

## RESEARCH ARTICLE



# Analysing perceptions of nature and nature's contributions to people for a Swiss ecological infrastructure

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## Abstract

1. Understanding how a population perceives nature and nature's contributions to people is key to designing a society's ecological infrastructure. Narrative-based research can capture how people perceive and value nature.
2. Using the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) framework, through a survey, we capture narratives to assess the value and perceptions of nature and its contributions of Swiss residents living inside and outside parks. We examined 924 narratives of experiences (26% response rate) in nature from a large representative sample of the study areas' populations. This research grants agency to study participants to assess the social value of nature through experience interpretation, thus reducing the interpretation bias of the researchers.
3. Residents in these regions perceive parks, and other areas where nature has been prioritized, provide more benefits than other areas; nature's intrinsic value is as equally important or, for some, even more important than its importance for the economy or culture; and that the perception on the state of nature and nature's contributions differ inside and outside parks.
4. As one of the few exploratory studies to examine perceptions of all types of contributions of nature, using the IPBES international framework, and looking at nature inside and outside parks, this work contributes to strengthening the design and management of parks and ecological infrastructure in Switzerland and beyond. People's values and perceptions of nature provide information to establish ecological infrastructure that could transcend the boundaries of the parks into the larger landscape.

## KEYWORDS

biodiversity conservation, ecosystem services, micro-narratives, parks, protected areas, social value

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## 1 | INTRODUCTION

Parks may be planned with little consideration for the perceptions and values of their inhabitants towards nature, and are based mainly on biophysical data (Cebrián-Piqueras et al., 2020). Understanding people's view of nature can help determine their support of conservation (Palomo et al., 2011, 2013, 2014). Since access to nature and nature's contributions to people (NCP) are key to a good quality of life (Díaz et al., 2018), understanding people's perceptions of nature can help us design better ways to interact with the public on conservation issues, including park planning, biodiversity protection, policy development and transformation towards sustainability (Pascual et al., 2017, 2023). Specifically, when NCP are considered in land management decisions, this can help negotiate trade-offs and favour equitable land governance (Ellis et al., 2019; Martín-López et al., 2019; Pascual et al., 2023).

We contribute to the analysis of NCP perceptions and nature values in the context of ecological infrastructure (EI). We use contextual values and value indicators (Kenter et al., 2015) of Swiss residents. This study asks: *How is nature and NCP perceived in and around regional nature parks in Switzerland?* Analysing the population's perceptions of NCP and nature place us in a better position to understand their relative importance in the landscape. By studying these perceptions inside and outside parks, we add further detail to the analysis. We argue that people's perceptions of nature and NCP can contribute to the effective design of EI.

### 1.1 | Ecological infrastructure

Introduced as early as 1984 (Sun et al., 2020), the EI concept still has several slightly differing definitions (Perschke et al., 2023). Some overlap with definitions such as 'green, blue or natural infrastructure' and 'nature-based solutions'. Green infrastructure refers more to urban contexts and nature-based solutions encompass broader actions towards sustainable development (Grêt-Regamey et al., 2021). Perschke et al. (2023, p. 4) define EI as 'natural and naturally functioning ecological systems or networks of ecological systems that deliver multiple services to humans and enable biodiversity persistence'. The narrower Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) definition refers to 'the natural or semi-natural structural elements of ecosystems and landscapes that are important in delivering ecosystem services' (IPBES, 2017a glossary). Under the IPBES framework, EI is seen as an instrument to preserve NCP. This definition also allows for EI to encompass landscapes. In this paper, we have adapted the IPBES definition of EI to encompass biodiversity and nature conservation.

Regardless of the EI definition used, the socio-economic and political aspects of the establishment of EI need to be discussed, and it is important to address the question, 'For and by whom are new ecological infrastructures being designed?' (Tubridy, 2020, p. 134). For example, a study in South Africa defined EI core areas as those areas with land covers (e.g. forest plantations, grasslands, rivers)

delivering multiple services for Indigenous rural communities' livelihoods in the Tsitsa River catchment (Sigwela et al., 2017). In their study, the authors focused on the demand (beneficiaries) side of the ecosystem services concept. Other authors (Adger et al., 2005; Demuzere et al., 2014) present EI as a strategy to mitigate against land degradation and climate change and reduce risk and vulnerability for humans.

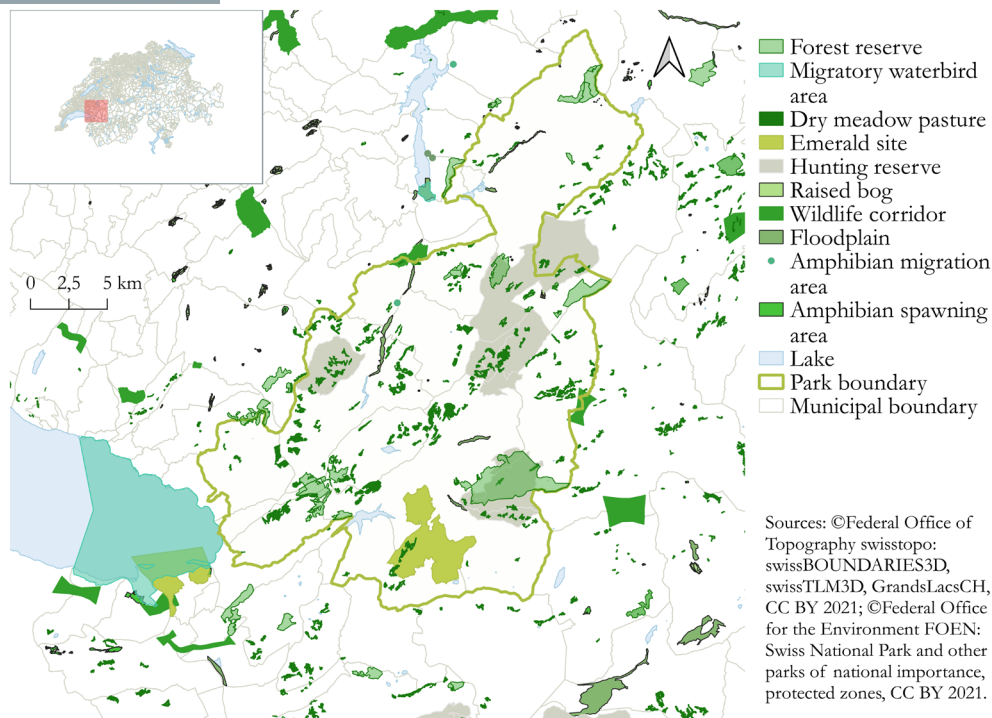
The link between EI, nature, and NCP is explicit. Since biodiversity, nature, and NCP are key to a good quality of life (Díaz et al., 2018), understanding how people value and perceive them is relevant for management, and transformation towards sustainability (Pascual et al., 2017, 2023). NCP include both positive and negative contributions. Positive NCP (benefits) may include air purification and recreational areas. Negative NCP may include transmission of diseases and natural hazards (Díaz et al., 2018; IPBES, 2017b). NCP have been classified as material (e.g. food and feed), regulating (e.g. water purification), and non-material or cultural (e.g. learning and inspiration) (IPBES, 2017b; Kenter et al., 2015). We use NCP and ecosystem services interchangeably given their overall equivalency.

Switzerland is planning to establish a functional EI with its primarily objective to conserve biodiversity and functional ecosystems (Grêt-Regamey et al., 2021). Therefore, EI establishment involves the establishment and expansion of core areas where biodiversity and ecosystems are maintained and functionally and structurally connected in the landscape (BAFU, 2023). In this context, EI core areas may include protected zones with the highest levels of biodiversity (e.g. biotopes of national importance, biodiversity areas set aside within agricultural systems) (BAFU, 2023; FOEN, 2020). Treated as 'grey infrastructure', Switzerland's government view EI as a continuum rather than as a collection of units.

Unlike the IPBES framework that tends to include all categories of protected areas or landscapes as EI, in Switzerland, regional nature parks (protected landscapes and areas with sustainable use of resources) are not currently considered EI, even at cantonal or national scales (BAFU, 2023). However, these parks may include within their boundaries several potential EI core areas (Figure 1). Thus, the existence of protected zones within regional parks, and the regional parks' main goal of promoting sustainable development (Pütz et al., 2017), have made of such parks testing grounds for EI design (FOEN, 2017).

### 1.2 | NCP and nature values and perceptions

Personal values transmit our motivations, what is important to us, guiding our attitudes, opinions, and actions (Rokeach, 1979; Schwartz, 2012). Because our ability to observe people's values simply and directly is limited, we need to infer their occurrence from evidence gained by looking at people's behaviours and beliefs (Maio, 2016). IPBES's typology includes five value perspectives (Pascual et al., 2022). We describe two of these: (a) contextual or specific values, which are judgements, perceptions, or attitudes in terms of the importance of an object (e.g. nature and animals)



**FIGURE 1** Simplified map of protected zones (potential core and connecting areas of EI) in the Gruyère Pays-d'Enhaut Regional Nature Park and surrounding areas.

being valued under contextual factors (e.g. culture and age) (Kenter et al., 2015; Pascual et al., 2022, 2023) and (b) value indicators, which are a measure of the importance of something expressed in monetary (e.g. social willingness to pay) or non-monetary terms (e.g. the frequency a coded term occurs in a micro-narrative) (Anderson et al., 2022; Kenter et al., 2015), and are grouped as biophysical, monetary, and sociocultural (Pascual et al., 2022). Not values as such but instead a way of quantifying and qualifying them, these indicators are used in practice to evaluate the trade-offs people are ready to make (Kenter et al., 2015).

IPBES categorizes contextual values as instrumental, intrinsic, or relational (Pascual et al., 2022, 2023). Instrumental values are those values ascribed to an object as a means to an end; there is a utility behind the value (Díaz et al., 2015; IPBES, 2017b). Relational values are values attributed to meaningful relations and obligations amid humans and involving humans and nature (Arias-Arévalo et al., 2017; Chan, 2016), for example, the relationship between a person and a specific plant. IPBES defines intrinsic value as including 'entities such as habitats or species that are worth protecting as ends in and of themselves' (Pascual et al., 2022, p. 10). Nearly 75% of studies on contextual values have focused on nature's instrumental values, leaving relational (6%) and intrinsic (20%) values to few studies (Pascual et al., 2022).

Many studies have focused on NCP and how they are valued or perceived. These studies have used quantitative (frequency, ranking, statistical analysis) (e.g. Hartter et al., 2014), qualitative (interviews, narratives, participatory mapping) (e.g. Bieling, 2014), or mixed methods (e.g. Hattam et al., 2015) to arrive at social values of NCP.

Despite this wealth of approaches to studying NCP and perceptions of nature, surveys to assess all types of NCP have been limited. Most of the literature focuses on the perception and identification of ecosystem services within parks and protected areas (Lopes & Videira, 2016; Martín-López et al., 2007; Segura et al., 2015) or in parks and their immediate surroundings (Hartter et al., 2014), and less so on a comparison of the perceived quantity and quality of NCP provided by these protected areas and parks vis-à-vis the overall landscape. Our study addresses this gap by examining the full range of NCP in the study regions.

### 1.3 | Perceptions and micro-narratives

Perception is how we see things and interpret them (Bennett, 2016). It is a 'set of lenses through which an individual views reality' (Munhall, 2008, p. 607). An individual's set of lenses evolves experiences, learning, and contexts (Munhall, 2008). Most individuals experience their interpretations as truth. Thus, perceptions can influence people's behaviour and judgement (Munhall, 2008). Indicators of perceptions can therefore be used as tools for evaluation (Webb et al., 2004), management, and decision-making.

Individuals can convey their perceptions through storytelling (Munhall, 2008) and make sense of the world by creating narratives (Fisher, 1984). Knowledge derived from micro-narratives—experiences or everyday short stories people tell in social settings (Van der Merwe et al., 2019)—can shed light on the elements that guide behaviours, actions, and decisions, which in turn may provide clues to

people's and communities' potential truths (Fisher, 1984). Narratives have been used to assess NCP, to collect perceptions, and to analyse values (Bieling, 2014; Chan, Guerry, et al., 2012; Chan, Satterfield, & Goldstein, 2012).

## 2 | METHODS

Our study is part of the ValPar.CH project, which examines the benefits and added values of the EI in Swiss parks and supports the action plan for the Swiss Biodiversity Strategy (Keller et al., 2020; Reynard et al., 2021).

In Switzerland, projects not related to health, and hence not subject to the Federal Law on Research on Human Beings (LRH), such as the present project, are not required to be approved by an ethics committee. All participants gave prior, informed consent, consistent with established principles in the Swiss Data Protection Act of 1992, and confirmed they were over 18 years of age.

### 2.1 | Selection of study areas

We selected areas in and around four Swiss regional nature parks (Beverin, Jurapark, Gruyère Pays-d'Enhaut (GPE), and Pfyn-Finges) as study areas (Figure 2). We based park selection on obtaining a balanced representation of relevant criteria (e.g. geographical region, diversity of main ecosystems present, availability and quality of data, linguistic coverage—German and French). Swiss parks are not considered protected areas. Thus, in this study, we refer to the regional nature parks as 'parks' and to the other Swiss

ecological measures as 'protected zones'. We use 'protected areas' to refer to either parks or protected zones following international usage and to limit confusion.

### 2.2 | Data collection

We implemented a preliminary literature review on existing NCP data and studies of perceptions and values (in Switzerland and abroad) to develop the questionnaire's conceptual framework and compile contextual data. To draft the questionnaire to collect new data, we implemented two stakeholder workshops (one in French, another in German). During the workshops and through subsequent engagement with the research team, relevant stakeholders (authorities at the federal, cantonal, and municipal levels, park management; and forestry, agriculture, and tourism representatives), advisors from Cognitive Edge (SenseMaker® developers), and recommendations of staff at the Swiss Centre of Expertise in the Social Sciences (FORS) on a draft version, we finalized and piloted the questionnaire online before survey dissemination.

### 2.3 | Sampling strategy

We drew a stratified random sample representative of the Swiss resident population 18 years old and older in January 2021 from the registry of residents maintained by the Swiss Federal Statistical Office. Three study regions were represented by 500 people living in municipalities inside park boundaries (henceforth 'inside the park') and 500 people living in municipalities outside those same

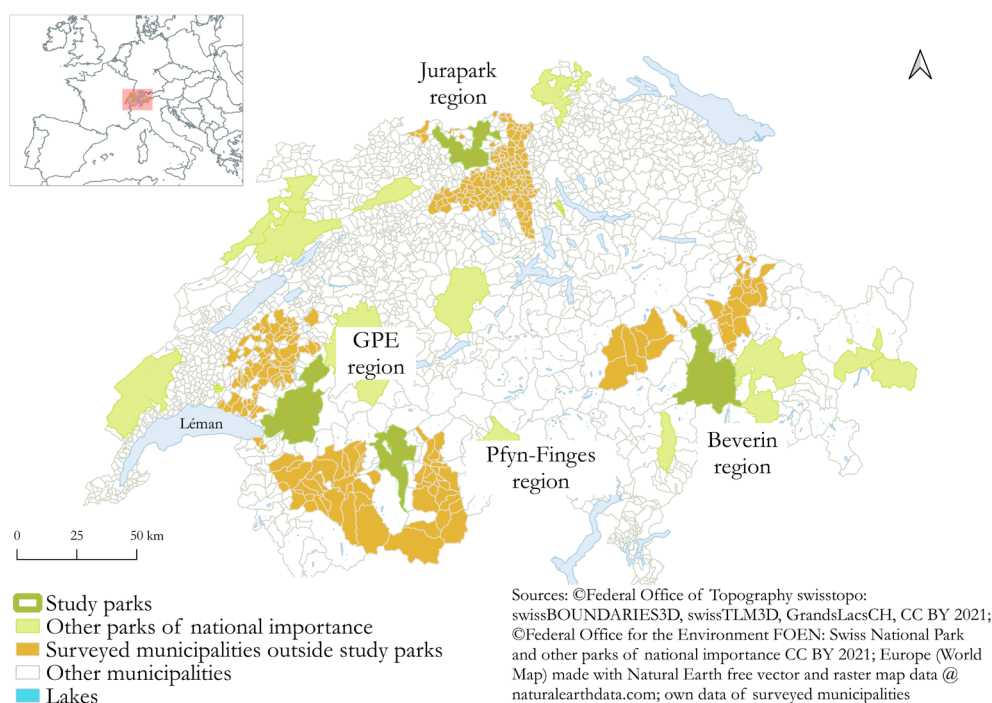


FIGURE 2 Map of the study areas.

park boundaries (henceforth 'outside the park'). For Beverin Park, this number was lower, 250, given the statistical limitations of the smaller population size inside the park. We defined 'outside' as the municipalities in the same canton(s) as the park but excluding those municipalities located far from the park (over 40–50km) or closer and adjacent to the specific park or other parks, to obtain an even spatial distribution of respondents in these regions. We defined 'inside' as municipalities that form part of the park. Municipalities adjacent to the study parks were treated as inside the park and excluded in sample collection. Since the random selection procedure selects respondents based on population density, areas of high population density in urban centres were overrepresented in the analysis (similar to Wartmann et al., 2021). We received 37 additional addresses from the Statistical Office to compensate for any potential loss of respondents (e.g. latest changes in residence, death). We sent the survey to 3537 residents.

## 2.4 | Conceptual framework and questionnaire

We used the IPBES framework and its list of nature and NCP indicators (see Appendix S1) as a basis for analysing and ranking values and perceptions from a social perspective. SenseMaker, a commercial software package, was used to house the questionnaire (Cognitive Edge, 2022). Collecting numerous experiences helps to identify patterns, which could also be combined within demographic subsets (Minnaert, 2020).

The questionnaire included a prompting question, where we asked respondents to write a micro-narrative about an experience in or with nature (as defined by the respondent); a series of dyad and triad measures linked to the micro-narrative, where respondents interpreted their experience; general research questions and multiple-choice questions linked, or not, to the experience; and socio-demographic questions (see Appendix S2). We asked for membership in associations, as members of an environmental association have shown higher than average pro-environmental stance than those who are not (Otto et al., 2021).

## 2.5 | Questionnaire design and implementation

We designed and piloted the survey between November 2020 and January 2021. Survey implementation run between 26 February and 30 April 2021. We developed a lexicon in French and German to draft culturally attuned questions (e.g. seeking the French and German words or terms that would best translate 'NCP' or 'intrinsic value'). The six-part survey had an online and a pen-and-paper version. The online survey included an initial page with information on the project and a consent box. We mailed an invitation with a short and meaningful URL and QR code (to access the online survey), general information on the project, and our contact information to people in each of the four study regions. For the Beverin study area, we sent the invitation in both German and Romansh, which

are both spoken in the area. Fifteen days after sending the invitation, we mailed a reminder with a paper version of the questionnaire to support respondents unaccustomed to electronic means or with limited or no accessibility to the Internet or a smartphone (Omoding et al., 2020). Originally, we planned to engage enumerators for the survey, but the COVID-19 pandemic rendered face-to-face support impossible.

## 2.6 | Tools used in the analysis

SenseMaker helps with the analysis of meaning and relationships between concepts but does not measure causality (Van der Merwe et al., 2019). Since respondents are active participants and make sense of their own micro-narratives rather than the researcher's coding, the introduction of bias is minimized (Lynam & Fletcher, 2015; Minnaert, 2020).

SenseMaker's built-in statistical analysis tool uses comparison of frequencies of responses, means and medians (Appendix S3 shows an example of the platform). To prepare the data for analysis, we curated the comma-separated values file extracted from the platform. We used ATLAS.ti 22 to review specific topics within the micro-narratives from the Gruyère Pays d'Enhaut region (e.g. intrinsic value and recreation) and eclectic coding when needed (Saldana, 2013). We used Stata/SE 17.0 for additional nonparametric statistical analyses ( $\chi^2$  and the Kruskal–Wallis  $H$  test), and QGIS 3.16.4 for the geo-spatial presentation of data for selected NCP.

Through DeepL Pro, we translated the experiences shared in the results section from French to English. Native speakers revised the translations. Using mixed methods to collect, analyse and present the data, through patterns, and maps, that speaks to different audiences, and increases the robustness of our results, is one of the study's main strengths.

## 3 | RESULTS

We present information on the response rate, demographic characteristics of respondents, and overall ranking of NCP in Appendices S4 and S5.

### 3.1 | Perceptions of nature and Nature's contributions to people

In a closed question, over two-thirds of survey respondents (68%) perceived areas where nature has been prioritized (protected zones, nationally important ecosystems, parks) as providing more NCP compared to other areas. Only 12% disagree with this statement, and 20% did not know. Two examples drawn from the content analysis of the micro-narratives from respondents who are resident in the Gruyère Pays d'Enhaut Park and perceive protected zones and parks provide more NCP:



A walk on the northern slopes of the mountain in spring: the richness of the flora, the low shrubs and the bare rock, and many ibexes on the wild heights. (female, 56–65 age bracket)

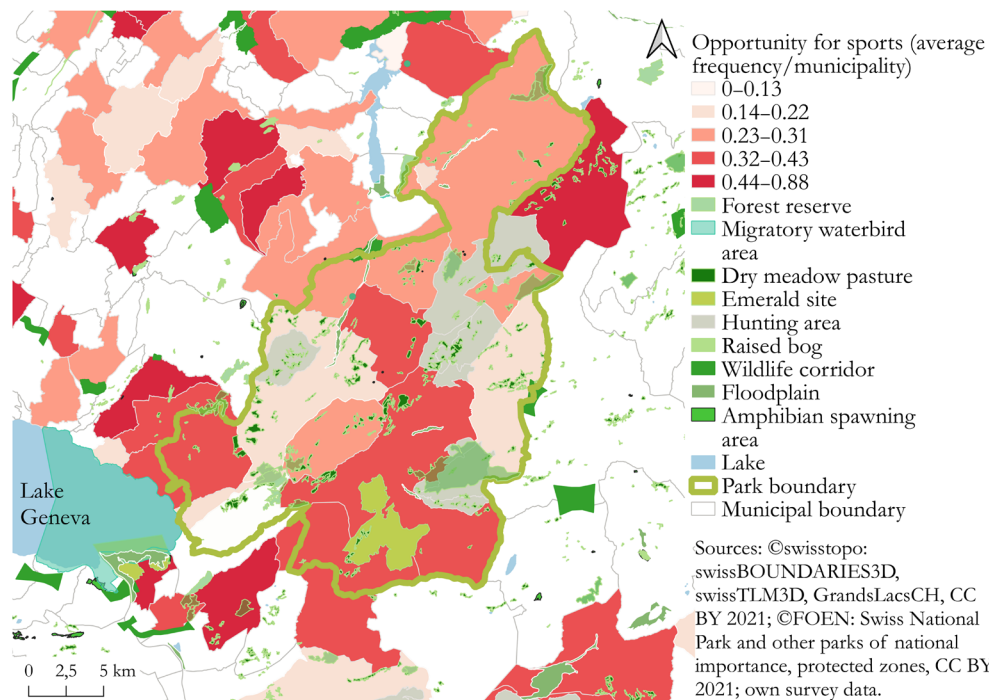
Hiking with my wife, off-trail, up a stream..., climbing the huge boulders, crossing the river ... watching the passing trout. We also observed a viper up close, in the surrounding forest, full of dead wood and with a rich structure. (male, 26–35 age bracket)

Further statistical analyses (see Table 1; Appendix S5) of frequencies for these closed survey questions showed this perception differs according to gender (female responses were more frequently positive than male responses). However, we did not find any difference according to age group or highest educational level attained.

**TABLE 1** Results of the frequency analysis of perceptions of NCP inside and outside parks.

Perception	$\chi^2$	df	n	p-value
Protected zones and parks as providing more NCP according to gender	30.748	6	900	0.000
Protected zones and parks as providing more NCP according to where respondents live (inside/outside parks)	2.036	2	819	0.361
Residents believing they live inside or near a park or near a protected zone (whether they do or not)	11.528	4	894	0.021

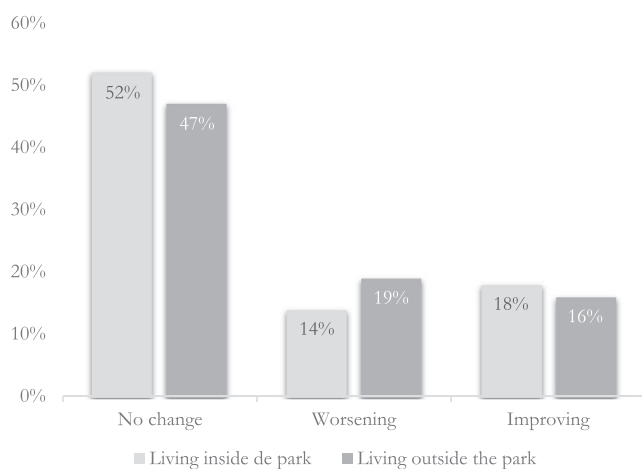
Abbreviations: df, degrees of freedom; n, population sample size; NCP, nature's contributions to people.



**FIGURE 3** Map showing respondents' average perception of the importance of nature as providing opportunities to practise sports, by municipality, and inside/outside the Gruyère Pays-d'Enhaut Park and its surroundings (map includes protected zones).

Most respondents (48%) did not perceive a change in the state of nature in the municipality where they live in comparison with 5 years earlier, while an equal number of respondents (17% and 17%, respectively) perceived a deterioration and an improvement. However, comparing the perceptions of respondents living inside and outside the selected parks, we observed a slight difference in patterns. As with respondents overall, most residents living inside and outside the parks (52% and 47%, respectively) perceived no change in the state of nature where they live. However, the proportion of respondents who perceived a worsening of or improvement in nature in the last 5 years differs between inside (14% and 18%, respectively) and outside parks (19% and 16%, respectively). Perceptions of positive change are more frequently observed inside the parks, while perceptions of negative change are more frequently observed outside the parks (Figure 4).

Statistical analyses show a relationship exists between perceptions of the state of nature inside and outside parks (Figure 4; Table 2; for details, see Appendix S6). Using 2 × 2 matrices comparing combinations of categorical variables (no deterioration inside and outside parks, no improvement inside and outside parks, improvement or deterioration inside and outside parks) exposed a correlation among those that perceived nature as improving or deteriorating over the last 5 years inside and outside parks but not for perceptions between



**FIGURE 4** Perceptions of the state of nature in the last 5 years, by whether respondents live inside or outside parks.

Perception	$\chi^2$	df	n	p-value
State of nature in the last 5 years inside and outside parks	16.1738	3	819	0.001
State of nature as improving or deteriorating over the last 5 years inside and outside parks	12.6082	1	284	0.000
Nature as a place for exploration and discovery was different for the two groups, inside and outside parks	4.747	1	754	0.029

no change and improvement/deterioration. Meaning, slightly more people living inside parks perceived a positive change in the state of nature while slightly more people living outside parks perceived a negative change in the state of nature in the last 5 years.

For NCP, statistical analysis using the Kruskal-Wallis *H*-test for inside and outside the parks also reveals correlations. Nature as a place for exploration and discovery was different for the two groups, inside the park ( $n=386$ ) and outside the park ( $n=368$ ), which showed a statistically significant difference in perception of such NCP between the two groups. Further analysis rules out the effect of municipality type (rural, intermediate, urban) in explaining the difference. Nature offering the opportunity to practise sports also differs inside and outside the parks.

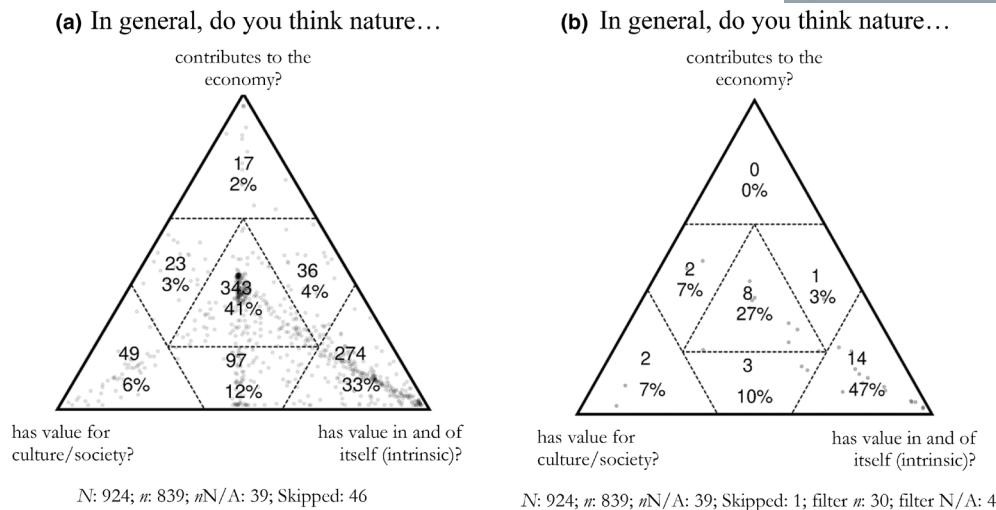
### 3.2 | Nature's intrinsic value

A significant proportion of respondents (33%) signified the intrinsic value of nature alone (see pattern of triad, Figure 5a) and equally (41%) with the other two statements, 'nature important for the economy' and 'nature important for culture and society'. Filtering these three statements in the triad by age group (from the multiple-choice question), we see a lower proportion (17%) of 18- to 25-year-olds signifying intrinsic value; this increases to 46% for the 66-75 age group.

When combining the three statements with membership (multiple-choice question), respondents belonging to a hunting/fishing club signified intrinsic value 47% of the time (Figure 5b), followed by those belonging to nature and naturalist organizations and religious organizations, signifying intrinsic value at 41% and 40%, respectively. Members of farmer and forestry organizations signified intrinsic value alone the least (23%), with the majority signifying all three statements (50%). Further, we find a slight difference between the language spoken by respondents and signification of the intrinsic value of nature, with French-speaking respondents choosing it 36% of the time and German-speaking 30%.

One respondent ranking intrinsic value highly wrote about her experience of 'birds and insects [as] living jewels' (Table 3). In coding experiences (the first open-ended question of the survey) from the Gruyère Pays d'Enhaut region, we found possible implicit references

**TABLE 2** Results of statistical analysis showing the relationship between perceptions of the state of nature inside and outside parks.



**FIGURE 5** (a) Results for the entire survey sample; (b) Results specific to people belonging to hunting/fishing organizations. Each dot in the triangles represents a response; N = total number of respondents for the entire survey; n = respondents for specific questions; N/A = total number of respondents for which the question was not applicable; Skipped = number of respondents who skipped the question.

**TABLE 3** Micro-narratives containing implicit or explicit intrinsic value perceptions.

Intrinsic value	Response examples
Experience of a high signification of intrinsic value	Walking along dirt roads, ... watching the birds and insects for a long time, true living jewels, allowing yourself to be lulled by their song, reconnecting with the very essence of life... (female, 56–65 age bracket)
Concern about the wellbeing of animals	I am lucky to live in the mountains ...; the only drawback is the way rivers have been canalized, with the fish no longer able to go up them... (male, 36–45 age bracket)
Concern about a specific animal	A unique experience, out in the wild, of rescuing a common chaffinch that had been caught by a cat (female, 66–75 age bracket)

to intrinsic value. For example, a respondent stated his concern about the wellbeing of a taxonomic group (fish), while another participant showed concern about a specific animal (Table 4).

Respondents perceived intrinsic value differently depending on the demographic characteristics selected, such as by municipality, in the Gruyère Pays d'Enhaut Park and environs (Figure 6a). However, many protected zones remain as if they were islands separated from other protected zones in the larger landscape (Figure 6b).

Further statistical tests of the frequencies obtained (Table 4, and for details see Appendix S6, Kruskal–Wallis *H*-test) showed a statistically significant difference in nature's intrinsic value between gender, age group, educational level, type of municipality where they lived (the difference appearing between rural and intermediate municipalities), and language. Meaning there is a difference in the perception of nature's intrinsic value between female and male respondents, people from rural and intermediate municipalities, but not from rural and urban or urban and intermediate, etc.

## 4 | DISCUSSION

### 4.1 | NCP and perceptions of nature can support the design and maintenance of EI

Perceptions show protected areas are more important sources of NCP than other areas. Recent global-scale modelling (Chaplin-Kramer et al., 2019, p. 2) showed how the proportion of potential NCP 'is predictably highest where nature is most intact'. Similarly, a gap analysis revealed half of the European Natura 2000 sites were 'of high conservation value ... for species, regulating, and cultural NCP' (O'Connor et al., 2021, p. 2). There is a need to protect essential areas for biodiversity and NCP because 'priorities for biodiversity better represent NCP than the reverse' (O'Connor et al., 2021, p. 1; see also Lan et al., 2022). Nature protection will be most beneficial where those with the greatest needs for nature overlap with where nature yields the highest contributions (Chaplin-Kramer et al., 2019). Therefore, knowing what those needs are (including perceived needs) and where the highest NCP exist (including perceived contributions) is essential for the design of an effective EI.

Even though a high presence of NCP may not necessarily equate to high biodiversity, it is clear that nature benefits are motivators of conservation (O'Connor et al., 2021). The demand for NCP varies depending on the beneficiaries (Sigwela et al., 2017; Tubridy, 2020), and EI is usually designed and managed to support NCP and conserve biodiversity (Grêt-Regamey et al., 2021). Therefore, to motivate conservation and EI design, it is also important to account for perceptions of NCP. We argue that positive perceptions towards parks and protected zones should help strengthen public support for developing EI, from core to connectivity areas.

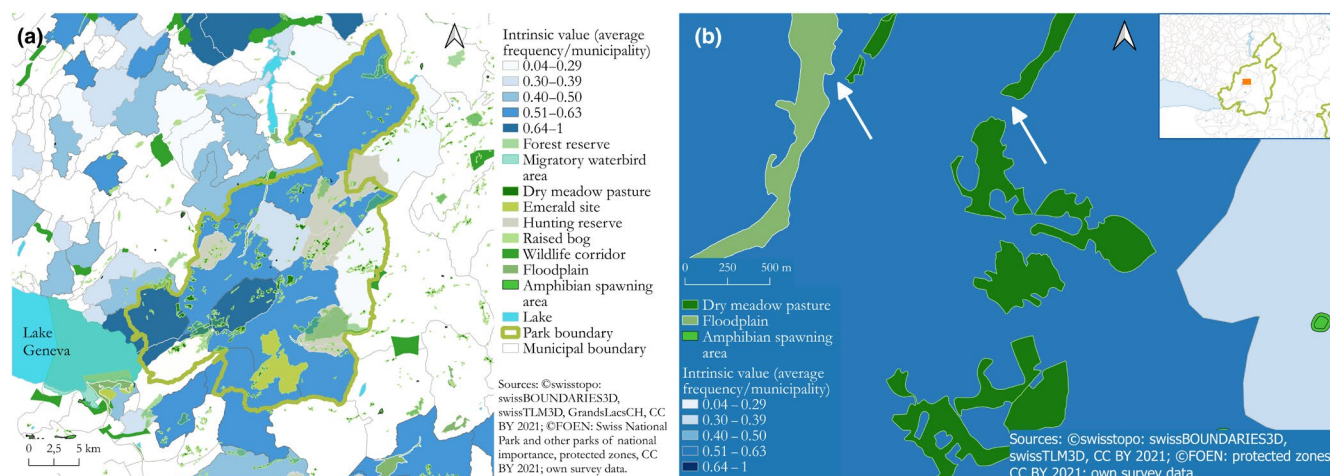
Our study revealed different perceptions exist of the state of nature and some NCPs inside and outside parks. Perceptions may not reflect the real state of a species' population or of biodiversity



	$\chi^2$	df	n	p-value
Gender (male, female)	4.641	1	817	0.0312
Age group (18 to over 75)	14.395	7	834	0.0446
Educational level (primary/secondary I/secondary II/tertiary)	12.349	3	828	0.0063
Type of municipality (rural/intermediate)	6.220	1	552	0.0126
Language (French/German)	9.060	1	839	0.0026

**TABLE 4** Kruskal–Wallis *H*-test: Perceptions of nature's intrinsic value by demographic characteristics.

Note: The Kruskal–Wallis *H*-test determines if statistically significant differences exist between two or more groups of an independent variable [demographic characteristics] on a continuous/ordinal dependent variable [intrinsic value] (MacFarland & Yates, 2016).



**FIGURE 6** (a) Map showing respondents' average perception of the intrinsic value of nature, by municipality, in the Gruyère Pays-d'Enhaut Regional Nature Park and environs. The map includes a few protected zones. (b) Potential EI. Map showing a close-up of an area of Map (a) with respondents' average perceptions of the intrinsic value of nature, by municipality, in the Gruyère Pays-d'Enhaut Park and environs. Arrows indicate gaps in connectivity and potential connection between protected zones.

(Bennett, 2016). However, the gap between both indicators (perception of social value and objective ecological value) may help point to additional research needed and inform practice (e.g. awareness and education campaigns) and policy to strengthen parks and EI.

We observed the perceived importance of nature's material values and nature's contributions in terms of exploration and discovery inside parks is higher than outside; this difference could be explained by the increased number of nature education programmes and conservation activities park management coordinates with park inhabitants (SPN, n.d.). Another potential explanation relates to marketing campaigns to 'discover parks' as a tourism slogan (Switzerland Tourism, 2022).

Nature as contributing to a beautiful view and providing opportunities to practise sports are perceived as most important outside parks. Overall, perceptions about biodiversity and NCP differ among different stakeholders (Ellis et al., 2019). Our study contributes to this research by showing that perceptions may also differ depending on where stakeholders live within the landscape. There is a need to tailor the design of EI according to the specific NCP decision makers could appeal to for particular areas (inside/outside parks). An example

could be the establishment of outdoor fitness facilities outside parks to increase recreation areas (social and economic value) with consideration of the ecological needs of certain species (ecological value). Increased natural areas tailored to the needs of species and to the maintenance of biodiversity may be more accepted if certain non-disruptive recreational activities are allowed. Palomo et al. (2013) explored the main ecosystem services people associate with protected and unprotected areas finding cultural and regulating services being perceived as mainly located inside the national park. We provide empirical results that show the differences inside and outside parks in terms of certain perceptions. Although the differences we found are small, perceptions that parks maintain and improve the state of nature and the different values of particular NCP within the landscape should be of interest to land planners and conservation professionals.

An increased awareness and knowledge of NCP provided by parks improves perceptions of the importance of these areas (Allendorf & Yang, 2013). For Palomo et al. (2014), integrating protected areas into the broader territory is essential as these tend to be disconnected from the adjacent degraded landscape, and 'there is no clear conceptual framework that integrates them into the surrounding landscape' (p. 181). With this in mind, we believe

EI could help connect protected areas to the larger landscape. Our results show that current perceptions and social values of NCP in the landscape, inside/outside parks, should also help define EI. During the design and evaluation of EI and parks, the population's values can be used to plan and manage objectives and activities (e.g. education and awareness campaigns) that in turn could help modify values and behaviours that go against park objectives or appeal and heighten values that support biodiversity conservation and human wellbeing.

## 4.2 | Nature's intrinsic value is perceived equally or higher than nature's value for the economy and culture

In our study, respondents perceived nature's intrinsic value as equally or more important than nature's value for the economy or culture. Patterns were similar inside and outside parks but differed according to gender, age, and rural and intermediate municipalities. Jaligot et al. (2019) found the spatial distribution of the 'simple nature value', as they defined nature's intrinsic value, increasing along the urban–rural continuum in Switzerland. They emphasize the need for further studies given the abstract nature of the term they used. In our study, respondents' micro-narratives do not always mention intrinsic value explicitly, but we found elements pointing to it implicitly.

Park users assessed intrinsic and relational values more highly than were assessed the instrumental contributions offered by nature in Tierra del Fuego National Park, Argentina (Mrotek et al., 2019). Studies in other countries have also shown the importance of intrinsic value for respondents to be high. However, these focus mainly on species instead of parks. In one study, almost 69% of USA respondents perceived wildlife as having intrinsic value (Wickizer, 2016). Interestingly, this belief was shared by consumptive users of wildlife, like hunters, and non-consumptive users (Vucetich et al., 2015). Another study found that recognizing nature's values could help certain programmes (e.g. payments for services) boost pro-environmental behaviours (Liso et al., 2022).

Switzerland is not new to the discussion on the inherent value of nature and biodiversity. In 2001 and 2008, the Swiss Federal Ethics Committee on Non-Human Biotechnology (ECNH) published two documents: 'The Dignity of Animals', and 'The Dignity of Living Beings with Regards to Plants: Moral Consideration of Plants for Their Own Sake'. These documents discuss the inherent properties and value of animals and plants (ECNH, 2001, 2008). However, neither address how the population perceived the intrinsic value of animals and plants nor proposed concrete activities to catalyse the intrinsic values in the landscape. Indirectly, policymakers began to consider people's perceptions of intrinsic value in Switzerland. One example relates to recreational fishing policy. In Switzerland (and Germany), catch-and-release angling of legally harvestable fish is banned because recreational fishing is only justified if it is practised for food consumption. According to the researchers, the

recreational fishing policy can only succeed if public behaviour changes from being human-centred to animal-centred (wellbeing of individual animals), while downplaying the benefits obtained for individuals or society generated by recreational fishing (Arlinghaus et al., 2007). Since most stakeholders, even those not usually associated with environmental issues, perceive wildlife has intrinsic value, intrinsic value could be incorporated into the decision-making process for conservation programmes (Butler & Acott, 2007).

However, the relevance of intrinsic value in policy and management is not limited to how diverse the population's perceptions are in terms of its importance but also includes how intrinsic value may signal a deeper sense of moral duty towards nature. There is a long-standing debate on the intrinsic vs. instrumental value of nature; relational values have been proposed as a means of bridging the dichotomy (Chan et al., 2016). However, few empirical studies have examined whether or not this solution is valid (Lan et al., 2022). A study of a representative sample of people in Singapore examined whether intrinsic and relational values of animals and ecosystems were predictors of people's sense of moral duty towards nature conservation for the future (Lan et al., 2022, p. 1). The study found 'that the best predictor of such a sense of moral duty for future nature conservation is the recognition of the intrinsic values of sentient beings', implying that perceiving an animal's intrinsic value 'may enhance rather than compete with the sense of moral duty towards nature conservation.' The results contribute to the debate as to whether nature conservation is justified by the benefits nature provides to humans or because it has value *in and on itself* (discussed in Holmes et al., 2017; Lan et al., 2022). All of this suggests the significance of appealing to intrinsic values for people and society to protect nature, 'or at least the sense of moral duty to do so' (Lan et al., 2022, p. 9), and explains that because intrinsic values are more constant over time as compared to perceptions of NCP, their use to motivate people to protect nature may have fewer constraints than in the case of other values.

Policies should include values of moral duty of care and responsibilities towards nature (Piccolo et al., 2022). However, biodiversity strategies and action plans more frequently mention instrumental rather than relational or intrinsic values, and when strategies do allude to intrinsic values, they do so without being linked to specific actions (Anderson et al., 2022). This is the case in Switzerland, where intrinsic value is barely mentioned in the introduction of the Biodiversity Strategy and Action Plan and is disconnected from specific conservation activities (FOEN, 2012, 2017), including EI design.

The prominent perception of intrinsic value in our study can also contribute to discussions as to how nature as having intrinsic value may translate into an equitable and moral stance towards nature conservation. We also maintain the importance of appealing to intrinsic value in the design and maintenance of EI. EI planners could appeal to the intrinsic value of nature to obtain support for the establishment of dedicated crossings to help small mammals travel between protected zones, from protected zones to specific sustainable-use areas of ecological value within a park, and from protected zones in the park to areas beyond (Figure 6b).

### 4.3 | Values should be used to expand EI from protected zones and parks to the rest of the landscape

We recommend the analysis of NCP to account for diverse valuations of nature with site-specific or regional analyses. Additional case and theoretical studies on NCP and nature valuation in different contexts and settings will 'improve and enhance the use of NCP and its application in policy and planning' (Managi et al., 2022, p. 703). Surveys help integrate people and stakeholders' needs and perceptions into management plans (Castro et al., 2015). However, the uptake of valuation study results into decision making has remained low (Pascual et al., 2023). Other researchers (Pascual et al., 2023; Stålhammar, 2021) posit that the emphasis should be on understanding how to move socio-cultural values towards sustainability rather than concentrating on describing these values. We see it as essential to strike a balance between the two. Only once the perception of value indicators in specific contexts (e.g. inside/outside parks) and for specific biodiversity conservation tools (e.g. EI, green infrastructure, parks, and nature-based solutions) is understood can the kind of transformation required be realized. Additionally, monitoring these value indicators helps clarify whether the desired change is happening or requires further refinements. Knowing the values and perceptions can help understand trends, change undesirable behaviours and adapt policy instruments (e.g. incorporating intrinsic value in the Biodiversity Action Plan) and management tools (e.g. parks management plans). Finally, because the design and management of EI are still in their early stages, there is a need to use the information on nature values and NCP perceptions to develop a conceptual framework to guide policy makers and practitioners in planning EI.

### 4.4 | Research limitations

In our study, we do not define nature or EI. Respondents shared their experiences in nature as they defined it, and we did not provide any reference to the explicit concept of EI in terms of its recent usage and complexity. Furthermore, we are aware the concept of 'infrastructure' might imply a commodification of nature. Our approach to the concept of EI was from the angle of EI as a tool for conserving biodiversity, maintaining nature, and NCP. We did not discuss or analyse the concept's many potential interpretations.

We have used micro-narratives to help us understand the perceptions and values of people in terms of nature and NCP. Overall, our survey, with its requirement of an initial micro-narrative, had similar response rates to typical surveys, although with a gender bias towards women. We maintain that the method of making sense of experiences and narrative fragments is relevant for monitoring and measuring the pulse of the perceptions individuals have of NCP and nature. Researchers could extend this method to ask about specific or general management aspects of EI.

Given the different format and new elements our survey brought to a population used to completing more standard questions and questionnaires, a paper format of our questionnaire would need to be further piloted in future research. Special attention should be placed on the completion of dyad and triad questions in paper format and where enumerators are absent.

## 5 | CONCLUSIONS

Perceptions of different NCP in the Swiss landscape were not homogeneous. The Swiss population attributed nature as having equal importance for the economy, culture, and nature itself (intrinsic value), with many respondents selecting the latter. They also perceived NCP as being higher in protected areas, and specific NCP, and the state of nature, were valued differently outside and inside parks.

Protected areas are key elements in the definition of EI, which in turn helps conserve nature and NCP. High biodiversity areas tend to provide more NCP, while NCP benefits (including those perceived) motivate the conservation of nature. We argue that knowing what people value about nature and their perceptions of NCP can motivate and support EI. Comparing values and perceptions inside and outside the park provides a higher granularity of data and definition for the development of more specific recommendations to develop EI.

Our study adds to the existing body of literature on NCP in general and presents additional data on the intrinsic value of nature using the internationally recognized IPBES framework. We also contribute further to the connection between the social value of nature, NCP, and EI, and potential ways to expand the parks' EI into the larger landscape. More importantly, we present new information on the social value of NCP and nature inside and outside nature parks, providing novel ways to use these perceptions towards the design and maintenance of EI or any network of natural areas at different scales, with the ultimate aim of reducing biodiversity loss and increasing human's quality of life.

### AUTHOR CONTRIBUTIONS

Marina Cracco: Conceptualisation, methodology, research, analysis, project administration and fundraising, visualization, writing—original draft, writing, edition and revision. Gretchen Walters: Conceptualisation, methodology, project fundraising, writing—revision. Romain Loup: support survey design, reviewed statistical analyses, writing—revision.

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## CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interests.

## DATA AVAILABILITY STATEMENT

The dataset includes personal and demographic information, making survey results confidential.

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## SUPPORTING INFORMATION

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

**Appendix S1:** Elements covered in the survey questionnaire compared with the main elements of the IPBES framework and their indicators.

**Appendix S2:** Survey questionnaire (translated from the French version).

**Appendix S3:** SenseMaker live data dashboard and analysis tool.

**Appendix S4:** Demographic and other explanatory variables and the response rate.

**Appendix S5:** General ranking of nature's contributions to people.

**Appendix S6:** Chi-square tests and Kruskal–Wallis *H*-tests.

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