for sustainable development. However, what determines urban residents' engagement in activities for the protection of UGS still lacks a systematic understanding.
2. Our study aims to address this gap by enriching the value-belief-norm (VBN) theory with relational values based on a questionnaire ($N=221$) among residents engaging in UGS maintenance in the city of Munich (Germany).
3. Exploratory factor analysis and structural equation modelling showed that both individual responsibility and societal responsibility guide urban residents in their actions towards UGS protection.
4. Furthermore, we found a direct impact of biospheric, altruistic and hedonic values on engagement for the protection of UGS.
5. Therefore, this study signals the importance of investing in actively promoting pluralistic values among urban residents as cities today urgently need a reconnection of the human-nature relationship and UGS stewardship actions.
6. As we further confirm that relational values have impact on the constructs of the VBN theory, we conclude with a plea for recognizing the potential of relational values as enablers of change towards more responsible behaviours towards urban nature.

KEYWORDS

Munich, pro-environmental behaviour, relational values, urban green spaces, urban human-nature connection, VBN

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1 | INTRODUCTION

Urban green spaces (UGS) are vital for strengthening relationships between urban residents (Allen et al., 2018) as well as human-nature connections (Pauleit et al., 2019) both of high relevance for sustainable development (Jaung et al., 2021). UGS encourage civic engagement with nature, thus co-producing urban sustainability by contributing to the creation and maintenance of UGS (Buijs et al., 2019).

In fact, human interactions with nature are crucial to avoid the deterioration of pro-environmental attitudes and behaviour (Soga & Gaston, 2016) and to tackle today's multiple ecological (i.e. biodiversity loss) and social challenges (i.e. social exclusion) (Pauleit et al., 2019; UN, 2015). Therefore, research on human-nature connections presents a major lever for sustainability transformations in general (Abson et al., 2017; Riechers, Pătru-Dușe, et al., 2021), and in particular in urban contexts where the extinction of nature experience is omnipresent (Ives et al., 2017; Soga & Gaston, 2016). Psychological constructs (i.e. values, attitudes, worldviews, beliefs, etc.) have been suggested to influence people's pro-environmental actions towards nature (Heberlein & Black, 1981) across multiple environmental domains [i.e. recycling (Oreg & Katz-Gerro, 2006), transportation behaviour (Lind et al., 2015), sustainable behaviour and volunteering for urban nature (Jaung et al., 2021)]. In the work of Donella Meadows, (Meadows, 2008), values, worldviews and paradigms have been associated with deep leverage points, compared to shallow leverage points (i.e. parameters and feedbacks). However, changing these deep leverage points towards important considerations such as sustainability is difficult but holds substantial potential for system transformation towards a better socio-ecological well-being for human and more-than-human nature (Fischer & Riechers, 2019; Horcea-Milcu, 2022; IPBES, 2022).

1.1 | Values towards pro-environmental behaviour

People engage in pro-environmental actions for different reasons: biospheric (nature-oriented), altruistic values (society-oriented) as well as egoistic (self-oriented; Admiraal et al., 2017; Asah & Blahna, 2012; Sloane & Pröbstl-Haider, 2019) and eudaimonic (spiritual- and meaningfulness-oriented; van den Born et al., 2018). Several studies confirmed the positive associations between biospheric and altruistic values and pro-environmental behaviour and the little importance assigned to egoistic and hedonic values (De Groot & Steg, 2007; Dietz, 2015; Sloat et al., 2018; Stern et al., 1999). The latter ones could also be promoters of engagement in pro-environmental behaviours especially when self-benefits are experienced (De Dominicis et al., 2017; van Riper et al., 2020) or nature connectedness is powerful (Sockhill et al., 2022). Mould et al. (2020) found several enablers for participation in river management to have a relational character (i.e. active social relations; social networks). Such relational values can get people engaged in pro-environmental behaviours (Klain et al., 2017). They are linked to a diversity of

attitudes about nature (i.e. care, responsibility, identity and stewardship; Chan et al., 2016). For example, Dresner et al. (2015) found that strong levels of environmental identity (i.e. the interdependence between people and nature which guide their perceptions and actions towards the natural world) empower active stewards for urban parks in Portland, Oregon. Su et al. (2022) confirm this finding by showing the important role of the relational values of residents in the formation of moral obligations to protect UGS in Beijing, China.

Although some psychological constructs (i.e. values) may have a direct influence on a pro-environmental behaviour, others can play intermediary roles. In the example of the motivations of US recreational anglers getting engaged in actions for the minimization of biological invasions, Shin et al. (2022) found that eudaimonic values require endorsement of other values (i.e. biospheric, egoistic, etc.). Punzo et al. (2019) showed that values (i.e. biospheric, altruistic, etc.) indirectly through the effect of feelings of responsibility contribute to pro-environmental actions in Germany.

1.2 | Theories of pro-environmental behaviour

To study the causal pathways to pro-environmental behaviours, several models have been developed: that is the norm activation model (NAM; Schwartz, 1977), the theory of planned behaviour (TPB; Ajzen, 1991) and the value-beliefs-norm theory (VBN; Stern et al., 1999). These models by themselves or in combination with each other have been commonly used to depict such pathways. For example, De Groot and Steg (2009) applied the NAM and found that by activating feelings of responsibility, individuals are more motivated to act pro-environmentally. By using the VBN theory, Jaung et al. (2021) highlighted the important influence of relational values (i.e. eudaimonia, individual identity, moral responsibility towards non-humans) on personal norms in enacting pro-environmental behaviour concerning urban nature. Fornara et al. (2020) extended the VBN theory by adding constructs of the theory of planned behaviour theory (which considers attitudes towards behaviour, subjective norms and perceived behavioural control as predictors of behavioural intentions) and reported that with the influence of social norms, the biospheric values of people and personal norms explain their pro-environmental behaviour towards nature protection.

1.3 | Objectives and hypothesis

Empirical research on causal relationships between psychological constructs and individuals' pro-environmental actions is still limited with regard to (i) urban nature (i.e. Jaung et al., 2021; Su et al., 2022) and particularly in the context of specific types of UGS (i.e. gardens, parks and flower beds; Saito et al., 2021), (ii) actual behaviour—action (not intention; Fornara et al., 2020) and (iii) activists for nature (Ives et al., 2017). In recent years, specific types of UGS (i.e. urban community gardens) have been suggested to alleviate the extinction of nature-experience for urban residents (Lin, Egerer, &

Ossola, 2018) and individuals' psychological dimensions have been considered essential for profound sustainability transformations (Wamsler, 2018). Therefore, to pave the path towards more sustainable futures, our objective is to investigate the psychological constructs that drive the engagement among urban residents for the protection of UGS. For the study, we apply the value-belief-norm (VBN) theory (Stern et al., 1999) and enrich it with relational values. Thus, Klain et al. (2017) suggest that such values may support pro-environmental behaviour and could be embedded into *ascription of responsibility* and *personal norms* constructs in the VBN (Figure 1). Furthermore, enriching the VBN theory with relational values can contribute to recent efforts of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and research to increase awareness that humans not only hold instrumental or intrinsic values towards nature but also relational values referring to preferences and virtues people hold towards nature, nourishing responsibilities and care towards her (Chan et al., 2018; Díaz et al., 2015; Hakkarainen et al., 2020; Himes & Muraca, 2018).

Thus, we propose two hypotheses: (i) Hypothesis one (H1): *Values* (biospheric, altruistic, egoistic and hedonic) are positively related to *engagement for the protection of UGS* (Figure 1); and Hypothesis two (H2): The positive relationship between *values* (biospheric, altruistic, egoistic and hedonic) and *engagement in the protection of UGS* is mediated by the *ascription of responsibility*, which is linked to *personal norms*. In our VBN model, relational values are embedded into the *ascription of responsibility* and *personal norms* constructs (Klain et al., 2017).

1.4 | Theoretical framework

The VBN theory devised by Stern et al. (1999) has been the dominating theory to study pro-environmental behaviours in many fields (Fornara et al., 2020; Su et al., 2022; van der Werff & Steg, 2016) showing to be also effective in explaining urban nature experiences (Jaung et al., 2021). It represents a causal process including a set of psychological dimensions that can predict pro-environmental behaviour: individuals holding basic *values* become *aware of* both positive and negative *consequences* of a situation or own actions on the environment, which further activates a sense of *ascribed responsibility* (beliefs) that further triggers feelings of *moral obligations to behave properly* (De Groot & Steg, 2007).

The flexibility of the VBN theory allowed us to work with its components and made it relevant to our study: by removing components (i.e. worldviews) or adding different types of values (i.e. hedonic, relational, etc.), which have been found with no effect in reducing its predictive power, even making it more parsimonious (van der Werff & Steg, 2016). Mostly studied in the context of behavioural intentions, we applied VBN in a context of actual behaviour, covering therefore the value-action gap (Blake, 1999) by understanding which values drive engagement for the protection of UGS. Furthermore, it has been suggested that VBN has a stronger predictive power when it comes to specific behaviour (van der Werff & Steg, 2016), which our study addresses.

Basic *values* have been categorized into self-transcendence (biospheric and altruistic and self-enhancement, egoistic and hedonic

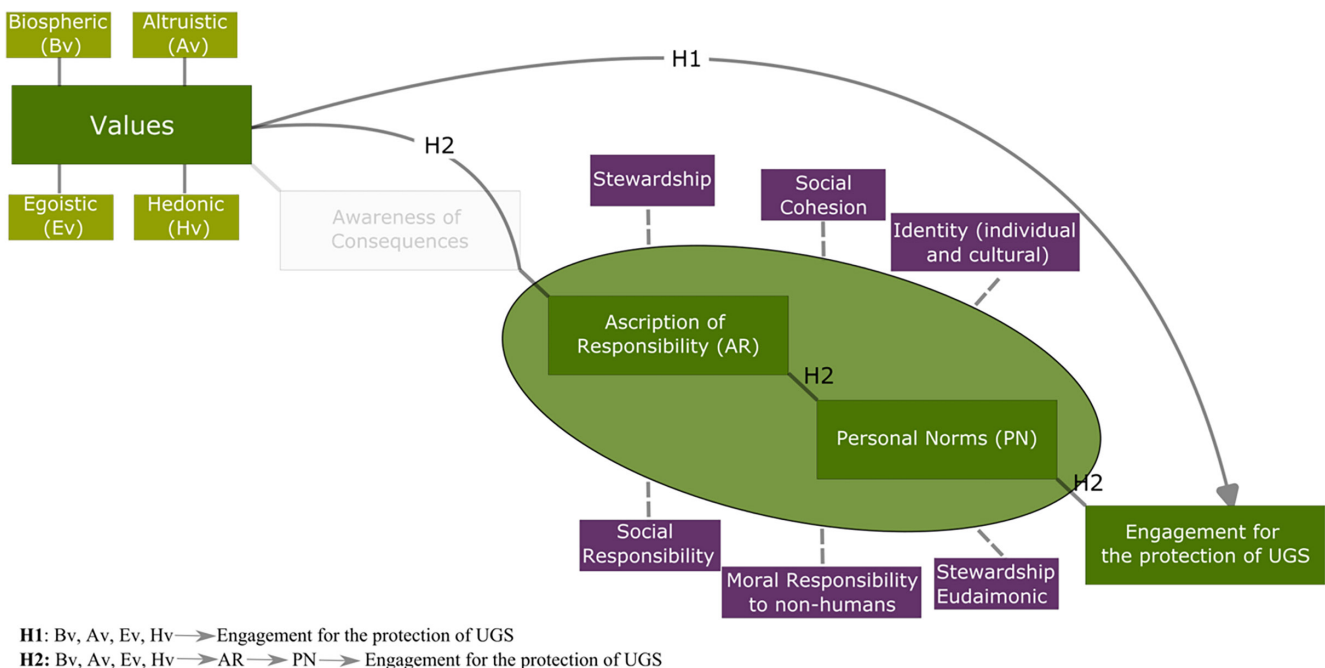


FIGURE 1 Model adapted from Klain et al. (2017). Green—the value-belief-norm (VBN) model, purple—the relational values used in the study, grey lines—the paths in the model between the VBN components and grey dashes—the influence of relational values on the VBN components; additionally to Klain et al. (2017), we added the 'Hedonic values' into values and 'Engagement for the protection of UGS' as pro-environmental behaviour. We did not explore the 'Awareness of Consequences' component (faint grey text box) in the VBN model (see the limitations Section 4.3 for details).

[comfort oriented]; De Groot & Steg, 2007; Steg, Perlaviciute, et al., 2014; Stern & Dietz, 1994). Biospheric values include concerns for nature and the natural environment (i.e. protecting the environment). Altruistic values reflect interests for the welfare of other human beings (i.e. helpfulness). Egoistic values are associated with concerns about personal status (i.e. wealth). Hedonic values refer to pleasurable feelings as perceived by users (i.e. people derive pleasure from engaging in recreation activities). In the context of the VBN theory, all four types of values have been suggested to be associated to a higher or lesser extent with pro-environmental behaviours depending on types of behaviour (i.e. public vs. private-sphere pro-environmental behaviours, effortful or costly behaviours, etc.; Shin et al., 2022; Stern, 2000) as well as situational factors (i.e. eco-friendly countries, Punzo et al., 2019).

However, recent research has highlighted another type of values: relational values that express more deeply the people's relationship with nature (Chan et al., 2016; IPBES, 2016). In the context of VBN theory, Su et al. (2022) consider relational values as basic values and show their positive effect on awareness of consequences, ascription of responsibility and moral norms. Furthermore, the more citizens endorse relational values, such as stewardship, identity, responsibility and so forth, the more likely they are to adopt ecological practices (Klain et al., 2017) and conservation behaviours (Knippenberg et al., 2018; see H1). Klain et al. (2017) imagine relational values linked to *ascription of responsibility* and *personal norms* within the VBN theory and propose the hypothesis that socio-ecological relational framing may influence behavioural intention (see H2). According to the hypothesis of Klain et al. (2017) we enrich the VBN theory with relational values (Figure 1).

For the relational values, we employed the framework of Chan et al. (2016) given the strong connection to feelings of responsibility and personal norms (to behave protective towards nature) of the values of cultural identity; social cohesion, social responsibility, moral responsibility to non-humans and individual identity, stewardship and stewardship eudaimonic. For example, *culture* has been found to be an important predictor of environmental behaviours (Oreg & Katz-Gerro, 2006) through its nature of belonging in a group and interdependence, which may empower individuals to act responsible for nature (Mancha & Yoder, 2015). Jennings and Bamkole (2019), Oh et al. (2022) and Veen et al. (2016) noted that *socially cohesive* people are more likely to engage in nature-related activities. Feelings of *responsibility* for the environment contributes to active engagement (Punzo et al., 2019). Social and moral responsibility is related to the attitude of altruism and people who endorse such values behave generally responsible towards nature (De Dominicis et al., 2017; Punzo et al., 2019). Individuals with a general attachment to nature develop a strong sense of *identity* with it, which can lead to acting responsible for nature (Cheng & Monroe, 2010) and those who have internalized an obligation to get engaged are also more likely to adopt a *stewardship* behaviour (Landon et al., 2018). Furthermore, *eudaimonic stewardship* can trigger personal responsibility towards nature, that is people act responsibly when they share a particular connection with nature and want to care for it for individual's meaningfulness (Shin et al., 2022).

2 | METHODOLOGY

2.1 | Study area

Our case study is focused on the third-largest city in Germany, Munich, the capital of the southern state of Bavaria. Due to a strong economy, Munich is one of the fastest growing cities in Germany with approximately 1.5 million residents (LHM München, 2020). On an area of 311 km² Munich is also one of the most densely populated German cities with an average population density of 4900 inhabitants per km². Each inhabitant has 74m² of green spaces (i.e. parks, agricultural areas, forests and waterbodies) available (Taubenböck et al., 2021) and around 38% of its area is covered by agricultural areas, woodlands, waterbodies and recreation areas (LHM München, 2020).

The presence of green spaces, such as woodlands, grasslands/meadows, gravel pits, wet meadows and forests are typically found in the temperate cities, such as Munich. Green spaces are more sparse in the city center and more abundant on the outskirts (Figure 2).

The city's ecological qualities are linked to its favourable location along the Isar River and a variety of habitat types (different types of woodlands, extensively managed grasslands). In addition to strategic planning of green open spaces and a biodiversity program, there are also several participatory initiatives carried out with Munich residents and professionals to safeguard and increase the open spaces and public green spaces of the city. For example, urban gardening in Munich (Artmann et al., 2021) consists of a dense network of allotment, community and vegetable gardens, which grow in number as part of the city's planning initiatives. Civic participation was also a major pillar in the development of the recent 2040 urban development plan under the guiding principle "City in Balance".¹ Due to the pressure on open and green spaces due to the high demand for the residential housing market on the one hand, and the risks of climate change on living quality on the other, Munich aims to become a green compact city, making the importance of UGS for urban planning and policy visible. Therefore, Munich is an interesting case to investigate why and how urban residents engage to secure and improve UGS and how they can support urban governance to foster green and just cities (Buijs et al., 2019).

2.2 | The sample and questionnaire

To facilitate data collection, a standardized questionnaire has been conducted between May and December 2022 both online (via a private web page) and in person (with the standard paper-and-pencil procedure). Ethical review was not required for this study, as no sensitive personal data were collected. Participants were informed of the purpose of the study, ensuring anonymity by not creating links to their individual answers to the questions. For the online

¹<https://stadt.muenchen.de/infos/stadtentwicklungsplan-2040.html#id7>.

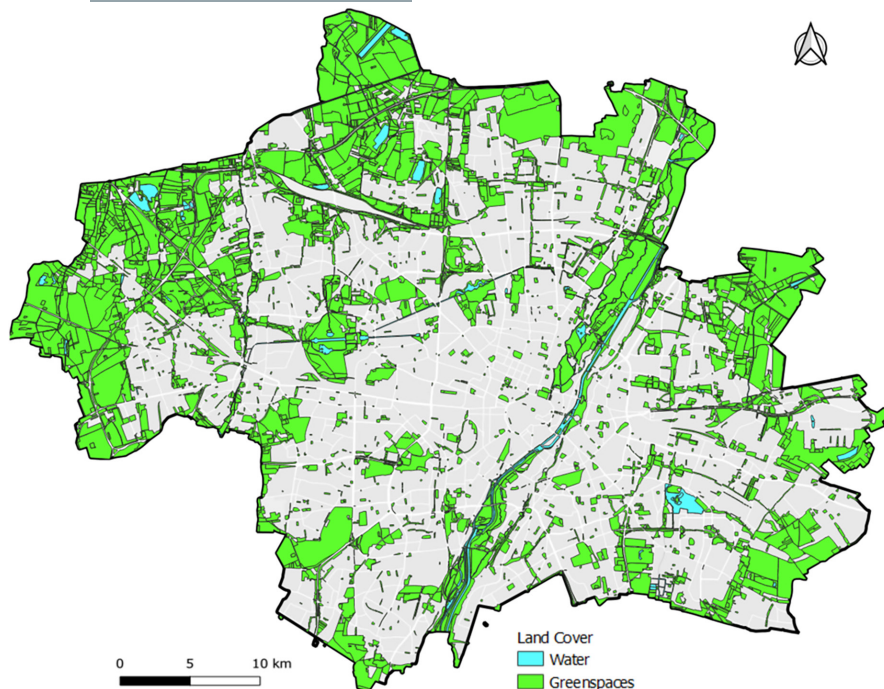


FIGURE 2 Green-blue spaces map of the city of Munich (data from Landeshauptstadt München, 2011).

questionnaire, the participants expressed their consent by self-enrolling and agreeing to participate in the questionnaire. For the in-person questionnaire, the data collectors informed the participants about the study and obtained their verbal consent for questionnaire administration.

The targeted group consisted of Munich residents who engage in an actual behaviour in favour of UGS protection. In the context of this study, UGS comprise managed and/or unmanaged areas with vegetation and/or water of different sizes and functions in the urban area (i.e. parks, forests, community gardens, greenways and water bodies/streams). We used the term *engagement* to describe any hand-on activity performed by urban residents to protect the UGS and promote human-nature interactions (i.e. greening of the public space, carrying for biotopes, planting of new vegetation, cleaning of waste and home/community gardening). Pretests were conducted with selected active urban residents (in terms of their involvement in UGS protection) from the authors' network of professional and personal contacts to ensure its clarity and appropriateness of wording for the targeted audience. This led to minor modifications of the questionnaire items. The criteria to reach the target sample were: (i) the participants must be residents of the city of Munich, (ii) who have been involved in activities for the protection of UGS (either as part of an organization, or informally, through self-management activities, that is home/community gardening). No monetary or other incentives were offered to secure participation.

2.2.1 | Online questionnaire

Contact with nature-oriented organizations and groups [i.e. (non-) governmental environmental organizations, city administration,

gardeners groups, academic groups in urban nature protection, etc.] was established via email. Contacts were asked: (i) to distribute the questionnaire through the mailing lists of urban residents that they have been engaged in different activities for the protection of UGS; (ii) to fill out the questionnaire by themselves, if they complied with the study objective; and (iii) to distribute the questionnaire to other contacts active in the protection of UGS. The distribution, therefore, proceeded the snowballing effect. To collect more responses to the questionnaire, QR code flyers were distributed in randomly selected UGS (i.e. parks, neighbourhood green areas, different projects oriented to UGS). Due to the overall length of the questionnaire, some respondents skipped answering some crucial questions to achieve the objectives of this study. For this reason, we did not consider them for further analysis. A total of 160 valid responses (out of 179) were collected using the online questionnaire.

2.2.2 | In-person questionnaire

To improve the number of responses, the online questionnaire was followed by an in-person questionnaire. A deliberate selection of participants (purposive sampling method; Etikan et al., 2016) was employed to collect data via the in-person questionnaire. Public locations with high pedestrian flow: parks, neighbourhood green areas, as well as different events that involved sustainable activities (i.e. 'Kleidertauschparty') were randomly selected to distribute the questionnaire among potential participants. If the participants adhered to our recruiting criteria, they were invited to participate in the questionnaire. Individuals that declined to participate were recorded as nonrespondents. The in-person questionnaire was distributed during the working days but mostly on weekends to reach

a wide range of visitors. Approximately 460 urban residents were contacted and asked to participate in the questionnaire. In total, 61 in-person questionnaires were completely filled in. Thus, a total of 221 valid questionnaires (160 online; 61 in-person) were retained for data analysis.

2.2.3 | Questionnaire measures

The questionnaire included the following construct (Hossu et al., 2023):

In the first part, we collect information on active behaviour (engagement in activities for the UGS protection): (i) the type of UGS activity in which urban residents were engaged, (ii) the type of UGS for which urban residents engaged themselves in protection activities (i.e. urban parks, community gardens, roadside UGS, water bodies or streams), (iii) the interactions that urban residents had with the components of UGS (i.e. flora, fauna), (iv) the number of involvements in such activities and (v) the reasons for staying engaged.

In the second part, a total of 33 items were measured on a six-point Likert scale ranging from: (1) strongly disagree to (5) strongly agree along with an option of "I don't know". The not-applicable (NA) responses were coded as "don't know" under the assumption that it indicated that the respondents were uncertain if the specific item is important to them and left unanswered. Fourteen items referring to self-enhancement and self-transcendence values, selected and adapted from De Groot and Steg (2007) and Steg, Bolterdijk, et al. (2014) were used to measure the values construct in the VBN theory: *biospheric values* (i.e. preventing pollution, protect the environment, respecting the earth and unity with nature), *altruistic values* (i.e. equality, a world at peace, social justice and helpfulness), *egoistic values* (i.e. social power, wealth and influential) and *hedonic values* (i.e. pleasure and enjoying life). Compared to previous studies testing the VBN theory, we also included the hedonic values (van der Werff & Steg, 2016). The items were developed to reflect the UGS context and adapted to the specific behaviour under study: engagement in activities for UGS protection.

Nineteen items refer to relational values based on Chan et al. (2016). *Cultural identity* was measured with two items adapted from Arias-Arevalo et al. (2017) and Riechers, Balázsi, et al. (2021). *Social cohesion* and *social responsibility* were measured with three items each adapted from Saito et al. (2021). *Moral responsibility to non-humans* was measured with one item adapted from Chan et al. (2016), representing feelings of a moral obligation to care for the variety of life provided by the UGS. *Individual identity* was measured with four items adapted from Klain et al. (2017) and Saito et al. (2021). The *stewardship principle* was measured with two items based on the authors' own elaboration, reflecting feelings of moral obligation to take action to avoid perceived threats, that is diminished care and protection of UGS. *Eudaimonic stewardship* was measured with four items, reflecting the positive

consequences of caring for nature in the UGS to improve one's own eudaimonic well-being, adapted from Saito et al. (2021) (Hossu et al., 2023).

In the third part, the questionnaire included an open question "Why do you consider it important to preserve the variety of life provided by urban green spaces?" and a set of questions that evaluate the factors related to nature (i.e. accessibility to UGS, frequency of visiting the UGS, nature experience in childhood, etc.) and the socio-demographic characteristics of residents (age, gender, education and profession; Table 1, Section 3). These were used for other activities within the research project.

2.3 | Analytical procedures

An exploratory factor analysis (EFA) was conducted to find the most appropriate latent structure among the items of (i) biospheric, altruistic, egoistic and hedonic values, and (ii) relational values in order to develop the VBN model and test our hypotheses based on Klain et al. (2017). The threshold values for each item were factor loading >0.40. Factor retention was determined using the Kaiser-Guttman rule criteria (eigenvalue >1), parallel analysis and scree plot (Bandalos & Finney, 2018). The robust maximum likelihood method was used for parameter estimates with oblimin factor rotation.

Structural equation modelling was conducted to obtain evidence on causal pathways in VBN theory in the context of active engagement for UGS protection. First, the measurement model was designed and confirmed by a confirmatory factor analysis (Hossu et al., 2023). The structure model was then examined to test our hypotheses. The structure model was designed on the basis of the best measurement model. The global model fit of the structure models was considered with the comparative fit index (CFI) and the root mean square error of approximation (RMSEA) (CFI > 0.95 and RMSEA < 0.08; Bandalos & Finney, 2018). The model parameters were estimated with the mean, and value adjusted weighted least squares estimation method. To achieve the global maximum result and avoid local maxima, the model was estimated with different starting values. When the model fit was not acceptable, post hoc modifications were applied on the basis of the modification indices. Pairwise deletion was used for missing data. All analyzes were conducted using Mplus 8.8 (Muthén & Muthén, 1998).

The questionnaire, as well as the anonymized raw and result data, are made available in a [data repository](#).

3 | RESULTS

3.1 | Engagement for UGS protection

Urban residents reported a wide range of activities for UGS protection in which they engaged. The word cloud with the German words (Figure 3) highlights the most frequent activities urban residents

TABLE 1 Residents profile and their demographic characteristics.

Variable	Number of respondents	Percentage (%)	Variable	Number of respondents	Percentage (%)
UGS type ^a			Gender		
Urban Parks	56	25.3	Female	148	67.0
Community gardens	101	45.7	Male	58	26.2
Roadside UGS	51	23.1	Diverse	3	1.4
Waterbodies or streams	31	14.0	I do not want to disclose	7	3.2
Other	60	27.1	NA	5	2.3
NA	2	0.9			
Interaction with UGS components			Age class		
Flora	113	51.1	0-18	13	5.9
Fauna	8	3.6	19-35	54	24.4
Both	77	34.8	36-50	50	22.6
Other	19	8.6	51-65	75	33.9
NA	4	1.8	Over 65	24	10.9
			NA	5	2.3
Experience with UGS activities			Level of education		
No experience	25	11.3	No education	6	2.7
1-5 involvements	96	43.4	Primary school	16	7.2
5-10 involvements	35	15.8	Vocational education	90	40.7
More than 10 involvements	63	28.5	High school	25	11.3
NA	2	0.9	University	78	35.3
			NA	6	2.7
Reasons for staying engaged ^a			Occupation ^a		
Because of a membership in an NGO	77	34.8	Employee	82	37.1
Because other familiar people were participating	53	24.0	Student	43	19.5
Because I saw value in such activities	137	62.0	Retired	35	15.8
Because I care for the green space where these activities are conducted	112	50.7	Self-employed	15	6.8
Because of incentives (i.e. monetary awards, gifts, food)	20	9.0	Civil servant	11	5.0
Other	53	24.0	Jobseeker	9	4.1
			Housewife/husband	8	3.6
			Pupil	5	2.3
			Trainee	3	1.4
			Occupations above combined	5	2.4
			NA	5	2.3

Note: Valid responses $n = 221$.

^aMultiple response question.

engaged in: gardening (*Gartenarbeit*) (48 responses), waste removal (*Abfallbeseitigung*) (41), biotope care (*Biotoppflege*) (20) and tree planting (*Baumpflanzung*) (20).

Among the most common types of UGS for which urban residents engaged in protection activities were community gardens (including allotment gardens), followed by the category 'other' (with

TABLE 2 Factor loadings and interfactor correlations of exploratory factor analysis on items of biospheric, altruistic, egoistic and hedonic values.

	Items	Biospheric values (bv)	Altruistic and hedonic values (avhv)
<i>It is important to me</i>			
To protect the natural resources (i.e. trees, grass, birds, insects, animals, water bodies) of the urban green spaces to prevent pollution (i.e. air pollution, litter)	bv1	0.81*	0.05
To preserve the flora and fauna (i.e. trees, grass, birds, insects, animals, water bodies) of the urban green spaces	bv2	0.96*	-0.03
To respect the animals (i.e. birds, butterflies, squirrels) within the urban green spaces	bv3	0.78*	0.07
To be in unity with the nature (i.e. trees, grass, birds, insects, animals, water bodies) of the urban green spaces	bv4	0.63*	0.04
That the urban green spaces can be used by children, elder, or other vulnerable groups	av1	0.26	0.65*
That no conflicts between users or between nature and people emerge on urban green spaces	av2	0.09	0.48*
That the urban green spaces to be evenly accessible among all people, regardless income, disabilities, gender, nations, etc	av3	0.27*	0.58
That the urban green spaces contribute to the welfare of people (i.e. by providing health, food, etc.)	av4	0.11	0.61*
That the urban green spaces offer a low-cost day out	ev2	-0.18*	0.76*
That the urban green spaces offer me opportunities to have fun (i.e. playing games on the urban green space)	hv1	-0.14*	0.74*
That the urban green spaces offer me leisure opportunities (i.e. walking, cycling)	hv2	0.32*	0.56*
Interfactor-correlations			
Biospheric values (bv)		1	
Altruistic and hedonic values (avhv)		0.64*	1

* $p < 0.05$.

(consequences of care for the individual's meaningfulness in life, eudaimonic stewardship) and individual identity, which showed high factor loads. The AR (*societal*) factor is named after the items for social responsibility and cultural identity that reflect responsibility at the societal level. The factor correlations between AR (*individual*) and AR (*societal*) were $r = 0.31$. Four items were removed due to low loadings: rvii1 (*I would feel less attached to the urban green spaces, if the diversity of plants and animals disappeared.*), rvsc1 (*Without my social connections supported by the urban green spaces, I would probably move.*), rvsp1 (*When I go to urban green spaces and see that they are threatened by diminished care and protection, I feel that I should get engaged in activities to increase their care and protection.*) and rvsp2 (*When I go to urban green spaces and see that they are threatened by diminished care and protection, I feel that I should urge the management authorities to take action in this matter.*). While the last two items (rvsp1 and rvsp2) were removed in the EFA process, the PN factor (personal norms) was made of rvsp1 and rvsp2 based on the hypotheses (Figure 1).

3.3 | Final model

The final model (Figure 4) shows the causal paths from basic values to *Engagement for the protection of UGS*. The fit indices of the model

are as follows: $\chi^2 = 806.02$, $p < 0.01$; RMSEA = 0.07; CFI = 0.75. Low CFI suggests that this model does not fit well to the data and RMSEA shows that this is an acceptable model; thus, we proceeded with the model.

The final model partially supported our hypothesis (H1) that values have a direct impact on *Engagement for the protection of UGS*. Biospheric values (bv) have a positive ($\beta = 0.72$, $p < 0.01$), while altruistic and hedonic values (avhv) have a negative impact ($\beta = -0.71$; $p < 0.01$).

Our model partially supported hypothesis two (H2) about the causal pathway in the VBN that we explored (Figure 1, Section 1). First, values had significant impacts on beliefs: biospheric values (bv) showed a positive impact on the ascription of individual responsibility (AR (*individual*)) $\beta = 0.81$; $p < 0.01$ and social responsibility (AR (*societal*)) $\beta = 0.83$; $p < 0.01$. Altruistic and hedonic values (avhv) had a relatively small impact on both the AR (*individual*) and the AR (*societal*) responsibility: $\beta = -0.24$; $p < 0.06$ and $\beta = 0.20$; $p < 0.01$, respectively. Second, beliefs (AR (*individual*) and social AR (*societal*)) have positive impacts on personal norms (PN): $\beta = 0.27$; $p < 0.01$, and $\beta = 0.37$; $p < 0.01$, respectively. However, we did not find a link between personal norms to protect UGS and *Engagement for the protection of UGS* ($\beta = -0.12$, $p = 0.37$), that is the path mediated by AR (*individual and societal*) and PN did not have statistically significant effects on *Engagement for the protection of UGS* (Table 4), implying that values impact *Engagement for the protection of UGS* independently and

TABLE 3 The factor loadings and interfactor correlations of exploratory factor analysis on relational values items.

	Items	AR (individual)	AR (societal)
By caring for nature here in the urban green spaces I am closer, in many ways to living an ideal life	rvse1	0.77*	0.02
By caring for nature here in the urban green spaces the conditions of my life have become excellent	rvse 2	0.81*	-0.05
By caring for nature here in the urban green spaces I have gotten the important things I want in life	rvse 3	0.85*	-0.07
By caring for nature here in the urban green spaces I could live my life over, I would change almost nothing	rvse 4	0.71*	-0.14*
The urban green spaces are a big part of our culture	rvci1	0.26*	0.46*
The urban green spaces are the identity of the people that live in the district they are located	rvci 2	0.26*	0.41*
The friendships developed through various community or nature activities related to the urban green spaces strongly connect me to these spaces	rvsc2	0.49*	0.13
The friendships developed through various community or nature activities related to the urban green spaces strongly connect me to society	rvsc 3	0.50*	0.15*
The urban green spaces should be conserved because they represent the source of people's wellbeing	rvsr1	0.11*	0.77*
The urban green spaces should be conserved for future generation	rvsr 2	-0.07*	0.94*
The urban green spaces should be conserved for our children	rvsr 3	-0.08*	0.90*
I feel a deep feeling of identification with nature when I spend time in urban green spaces	rvii2	0.50*	0.32*
I feel a deep feeling of identification with nature when I spend time in green spaces outside the city	rvii 3	0.37*	0.42*
I learn a lot about myself when I spend time in the urban green spaces.	rvii 4	0.62*	0.04
I have strong feelings about nature, these views are part of who I am and how I live my life	rvii 5	0.43*	0.37*
Caring for the variety of life provided by the urban green spaces is a moral necessity. (it's our turn to protect it)	rvmr	0.45*	0.12
		Interfactor-correlations	
Ascription of individual responsibility (AR [individual])		1	
Ascription of societal responsibility (AR [societal])		0.31*	1

* $p < 0.05$.

beliefs [AR (individual) and AR (societal)] and personal norms do not mediate values.

4 | DISCUSSION

4.1 | Engagement for UGS protection

Community gardens have been reported to be the most common type of UGS in which people engaged in hands-on activities, while gardening is the most common activity. In fact, community gardens have been considered important UGS to improve stewardship practices, due to the values these gardens help cultivate among their users (Artmann et al., 2021; Langemeyer et al., 2018) and due to associated benefits: ecological (i.e. urban biodiversity and cooling effects, Lin, Egerer, Liere, et al., 2018), social (i.e. increased social inclusion, Delshad, 2022) as well as physical and mental health (i.e. physical exercise, healthy diet, reconnection

to nature, Artmann et al., 2021; Joshi & Wende, 2022; Soga et al., 2017).

The urban respondents highlighted more interaction with flora and less with fauna. This can be explained by increasing attention to vegetation compared to fauna in urban nature-related projects (Blanco et al., 2022), negative interactions (Pop et al., 2023) as well as urban people's difficulty to recognize species such as birds or insects due to their mobility and noticeability (small-sized species) (Ishibashi et al., 2020). An increased number of projects including fauna would facilitate stronger human-fauna interactions and a better understanding of the role of urban fauna in maintaining and enhancing biodiversity (Ishibashi et al., 2020).

Regarding the reasons for engagement, most of the respondents highlighted the appreciation of protective activities and UGS care that have a relational dimension (Chan et al., 2016). Relational values have been reported in several studies as motivators for pro-environmental action (i.e. Asah & Blahna, 2012; Ganzevoort & van den Born, 2020; Sloane & Pröbstl-Haider, 2019). These

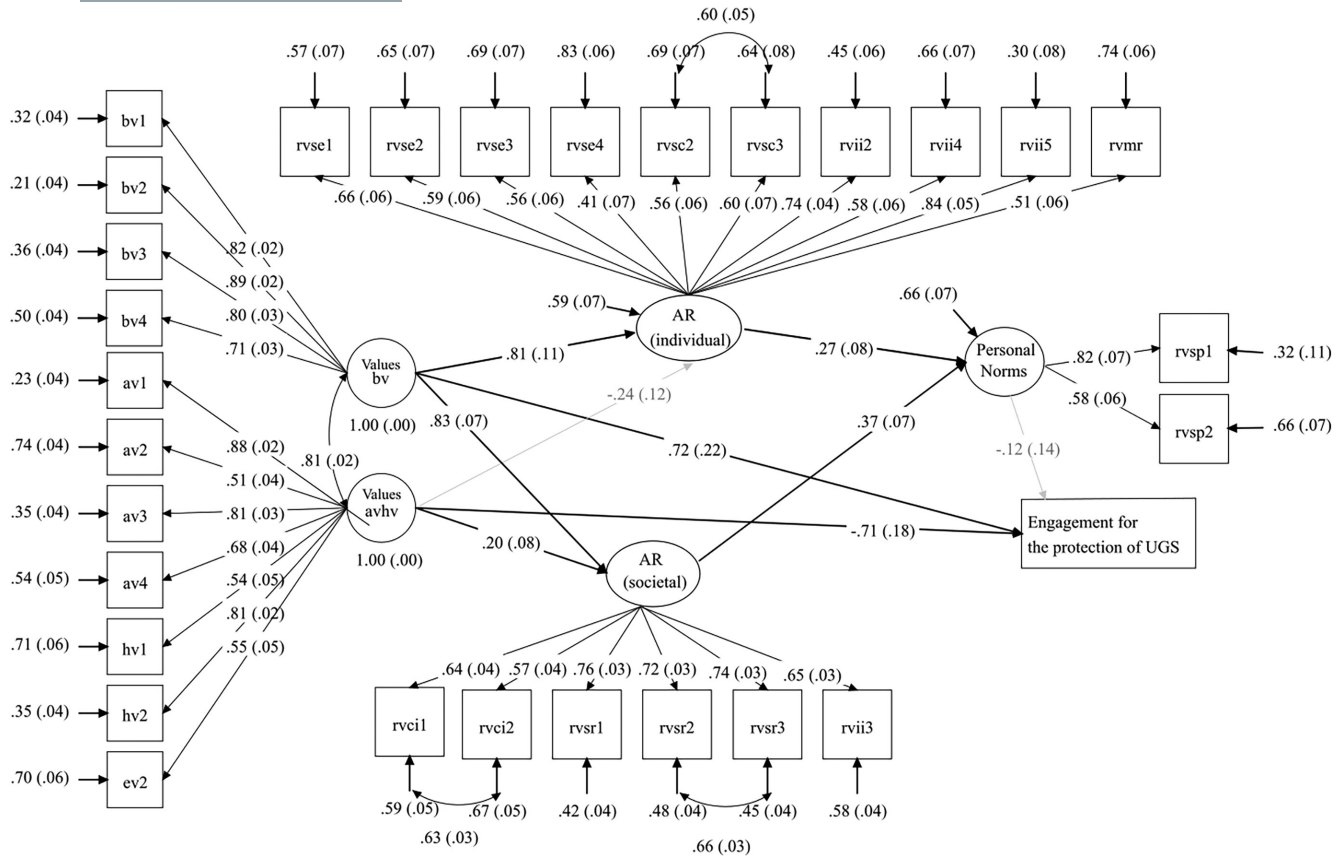


FIGURE 4 Final SEM model. All path coefficients are standardized. Brackets are standard errors. The grey paths are not statistically significant at $p < 0.05$.

TABLE 4 Direct and indirect paths from values to Engagement for the protection of UGS.

	Estimate	S.E.	Estimate/S.E.	p-value
Direct (bv → Engagement for the protection of UGS)	0.722	0.221	3.262	0.001**
Sum of indirect (bv → Engagement for the protection of UGS)	-0.065	0.075	-0.873	0.383
Specific indirect 1 (bv → AR (individual) → PN → Engagement for the protection of UGS)	-0.027	0.031	-0.889	0.374
Specific indirect 2 (bv → AR (societal) → PN → Engagement for the protection of UGS)	-0.038	0.045	-0.834	0.404
Direct (avhv → Engagement for the protection of UGS)	-0.711	0.176	-4.038	0***
Sum of indirect (avhv → Engagement for the protection of UGS)	-0.001	0.006	-0.232	0.816
Specific indirect 1 (avhv → AR (individual) → PN → Engagement for the protection of UGS)	0.008	0.01	0.83	0.407
Specific indirect 1 (avhv → AR (societal) → PN → Engagement for the protection of UGS)	-0.009	0.011	-0.826	0.409

** $p < 0.01$. *** $p < 0.001$.

nature-related motivations were more important than social ones (membership in an NGO or the participatory behaviour of family and friends), also found by other studies to influence engagement (Folmer et al., 2013; Mathers et al., 2015).

4.2 | Paths to engagement for UGS protection

According to the latent factor structure of the relational values (Table 3, Section 3.2) we found a separation of the items reflecting

individual responsibility from those reflecting a societal responsibility. This shows that residents who engage in UGS protection activities (i.e. gardening, tree planting) manifest both individual and societal responsibilities. Such responsibilities may act as a bridge to shift behaviours and promote stewardship as a widely embraced social norm (Horcea-Milcu, 2022; IPBES, 2022). Furthermore, societal responsibility for the protection of UGS may be oriented by feelings of responsibility for the individual's fulfilment (confirmed by the presence of an item reflecting societal responsibility, i.e. *Caring for the variety of life provided by the urban green spaces is a moral necessity*,

in the factor of individual responsibility in the EFA analysis). In this sense, de Groot et al. (2015) noted that committed actors for nature are guided by their individual desires to live meaningful lives and once meaningfulness is established other social values further support action towards biodiversity.

4.2.1 | Biospheric and altruistic-hedonic values support engagement in the protection of UGS (partial confirmation of H1)

The final model that we explored shows that urban residents holding biospheric values engage for the protection of UGS (direct positive path in the model, Figure 4, Section 3.3). A large body of empirical evidence shows a consistent positive relationship of biospheric values with various types of pro-environmental behaviours, also in urban contexts (Bouman & Steg, 2022; Jaung et al., 2021). A direct negative path in the model (Figure 4, Section 3.3) shows that people holding altruistic and hedonic values engage less for the protection of UGS. Consequently, these values were found in some studies to be less related to pro-environmental behaviour. For instance, Shin et al. (2022) found that altruistic values do not predict the actions of recreational anglers to minimize the spread of aquatic invasive species, such values being more relevant for humanitarian than environmental based behaviours. Furthermore, van Riper et al. (2020) found that hedonic values might not be compatible with pro-environmental behaviours. These values also influence to a lesser extent participation in smart energy systems (van der Werff & Steg, 2016). However, hedonic values have generally been recognized as important antecedents of environmental behaviour (Steg, Perlaviciute, et al., 2014) but underrepresented in studies using the VBN theory (van der Werff & Steg, 2016). Using components of VBN theory, we found that urban residents, who are actively engaged in UGS protection, endorse to a lesser extent altruistic and hedonic values. Perhaps because they perceive engagement as a short-term fulfilment of their own comfort and a way to increase the well-being of other humans. Holzer (2005) found in the context of environmental volunteering that combined altruistic and self-interests serve as motivators. Furthermore, van Riper et al. (2019) reported positive interactions of altruistic and hedonic values with pro-environmental behaviours, which involve leisure. Also, in our questionnaire, the statements used to measure the hedonic values were related to fun and leisure opportunities in relation to UGS, thereby supporting in the end UGS-engagement.

With our findings (of the influence of multiple values on behaviour), we emphasize that it is important to integrate pluralistic valuations in UGS management. Identifying and recognizing pluralistic values are important to know how urban citizens think about the life they want to live, to build strong relationships with community (Mould et al., 2020), and fruitful collaborations between urban residents and public administration (Mattijssen et al., 2020), which are necessary strategies to cope with concerns of urban sustainability (Wang et al., 2015).

4.2.2 | Biospheric and altruistic-hedonic values are linked in causal pathways to relational values (H2 partially supported)

Given the direct paths from biospheric, altruistic and hedonic values on the relational values embedded into ascription of individual and societal responsibility, which is further linked to personal norms, we may assert that relational values may function as enablers of change for positive relationships with UGS for those holding biospheric values but also for those who manifest altruistic and hedonic values (both).

Unlike previous studies that explored relational values as basic values (Jaung et al., 2021; Su et al., 2022) our study integrates them into the ascription of responsibility and personal norms components in the VBN theory (Klain et al., 2017) offering evidence that they activate personal norms about the protection of UGS (positive path in the model, Figure 4, Section 3.2). This shows the importance of relational values for the management of UGS that could become more effective (Chan et al., 2016), fairer (Arias-Arevalo et al., 2017) and may better resonate with people locally, which in turn may encourage stewardship actions on their behalf (De Vos et al., 2018).

The final model showed that the relational framing supports VBN constructs (Klain et al., 2017) as the relational values in our study helped manifest responsibilities at the individual and societal level and spurred personal norms among residents active in UGS protective activities (H2 partially supported). That we did not find a link between *personal norms* and *engagement* could be explained by the fact that our two items in the personal norms construct (i.e. *When I go to urban green spaces and see that they are threatened by diminished care and protection I feel that I should get engaged in activities to increase their care and protection; When I go to urban green spaces and see that they are threatened by diminished care and protection I feel that I should urge the management authorities to take action in this matter.*) may reflect difficult challenges (i.e. 'urging the management authorities to take action') which may influence residents' confidence in their ability to improve UGS care and protection by getting engaged. For example, it was found that low self-efficacy (Perry & Davenport, 2020), self-percept of low ability (Schwartz, 1977) or perceived misalignment between individuals' concerns and the planning process (Pineda-Pinto et al., 2023) may neutralize active behaviour towards nature. Furthermore, engagement for the protection of UGS represents an active behaviour that requires effort, and in line with van der Werff and Steg (2016) and Stern (2000) suggestions such effortful behaviours are less strongly predicted by the VBN theory.

4.3 | Study limitations

This study has several limitations related to the methodology. First, according to the VBN theory, values influence worldviews and then in a casual process awareness of consequences, ascription of responsibility and moral norms (Stern et al., 1999). We did not include worldviews and aspects of awareness of consequences in our study. Previous

studies suggested that worldviews may be excluded from the VBN theory (i.e. van der Werff & Steg, 2016), as values represent a better predictor of the VBN components than worldviews. Worldviews are too focused on environmental issues, while values contain multiple motivations. Furthermore, Jaung et al. (2021) did not find any positive relationships between worldviews, awareness of consequence, and ascription of responsibility when they assessed the link between urban nature experiences and pro-environmental behaviour.

Second, although our study is focused on activities for UGS protection coordinated by (non)governmental environmental organizations, we also included private sphere UGS protection activities (i.e. gardening on an own private plot, private planting of vegetation). Although public UGS predominated, we did not draw a distinction between types of behaviour and UGS (public or private), although insightful differences regarding the frequency of involvement and relational values have been reported between different types (Dresner et al., 2015).

Third, although our sample size meets the requirements for conducting statistical analyzes (the minimum sample size needed for our model to get the power of 0.90 would be 115 according to a post hoc power analysis), compliance with Munich's demographic composition (51% female and 49% male, and an average age of 41.3 years old, Stadt München, 2022) was not consistent. As we conducted our questionnaire only among the specific group of active residents for the protection of UGS, the results of our study are not representative of the general population. Furthermore, our findings refer to one city (Munich) with its specific socio-cultural and economic setting. Our sample size was dominated by people who participated in gardening activities. This could be an effect of the data collected near the end of the COVID-19 pandemic period, when the use of urban gardens has increased, despite lower levels of connection among their users (Joshi & Wende, 2022).

Fourth, we acknowledge the limitations of our VBN model fit and its potential to be improved in a future study. Specifically, we treated basic values (biospheric, altruistic, egoistic, and hedonic) and relational values (embedded in ascription of responsibility and personal norms) as separate constructs in our model. The correlation between the two types of values (basic and relational) was extremely high (Table 5), which may indicate that relational values may

function better as basic values in the VBN theory. For example, Jaung et al. (2021) and Su et al. (2022) assessed relational values as basic values and found that they directly impact norms that further determine urban residents to engage in volunteer work to protect urban nature. Furthermore, the multicollinearity between variables may have impacted the result of the analysis, such as the contradictory result of biospheric values to *Engagement for the protection of UGS* and altruistic-hedonic values to *Engagement for the protection of UGS*.

Fifth, many relational values can manifest after the engagement. For example, in Warsaw, individuals developed a specific identity after engaging in UGS stewardship activities, such as feeling more relaxed and identified with nature (Sanecka et al., 2020). Additionally, eudaimonic well-being can be an outcome of active engagement, as due to engagement, individuals spend more time in nature, being more connected to it, resulting in improved eudaimonic well-being (Chapman & Deplazes-Zemp, 2022; White et al., 2017). This might suggest a possible reverse direction of causality between relational values and pro-environmental actions, which deserves empirical research.

Sixth, the questionnaire used in this study was distributed online and in person. We chose both approaches to improve the number of responses from the online questionnaire, as it is acknowledged that web-based surveys generally have lower response rates (Brown & Kyttä, 2014). We combined the responses from these two types of questionnaires since our target group was limited to people who were involved in hand-on activities for the protection of UGS, having fairly similar socio-demographic profile.

Lastly, our EFA analysis indicated a distinction between the individual and societal dimension of responsibility. That there are different types of connections between relational values and responsibility is also assumed by Schröter et al. (2020). They suggest that relational values can be expressed by taking care of the land due to one's perceived individual responsibility as the steward of nature or feeding into universal moral values and the aim of contributing to a just and fair development (i.e. societal responsibility) (ibid.). In fact, local actions, such as urban gardening, can translate into a global understanding of one's responsibility for societal sustainable transformation (Artmann et al., 2021). We suggest that future research focus on this distinction when evaluating the relationship between VBN components and active pro-environmental behaviour.

TABLE 5 Correlations among the latent variables used in the final model.

	bv	avhv	AR (individual)	AR (societal)	PN	<i>Engagement for the protection of UGS</i>
bv	1					
avhv	0.81*	1				
AR (individual)	0.62*	0.42*	1			
AR (societal)	0.99*	0.87*	0.60*	1		
PN	0.54*	0.44*	0.50*	0.54*	1	
<i>Engagement for the protection of UGS</i>	0.08	-0.18*	0.09	0.03	-0.05	1

* $p < 0.05$.

5 | POLICY IMPLICATIONS

This study offers a better understanding of what determines the engagement of urban residents in activities for the protection of UGS. This may have implications for policy making and urban planning.

First, by finding the importance of urban gardening to engage people, we highlight its contribution to active engagement of people in stewardship relationships with nature. Increased urban gardening initiatives at the city level will not only help (re)connect humans and nature, but also provide ecological and social benefits. Here, trans-disciplinary urban living laboratories together with civic groups, urban administrations and interdisciplinary research can provide interesting experiments on how collaborative shaping of green and edible cities can be up-scaled and accelerated (Plassnig et al., 2022).

Second, if governments want to stimulate active residents, they would need to find ways to highlight the basic values of residents that are associated with engagement (biospheric and altruistic-hedonic; i.e. by integrating them into public green spaces and the sustainable design of the city to remind them of these values) and show how the efforts of residents are being appreciated. Such encouragement may stimulate further engagement in nature stewardship activities (Ganzevoort & van den Born, 2020) and higher appreciation by the society of active residents (Sloane & Pröbstl-Haider, 2019). This will be advantageous for both people and nature with a meaningful impact on sustainability transformations.

Third, we noticed that caring for UGS for individual consequences (i.e. living a meaningful life) emerged as an important characteristic of active residents, which might have the potential to support the manifestation of further societal responsibilities. This finding could inspire policies to support the care of nature as an avenue for people's happiness and living meaningful lives, as well as to mobilize behavioural change for greater socio-ecological sustainability. Urban planning and policy can take into account the guiding vision of planetary health, highlighting that individual health depends on the health of the Earth. Urban planning has then the responsibility of shaping cities that allow sustainable engagement with the environment (i.e. diet and mobility) in the easiest way for all (WBGU, 2021).

Finally, this study signals the importance of pluralistic valuation. Since UGS have increasing pluralistic values, approaching their planning and management through the lens of actual and pluralistic values is crucial in the pursuit for urban resilience. Thus, a multifunctional design of UGS considering pluralistic values through creating biodiversity conservation areas, recreational activities, nature play areas and social interaction spaces would be beneficial.

6 | CONCLUSIONS

This study enhances the existing body of research on pro-environmental behaviour by focusing on a less explored behaviour (active engagement for the protection of UGS), by using the

components of the VBN theory and enriching it with relational values. By incorporating relational values, which are values relevant to pro-environmental behaviour into the VBN theory we advance a more comprehensive understanding of people's motivations and actions when it comes to engagement in the protection of UGS. Furthermore, by researching active engagement for the protection of UGS as behaviour, we show the predictive power of the VBN theory in this specific context. According to our findings, although we showed the importance of relational values in helping to manifest responsibilities at the individual and societal level and to promote personal norms among active residents, we found that our VBN model partly explains the engagement for the protection of UGS.

By focusing on urban areas where the extinction of nature experiences is omnipresent, we reveal how the VBN theory can help alleviate such a challenge by offering valuable insights into the particularities of this specific behaviour. Specifically, we found the importance of biospheric values (i.e. values oriented towards nature) and the lesser influence of altruistic-hedonic values (i.e. values oriented towards society and short-term happiness) to active engagement for the protection of UGS. This can inform the design and implementation of environmental initiatives aimed at reconnecting humans with nature. By developing initiatives that appeal to these values, the likelihood of engagement increases. Then sustainable engagement is not perceived as a burden, but as part of a good life, securing a healthy and flourishing life for human and more-than-human nature (Artmann, 2023).

AUTHOR CONTRIBUTIONS

Constantina Alina Hossu, Martina Artmann, Martina van Lierop, Cristian I. Ioja, Stephan Pauleit developed questionnaire design; Tomomi Saito and Constantina Alina Hossu conducted data analysis; Constantina Alina Hossu, Martina Artmann, Tomomi Saito, Martina van Lierop, Cristian I. Ioja and Stephan Pauleit conducted manuscript writing, editing and review. All authors contributed critically to the drafts and gave final approval for submission of this article.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

Data underlying all the results presented in this paper are archived and freely available on the Zenodo data repository: <https://zenodo.org/records/8318495>.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Supporting Information S1. Questionnaire.

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