Discover Environment

Research

The role of aesthetic beauty of natural landscapes in supporting conservation efforts

Mariela Cervetto[1] · **Ofelia Gutiérrez**[2] · **Walter Norbis**[3] · **Daniel Panario**[2]

Received: 11 March 2025 / Accepted: 27 June 2025
Published online: 10 July 2025

Abstract
A landscape is the perceptible manifestation of a socio-ecosystem, where social and natural subsystems interact and co-evolve at different spatial and temporal scales. It is both a reality from a physical standpoint, and the representation we get of it. It is both tangible and intangible simultaneously, and relevant in the formation of territorial identities. In Uruguay, between two country models—the natural and the productive—natural landscapes are in a situation of extreme fragility. This research analyses the perceptions of the rural and urban population, with different levels of education, of Uruguay's natural landscapes. The concept of beauty, as a pleasant affective response, drives people into interacting with natural environments in search of well-being. For urban dwellers, this is expressed in their need to reconnect with nature. For the rural population, it creates territorial identities, attachments, feelings of belonging, and accompanies life trajectories. Therefore, it can be concluded that the aesthetic and spiritual values that society attributes to Uruguayan landscapes could play a crucial role in the formulation of effective public conservation policies.

Keywords Aesthetic beauty · Conservation · Uruguayan natural landscapes · Socio-ecosystems · Social valuation

1 Introduction

1.1 Uruguay: one country, two realities

For several decades, Uruguay has been experiencing a process of productive intensification associated with land use change [1–6]. In this context, environmental policies are characterised by ineffective legal safeguards and weak institutional frameworks, with little or no monitoring capacity. These policies often overlap and conflict in contradictory ways with pro-productive transformation policies, which are strongly supported by financial instruments, specific legal frameworks and direct stimuli for their development [7–10].

The developmentalist policies have permeated not only Uruguay, but also Latin America as a whole, and moreover the costs of commodity-based economic "progress" have negative externalities for the environment [11–14]. Simultaneously,

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s44274-025-00297-5.

✉ Mariela Cervetto, mcervetto@fadu.edu.uy; Ofelia Gutiérrez, oguti@fcien.edu.uy; Walter Norbis, wnorbis@fcien.edu.uy; Daniel Panario, panari@fcien.edu.uy | [1]Instituto de Tecnologías, Facultad de Arquitectura, Diseño y Urbanismo, Universidad de la República, Bulevar General Artigas 1031, 11200 Montevideo, Uruguay. [2]Instituto de Ecología y Ciencias Ambientales, Facultad de Ciencias, UNCIEP, Universidad de la República, Iguá 4225, 11400 Montevideo, Uruguay. [3]Instituto de Biología, Facultad de Ciencias, Universidad de la República, Iguá 4225, 11400 Montevideo, Uruguay.

ecosystems are being pushed to the limits of their renewal capacities, exceeding ecosystem resilience thresholds [15]. The choice of one reality—the emerging, productive country developed on the basis of successive government policies and promoted as a guiding objective—over another—the so-called "natural country", which is more prevalent as a commercial brand than as a public policy objective—has resulted in territorial transformations with catastrophic environmental and cultural consequences.[16].

1.2 Productive Uruguay

The scientific community is in consensus that the loss of habitat due to land use change is the greatest threat to biodiversity on both a local and global scale [5, 9, 17, 18]. In particular, the loss of grasslands or natural field is alarming throughout the Pampean biome, of which Uruguay is part [2, 19–22]. According to data provided by the MapBiomas Uruguay project [23], grasslands were the country's dominant native vegetation in 2022, occupying 55.5% of its territory. However, it should be noted that 2.5 million hectares of natural grassland were lost between 1985 and 2022, equivalent to 20.4% of the country's natural vegetation cover.

The traditional Uruguayan production has been characterised by family farms with a limited number of animals, where external inputs such as phytosanitary products, concentrated feed or medicines are used sparingly, and generally more sustainable and environmentally friendly practices are employed. Instead, this new model was marked by monocultures such as soya, rice and forestry [10, 24–26]. To date, this model promoted by aid agencies and large multinational corporations, includes a uniform technological package (including genetically modified seeds, herbicides and agrochemicals) that generates both concentrated and diffuse environmental impacts beyond the areas of production [27–31]. This development model is characterised by a progression towards a system of continuous agriculture. It also leaves behind the traditional systems of rotation between agriculture and pastures, causing multiple changes, in terms of its expansion, which affects a larger territory, as well as its intensification. This approach has served the interests of central countries, threatening not only biodiversity, but also local landscapes and culture [4, 24, 32–34].

This new territorial matrix of agribusiness introduces profound social changes, eliminating the need for the producer to be established in the place of production. It also incorporates foreign and multinational businessmen as new actors [35].

1.3 Natural Uruguay

In accordance with Vidart [36], Uruguay is a country of nuances rather than of great contrasts. In his work, its territory is defined as a crossroads between the extremes of the regions that surround it, having neither the excesses of the Andes Mountain Range nor the horizontality of the Argentine Pampas. Moreover, the succession and alternation of different climates throughout its geological history has moulded (through erosion-accumulation processes) the pre-existing structure, generating a typical mosaic landscape, sensu González Bernáldez [37]. Due to the great variety of rock types involved in these processes, its landscapes have peculiar characteristics that are clearly visible in relictual forms to the present day [38, 39].

Even though it has been classified within the Pampean biogeographic province [40, 41], the Uruguayan territory is a transition zone where the Paranaense, Chaco and Mata Atlántica provinces also converge, forming the Uruguayensis District [42]. Considering the aforementioned, the end result of this is its varied physiognomy, characterised by a floristic richness, particularly in the grasslands, where the diversity responds to edaphic and palaeoclimatic factors [43]. In spite of the fact that the grassland is the most dominant matrix, with its diverse assemblages [44, 45], there are other plant communities, such as scrubland vegetation (riparian, mountain, escarpment and ravine), marshes, sand dunes and coastal dunes, halophytes (on the Atlantic coasts and in the estuary of the Río de la Plata), as well as special associations such as palm groves (butiá and yatay) and carob groves (park forest or savannah). In addition, subtropical elements from the northern areas enter through the riparian mountains and ravines of the northwest, connecting with the southern end of the Brazilian Atlantic Forest [46, 47]. Generally, the ecosystems that are present in the Uruguayan territory are classified into grasslands, forests, wetlands and coastal and marine ecosystems. However, the above-described biological diversity is manifested at its highest level of complexity in ecotones that exist among these ecosystems, in terms of communities and species assemblages, ecological processes and biogeographic heterogeneity, which explains the diversity of their landscapes [48].

In Uruguay, the National System of Protected Areas (SNAP) is a fundamental pillar of the country's environmental policy. Established by Law No. 17234 of 2000 and regulated by Decree No. 52 of 2005, its design and operation make it a

model of protection and an instrument of environmental management. As a protection model, it proposes the preservation of representative samples of the most relevant ecosystems in the country, as well as their associated biodiversity. As a public policy instrument, it articulates norms, institutions and actors to achieve environmental goals. Among the conservation categories defined by the SNAP, and relevant to this research, is "Protected Landscape". The SNAP defines a protected landscape as that portion of territory (continental or marine) where interactions between humans and nature have produced an area of defined character that presents a unique scenic beauty or possesses ecological or cultural values. The SNAP strategic plan 2015–2020 [49] had set a goal of integrating at least 17% of terrestrial areas and 10% of marine and coastal areas into the system. However, in 2023, according to official data on the institutional website, the total area under protection barely reached 336 203 hectares, which represents 1.06% of the country's total area.

2 Theoretical framework

2.1 The landscape

A natural landscape does not exist by itself. The landscape is a place of interaction with a temporal dimension that is as historical and cultural as it is evolutionary in itself, if not more so, and upon which past events have been inscribed, sometimes subtly, on the land [50]. From this standpoint, landscapes, or humanised environments—which Vidart [51] prefers to call simply landscapes—are the result of a socio-cultural organisations that makes them habitable. This is also known as "the ecumene" (Latin for inhabited land). Thus, it is possible to state that a country is a set of landscapes united by history [52].

According to González Bernáldez [37], a landscape is information that humans receive from their environment. This concept encompasses both the phenosystem (the perceptible elements that define the general appearance of the territory, its physiognomy), as well as the cryptosystem (the less evident and underlying ecological processes).

In this sense, the social-ecosystems approach (SES) does not consider humans as external agents of natural systems, but rather as an integral, inseparable and interdependent component [53–55]. From this perspective, the social and ecological subsystems merge into a single complex and adaptive system, where interrelationships determine their co-evolution [56–60].

Furthermore, both concepts of landscape from the SES approach converge in the recognition of the interdependence between human and natural subsystems, as well as in the importance of reciprocal and adaptive relationships in the evolution of landscapes. This link reaffirms both the role of society in the genesis of landscapes, as well as in the importance of landscapes in the construction of values and the formation of territorial identities [61, 62]. Moreover, social factors (values, beliefs, practices, ways of life and behaviour of a human group) explain and give meaning to the perception of the landscape. These socio-cultural dimensions are not merely contextual but are fundamental drivers of biocultural conservation. As Franco-Moraes et al. [63] argue, recognising and supporting the rights, worldviews and governance practices of local communities is essential for their well-being and the protection of biodiversity. Therefore, understanding how populations transform and relate to their landscapes can strengthen conservation efforts by making management more inclusive and effective. Both definitions also highlight the ecological importance and affective relationships (including the beauty), linking people to their landscapes [64]. Therefore, it is possible to relate perceptions to the structural conditioning factors that produce them, as well as to analyse the population's understanding of the logic of the relationships between subsystems.

Consequently, for the purpose of this research, a landscape is considered as a perceivable expression of a socio-ecosystem that can be valued both aesthetically and symbolically.

3 Aesthetic beauty

Although historically associated with art, beauty is a quality attributed to both man-made and natural objects. Objectivist theories argue that beauty is an intrinsic property of the object, based on its order and harmony. Objectivist theories of beauty originate from western antiquity and were particularly developed by the philosophers Pythagoras, Plato and Aristotle. Pythagoras associated beauty with the "mathematical order of the universe", an idea taken up by Aristotle, who noted that the Pythagoreans believed that "the principles of numbers were the principles of all things" and that "all of heaven is harmony and number" (Aristotle, Metaphysics, 985b–986a). Plato, for his part, maintained that "beauty is

eternal", neither born nor dying, nor increasing or diminishing. He asserted that the beautiful "exists in its own right, as an eternal and divine entity" (Plato, Banquet, 210e–211b), thus linking beauty with the intelligible world and ideas. Finally, Aristotle asserted that "beauty consists in magnitude and order" (Aristotle, Poetics, 1450b), emphasising the importance of proportion and structure in perceiving beauty. In contrast, subjectivist theories focus on the relationship between the object and the observer, emphasising the aesthetic experience as well as the emotions it evokes. Although subjectivist theories of beauty were consolidated in the modern era, they have antecedents in antiquity, for example in the Sophists, who introduced the idea of the subjective appreciation of beauty based on individual experience. However, they only underwent decisive development between the eighteenth and nineteenth centuries, when two philosophical currents emerged: British empiricism, which placed beauty in individual sensory perception (e.g. Hume), and German idealism, which linked it to the rational structures of the mind (e.g. Kant) [65]. Despite their differences—empiricism prioritised experience, while idealism prioritised reason—both currents coincided in shifting the focus of beauty from the objective to the subjective realm. From this experience, a socially shared "theory of taste" emerges, reflecting cultural patterns of appreciation and preferences that are not fixed, but socially moulded [65, 66]. In short, although beauty is experienced subjectively, it also tends to be universalised. These two approaches to the concept are not necessarily contradictory, but complementary, and are mediated by cultural factors [67, 68].

Aesthetic valuation has always been present in the relationship between individuals and nature and underlies many of the attitudes of people towards their environment [69–71]. In addition, the affective responses that arise from experiences in natural environments contribute to the physical and mental health of individuals [72–74]. Moreover, aesthetic value is an environmental value that, far from being a trivial issue of lesser hierarchy than its scientific or economic value, can contribute to the discussion of effective environmental policies that take into account socio-cultural aspects as drivers of conservation [75–78].

However, despite the aesthetic and spiritual benefit that ecosystems provide to people—recognised by the Millennium Ecosystem Assessment [79] under the so-called cultural ecosystem services—, the valuation of beauty is still neglected and considered less important than other services [75–77]. This is due to the fact that the central conceptual framework of ecosystem valuation, which combines science and economics, is not adapted to the valuation of beauty and spirituality, as they are ontologically opposed in their conception of nature, and axiologically opposed in their conception of the relationship between humans and nature [78].

Several recent studies have demonstrated the relevance of the study of perceptions as an input for planning and management, as well as for the definition of environmental policies in the territory [80–82]. A notable example is Punta Ballena in Punta del Este, Maldonado, a site of high landscape and ecosystem value that is internationally recognised for its scenic beauty and socio-cultural significance. In 2023, the announcement of a large-scale real estate project sparked widespread public opposition, backed by academics, professionals and scientists. While the existing regulatory framework (including constitutional provisions and environmental policy instruments) offered the necessary tools to halt the project, it was public engagement and the articulation of collective perceptions about the site's value that ultimately enabled these tools to be effectively enforced. The Ministry of the Environment rejected the proposal, and the local government designated the area as a nature reserve, integrating it into the National System of Protected Areas (SNAP). This case demonstrates how social perceptions of the landscape can provide valuable insights for the development and implementation of environmental policy instruments [83]. The aim of this study was to evaluate the perceptions of the Uruguayan population regarding their natural landscapes and to analyse the motivations that support a positive response to them, particularly to their beauty. It was hypothesised that by analysing perceptions, it would be possible to identify differentiated trends according to socio-demographic variables such as age, gender, residence and occupation. In this way, the goal of this work was to obtain diagnostic elements that may be useful for defining environmental policies aimed at protecting, co-managing and enhancing resilient natural landscapes.

4 Material and methods

4.1 Study area

The entire territory of Uruguay was considered as the study area (Fig. 1), excluding the metropolitan region and other areas strongly modified by human activity, in order to obtain sites with a high degree of naturalness. A bibliographic analysis and a search of institutional websites of local governments and state bodies were carried out in order to obtain information on natural and cultural landscape landmarks as well as their combinations. Twenty-two natural sites were

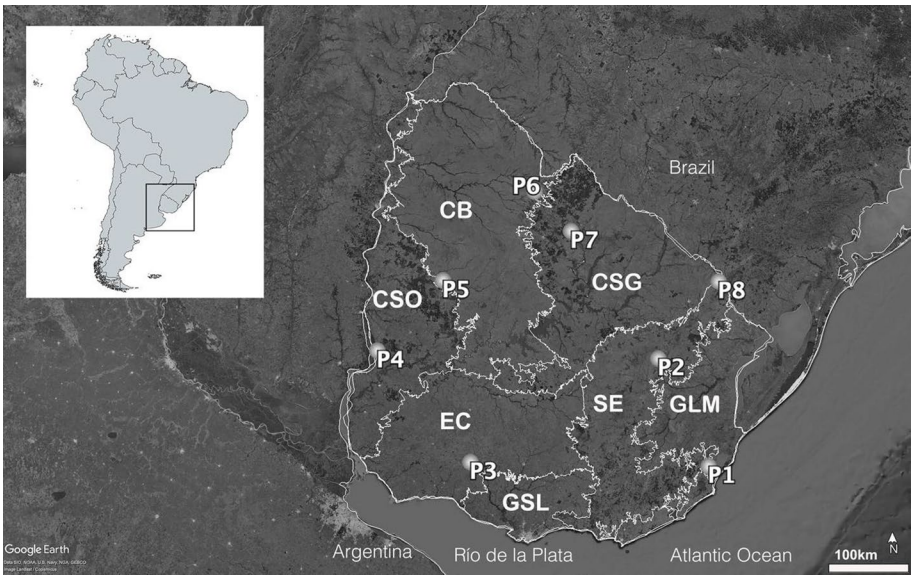

Fig. 1 Map of Uruguay with selected landscapes: P1 Palmares de Rocha, P2 Sierras del Yerbal (Isla Patrulla), P3 Sierra Mahoma, P4 Esteros y Algarrobales, P5 Montes del Queguay, P6 Cascada del Indio (Lunarejo), P7 Tres Cerros del Cuñapirú, P8 Pradera; and their location within each ecoregion; EC Escudo Cristalino, GSL Graben Santa Lucía, SE Sierras del Este, GSL Graben Laguna Merín, CSG Cuenca Sedimentaria Godwánica, CB Cuesta Basáltica, CSO Cuenca Sedimentaria del Oeste

pre-selected and visited. These were considered to be representative of the ecoregions of Uruguay and according to their characteristics, typical landscapes for each ecoregion [84]. During these field trips, we contacted nature guides, park rangers, and other qualified informants identified through the analysis of secondary information sources, such as databases containing public information. We established personal communication through social networks and telephone contacts to verify the status and conservation of the sites in place. Based on this information and the literature review, initial hypotheses were formulated about this perception, which were used for the evaluation thereafter.

Another objective of the field trips was to obtain photographic records of the landscapes. Furthermore, factors that could introduce sources of variability were controlled and standardised, especially lighting conditions and the angle of visual incidence, taking into account a standing observer and adjusting the focal length of the camera to obtain an optimal view of the landscape, favouring panoramic views. The Photos [85] photo file manager was used to preserve the records and the metadata obtained, such as geolocation, date, time of shooting, and camera settings. In addition, adjustments were made to the selected landscapes to make a small exposure correction and to replace all the skies with the clear blue-sky characteristic of Uruguay. These adjustments were made using Photoshop [86].

Lastly, landscapes corresponding to six ecoregions were selected: (1) Graben de Laguna Merín, (2) Sierras del Este, (3) Escudo Cristalino, (4) Cuenca Sedimentaria del Oeste, (5) Cuesta Basáltica, and (6) Cuenca Sedimentaria Godwánica [84]. Those sites that presented major alterations in their ecological structure and functions from an ecological point of view, resulting in poorly conserved natural landscapes, were discarded. Landscapes in the Graben de Santa Lucía ecoregion were not included as it is a highly disturbed area. A grassland landscape, characteristic of Uruguayan natural grasslands was also included (Fig. 2).

5 Perception survey

The survey was oriented to a general public and in order to maintain respondents' interest, a theoretical maximum duration of fifteen minutes was implemented. What contributed to the final choice on the number of landscapes was a combination of keeping the respondent's focused attention, the representativeness of the landscapes in the Uruguayan context and the specificity of the data required for the analysis, aligned with the objectives of the work.

The entire population of Uruguay served as the universe of study, excluding children (under 13 years of age). Foreign-born persons residing in Uruguay, and Uruguayan-born persons residing abroad were eligible to participate. So as to reach this population, socio-demographic variables (sex, level of education and residence environment) were controlled throughout the data collection process in order to obtain the desired representativeness. These variables were determined on the basis of data from the Continuous Household Survey and Population Census carried out by the National Institute of Statistics of Uruguay (INE in Spanish) [87]. It should be noted that, historically until 2011, censuses in Uruguay measured the demographic variable "sex". However, in the 2023 population census, the population over 12 years of age

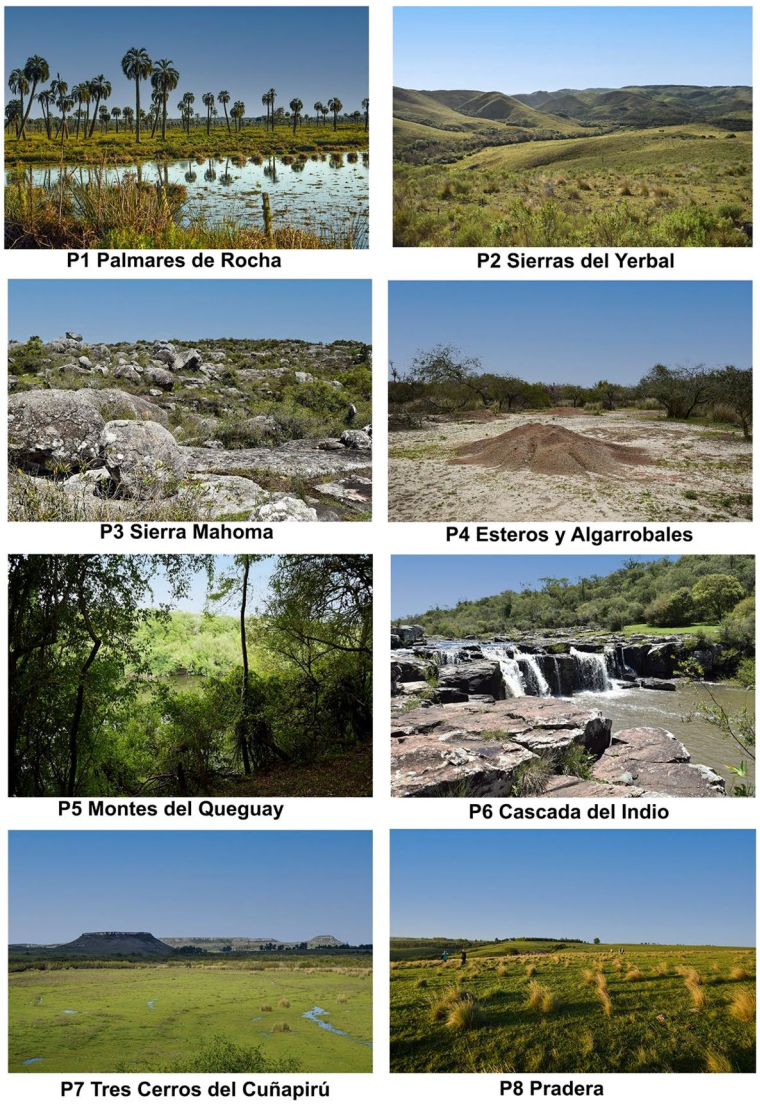

Fig. 2 Selected landscape picture: P1 Palmares de Rocha, P2 Sierras del Yerbal (Isla Patrulla), P3 Sierra Mahoma, P4 Esteros y Algarrobales, P5 Montes del Queguay, P6 Cascada del Indio (Lunarejo), P7 Tres Cerros del Cuñapirú, P8 Pradera

was asked about the gender identity variable for the first time. According to the 2011 census reports, the population of Uruguay was distributed as follows: women represent 52% and men 48% of the population; the population with higher education (university or equivalent tertiary education) stands at 10.8% at national level (25 years and older), and in the capital city, which concentrates more than 50% of the country's population, this figure increases to 22.5% of the population; the urban population stands at around 91% [87, 88]. Lastly, it is worth mentioning that the final figures of the 2023 census (recently published on the INE website) show an increase in the urban population (96%), at the expense of the rural population (4%) in the intercensal period 2011–2023.

This work was carried out with a non-probabilistic sample, obtained via online virtual sampling through the social networks Facebook and Instagram. The use of this modality made possible to reach the entire country, maximising the time–cost ratio to obtain responses from the population. Moreover, strategies were applied to obtain all the required cases, through promotions, prizes and incentives, making use of the social media segmentation algorithm as well as constant monitoring of the cases obtained [89–91]. Simultaneously, convenience sampling [92] was carried out using email contacts and distribution groups of academic institutions, in order to obtain sufficient cases from the equivalent university or tertiary education population.

The self-administered online survey was designed following the recommendations of Leeuw and Hox [93]—regarding the visual design of the online questionnaire, in order to provide the information in a way that avoids unintended errors (e.g. displaying all answer options to a question completely on screen)—, Arroyo Menéndez and Finkel [94]—regarding the organisation of the questions on the screen, the provision of information to respondents

about their progress, and the possibility of completing the survey within a certain timeframe, as well as the avoidance of horizontal scrolling on the screen—and Díaz de Rada [95]—regarding the visual presentation of a limited number of answers to avoid the primacy effect (tendency to select the first answer options) or on the contrary the recency effect (tendency to answer the last options)—. This work was carried out using Google Forms, taking advantage of the design functionalities offered by this tool, which allowed generating an adaptable design for its correct visualisation both on a computer screen and a mobile phone.

The survey was designed using the photograph-pairs test technique [96, 97]. This technique, which has been used by several authors in the study of perceptions [81, 98], allowed the comparison of all the landscapes with each other. It also enabled the respondents to choose their preferred landscape from each pair.

The survey consisted of 28 sections, one for each evaluation pair, using a composite image vertically organised. Additionally, each respondent was asked to justify their choice by selecting from the following hypotheses of appreciation: (a) because of its beauty (BE), (b) because it is unique or different (DIF), (c) because it has no people (NOP), (d) because of the presence of water (WA), (e) because it connects me with nature (NAT), f) because it gives me a sense of well-being (WB), (g) because it identifies me (IDE). Moreover, multiple responses were allowed in regard to the reasons for appreciation, in addition to the possibility of writing a personal justification (not compulsory) in a text field. At the end of the survey, socio-demographic data (control variables) were requested, such as sex, age (requested in numbers), place of birth and residence, last level of education attained, occupation and whether they were living in an urban or rural environment (see in Supplementary Information: Appendix S1).

Furthermore, Facebook and Instagram pages—PaisajeNaturalUY and paisajenaturaluy, respectively—were created with a link to the survey. Additionally, promoted publications were made based on the estimated reach once the segmentation parameters were defined, using the algorithmic engine of each social network. Impressions and clicks on the link provided were monitored, with appropriate adjustments made to the results of each evaluated promotion.

The optimal sample size (n), necessary to be representative of the population under analysis was calculated for a margin of error of 5% or 95% confidence, using the procedure proposed by Cochran [99]. The survey was conducted between August and November 2023.

The dataset was organised in a matrix, with individual survey responses (cases) forming the rows and the variables forming the columns. Socio-demographic variables—such as age, gender, occupation, place of residence, and type of activity—were included, as were the comparison variables between pairs of landscapes and the respondents' chosen judgement hypotheses. The socio-demographic variables were used to structure the analysis, while the landscape comparison variables supported the interpretation of the results.

Moreover, cases with incomplete information: children under 13 years of age and foreigners residing out of the country were excluded from the analysis, as they are not included in the study population. Thus, enough valid cases were obtained for the analysis. Furthermore, two databases that took into account the variables sex and education were used: (1) "Population with higher education" (university or equivalent tertiary education) resident in Uruguay (n = 616 cases), and (2) "Uruguayan population or general population" (n = 563 cases), comprising the population residing in Uruguay, both with no education and with education at all levels (primary, secondary and higher). The data were organised into two matrices: a general matrix, and a matrix exclusively for higher education. On the one hand, the socio-economic and perception variables were organised in columns, while on the other hand, the categories assumed by the variables (corresponding to the respondents' answers), were organised in rows. The socio-economic variables (columns) were recorded according to the criteria in Table 1.

The matrices were analysed using Multiple Correspondence Analysis (MCA), a multivariate graphical technique that simplifies the interpretation of categorical data in complex surveys [100]. The MCA fits the original data concomitantly to a scale that highlights its structure, generating axes that represent the greatest possible variability in the set. This technique determines the optimal number of factors by stabilising the explained variance. Lastly, MCA facilitates the identification of groups with similar profiles and displays associations among categories and cases on a two-dimensional map (cartesian plane) [100]. In the MCA, a p-value of 0.0001 was used, indicating a very low probability that the contribution of the analysed variables is due to chance alone, thereby highlighting their importance.

The MCA was performed with the statistical programme JAMOVI [101], through the use of the multivariate analysis package "Multivariate Exploratory Data Analysis" [102].

Table 1 Criteria for the recoding of the categories assumed by the variables

Original variable (categories)	Recoded variable (categories)
Age: response in years (numbers)	AgeRec: Young = 14 ≤ age ≤ 30 Adult = 31 ≤ age ≤ 64 Older adult = age > 65
Environment that inhabits do you live in an urban setting (YES or NO)	EnvRec: YES = Urban NO = Rural
Occupation: self-employed, part-time, full-time, student, unemployed, other	OcRec: Economically Active Population (EAP) = 14 ≥ of age, working or looking for work (unemployed) Economically Inactive Population (EIP) = 14 ≥ of age, not working (retired) and not looking for a job (not looking for a job) (houseworkers, students, income earners without economic activities)
Last level of education attained: primary, secondary, tertiary, university, no education	EducRec Primary = Primary (education cycle between about 6 and 12 years old) Secondary = Secondary (post-primary education cycle between about 12 and 18 years of age) Higher = University (post-secondary education for professional activities or scientific research) and Tertiary (post-secondary education for specialisation or professionalisation) No education = No education (persons who have not attended any of the above-mentioned cycles)

6 Results

The optimal sample size was estimated at 385 cases or respondents, which is less than the total number of the responses obtained in the surveys. Therefore, sampling was considered representative.

The general population that was surveyed (n = 563), was composed of 49.4% of men and 49.7% of women ($Chi^2 = 0.007 < 3.84$), with only 0.9% of the cases identifying as another sex. It was therefore decided to include the category "other" for those who did not identify with any of them, in addition to the categories historically surveyed in Uruguay's population censuses up to 2011, for the variable "sex" (male and female). The economically active population (EAP) represented 69.1%, whereas 30.9% belong to the economically inactive population (EIP) ($Chi^2 = 82.105 > 3.84$). The 18.5% live in rural settings and 81.5% in urban settings ($Chi^2 = 223.84 > 3.84$).

Moreover, the surveyed population with higher education (n = 616) consisted of 38.6% of men and 60.7% of women ($Chi^2 = 30.222 > 3.84$); only 0.6% declared another sex. The 73.9% belong to the EAP, and 26.1% to the EIP ($Chi^2 = 140.32 > 3.84$). Additionally, the 15.6% inhabit rural areas, while 84.4% live in urban areas ($Chi^2 = 291.84 > 3.84$).

6.1 MCA for the general population

The first three dimensions of the MCA explained 69.4% of the total cumulative variance (Table 2a). However, only the dimensions 1 and 2 (explain 49,8% of the total cumulative variance) were retained for the analysis since less than 3% of the total variance was explained between dimension 2 and 3 Factors or dimensions 1 and 2 were considered sufficient to explain the behaviour of the variables according to their contribution and statistical significance. In Multiple

Table 2 a) Estimated MCA factors (dimensions), eigenvalues and percentages of variance explained and accumulated by each factor for the general population

a) Eigenvalues and percentage (cumulative) variance			
Dimension	Eigenvalues	% of variance	Cumulative %
Dim. 1	0.353	28.2	28.2
Dim. 2	0.270	21.6	49.8
Dim. 3	**0.244**	**19.6**	**69.4**
Dim. 4	0.228	18.2	87.6
Dim. 5	0.155	12.4	100.0

b) Dimension 1		
Categories Dimension 1	Estimated inertia	p value
OcRec = EIP	**0.523**	**4.667e−134**
AgeRec = Older Adult	**0.631**	**2.389e−53**
AgeRec = Young	0.080	1.034e−25
Sex = Women	0.178	3.569e−13
EnvRec = Urban	0.146	5.374e−06
MR_P2P8_BE	0.091	1.497e−02
MR_P3P5_DIF	0.131	2.194e−02
MR_P1P2_WA	0.101	3.679e−02
MR_P2P8_NAT	− 0.113	4.424e−02
MR_P3P5_IDE	− 0.144	3.320e−02
MR_P5P7_DIF	− 0.108	3.259e−02
EnvRec = Rural	− 0.146	5.374e−06
Sex = Men	− 0.178	3.569e−13
AgeRec = Adult	**− 0.711**	**1.651e−103**
OcRec = EAP	**− 0.523**	**4.667e−134**

c) Dimension 2		
Categories Dimension 2	Estimated inertia	p value
EnvRec = Rural	**0.465**	**2.161e−82**
Sex = Women	**0.251**	**3.059e−34**
AgeRec = Older Adult	**0.489**	**1.298e−14**
AgeRec = Adult	**0.088**	**2.122e−11**
MR_P1P3_WA	0.125	2.053e−03
MR_P2P5_NAT	0.114	3.927e−03
MR_P1P5_WA	0.115	1.177e−02
MR_P2P3_WB	0.095	1.637e−02
MR_P1P6_WA	0.085	1.645e−02
MR_P1P7_IDE	0.116	2.158e−02
MR_P3P5_NAT	0.097	2.450e−02
MR_P3P4_DIF	0.081	3.290e−02
MR_P4P6_WA	0.056	4.216e−02
OcRec = EIP	0.048	4.432e−02
MR_P4P8_NAT	0.071	4.764e−02
OcRec = EAP	− 0.048	4.432e−02
MR_P3P4_BE	− 0.080	3.526e−02
MR_P5P6_BE	− 0.077	2.765e−02
MR_P2P5_BE	− 0.096	4.230e−03
MR_P1P3_WB	− 0.157	2.389e−03
MR_P2P3_BE;WB	− 0.178	1.486e−03
Sex = Men	**− 0.251**	**3.059e−34**

Table 2 (continued)

c) Dimension 2		
Categories Dimension 2	Estimated inertia	p value
AgeRec = Young	**− 0.577**	**2.110e−46**
EnvRec = Urban	**− 0.465**	**2.161e−82**

b) Description of the categories of variables for Dimension 1 (X-axis) for the general population. In the first column indicates the categories that the variables assume. EAP, economically active population; EIP: economically inactive population. Also: the MR (main reasons for choice): BEL: for its beauty; DIF: because it is unique or different; WA: because of the presence of water: NAT: because it connects me with nature; WB: because it gives me a sense of well-being; IDE: because it identifies me. In the second column, shows the inertia for each category, and in the third column, the p value (in bold highly significant differences). c) Description of the categories of variables for Dimension 2 (Y-axis). In the first column, the categories that the variables assume. EAP: economically active population; EIP: economically inactive population. Also: the MR (main reasons for choice): BEL: for its beauty; DIF: because it is unique or different; WA: because of the presence of water: NAT: because it relates me to nature; WB: because it gives me a sense of well-being; IDE: because it identifies me. The second column shows the inertia for each category and in the third column shows the p value (in bold highly significant differences)

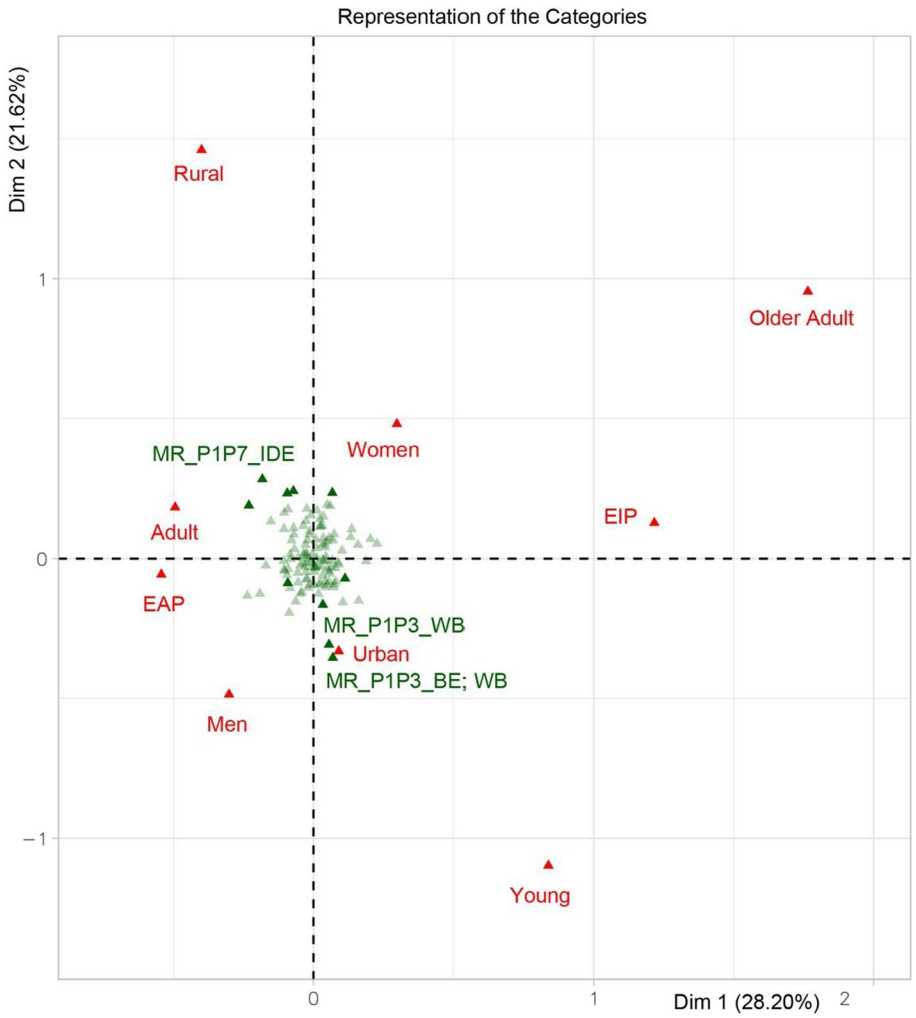

Fig. 3 Representation of the first two factors (dimensions 1 and 2) of the MCA and contribution of the categories and variables to the two factors. The green dots correspond to the cases. MR is the main reason for choice between pairs of landscapes P1 to P8

Correspondence Analysis (MCA), inertia measures how much each variable contributes to the variance explained by each factor (dimension), and its statistical significance (Fig. 3**,** Table 2b and c).

The dimension 1 explained 28.2% of the total variance (horizontal axis X) (Fig. 3, Table 2b). The categories contributing the highest inertia, both with positive sign are "EIP" (0.523; p = 4.667e−134), and "older adult" (0.631; p = 2.389e−53),

both significant. The highest inertia with negative sign were the "adult" (0.711; p = 1.651e−103) and "EAP" (0.523; p = 4.667e−134), both significant.

The dimension 2 explained 21.6% of the total variance (vertical y-axis) (Fig. 3, Table 2c). The categories contributing the highest inertia, with a positive sign, are "rural inhabitant" (0.465; p = 2.161e−82), and "older adult" (0.489; p = 1.298e−14), all significant. Those with the highest inertia with a negative sign are "young" (0.577; p = 2.110e−46), "urban inhabitant" (0.465; p = 2.161e−82), "men" (0.251; p = 3.059e−34), all significant, and "BEL;WB" (0.178; p = 1.486e−03) and "BEL" (0.157; p = 2.389e−03).

6.2 MCA for the higher educated population

The first three dimensions of the MCA explained 69.9% of the total cumulative variance (Table 3a). As for the MCA for the general population, the number of dimensions retained in the analysis were two (Fig. 4).

The Dimension 1 explained 28.3% of the total variance (horizontal axis X) (Fig. 4, Table 3b). The categories assuming the variables and contributing the highest inertia are "EIP" (0.564; p = 3.386e−160) and 'older adult' (0.869; p = 2.569e−121), both with positive sign; and with negative sign, the "adult" (0.618; p = 1.670e−76) and "EAP" (0.564; p = 3.386e−160), being all significant.

Furthermore, the dimension 2 explained 21.8% of the total variance (vertical Y-axis) (Fig. 4, Table 3c). The categories that assume the variables and contribute greater inertia of positive sign are "rural inhabitant" (0.369; p = 8.642e−43), "men" (0.272; p = 1.141e−41), "older adult" (0.638; p = 1.452e−16), being all significant, and 'IDE' (0.151, p = 2.829e−03) and "DIF" (0.134, p = 1.078e−02). The variables with the highest negative inertia were "WB" (0.102, p = 1.945e−02), "woman" (0.272; p = 1.141e−41), "urban inhabitant" (0.369; p = 8.642e−43) and "youth" (0.885; p = 1.882e−97), all significant.

7 Discussion

The populations analysed, represented by the two matrices, did not show major differences. However, it is possible to highlight different nuances, which are considered relevant. Moreover, the active variables (e.g. sex, age and place of residence) defined profiles that were clearly differentiated from each other (in terms of their inertia and sign), according to their location and contributions on the cartesian plane.

Both Multiple Correspondence Analysis (MCA) explained a similar percentage of variance for factors 1 and 2. However, the contribution of the variables enabled to differently infer the profile and perception of the analysed landscapes between the general population (contemplating all levels of education), and the population with higher education (exclusively with this level of education). For both populations, the categories of men and female, urban and rural, economically active and inactive population, were negatively related (coincident in absolute value of inertia, but positioned in opposite quadrants by origin), and were also determinant in the definition of the population profiles.

The MCA for the general population matrix showed two profiles. On one hand, a rural profile, consisting of female, older adults, belonging to the economically inactive population, who prefer landscapes with which they identify: Palmares de Rocha and Tres Cerros del Cuñapirú. On the other hand, a profile consisting of young, men, urban, belonging to the economically active population, who prefer landscapes that they deem as beautiful and that also produce a sense of wellbeing: Sierras del Yerbal and Sierra Mahoma.

The MCA for the matrix of the population with higher education showed two profiles. On one hand, a profile consisting of men, rural, adults and older adults, that belong to the economically inactive population, who prefer landscapes with which they identify: Montes del Queguay and Tres Cerros del Cuñapirú, and those that they consider unique or different: Esteros, Algarrobales and Pradera. On the other hand, a profile consisting of young, females and urban, that belong to the economically active population, who prefer landscapes that produce a sense of well-being: Esteros, Algarrobales and Pradera, which shows a different perception and feeling.

As for the matrix that considered those individuals with higher education, the major incidence of the female sex (60.7%) is related to their greater presence at university level [103], as well as their greater presence in tertiary education [104]. Furthermore, the rural population is considered over-represented both in the general population (18.5%), and in the population with higher education (15.6%), according to the data provided by INE. This could be explained by the existence of a new population that is perceived as rural, although it consists of rural workers living in urban environments, including towns and cities [35].

Table 3 a) Estimated MCA factors (dimensions), eigenvalues, and percentages of variance explained and accumulated by each factor for the higher educated population

a) Eigenvalues and percentage (cumulative) variance

Dimension	Eigenvalues	% of variance	Cumulative %
Dim. 1	0.354	28.3	28.3
Dim. 2	0.272	21.8	49.8
Dim. 3	**0.247**	**19.8**	**69.9**
Dim. 4	0.229	18.3	88.2
Dim. 5	0.148	11.8	100.0

b) Dimension 1

Categories Dimension1	Estimated inertia	p value
OcRec = EIP	**0.564**	**3.386e−160**
AgeRec = Older Adult	**0.869**	**2.569e−121**
Sex = Women	0.185	1.696e−14
MR_P5P8 = MR_P5P8_WB	0.157	8.114e−04
MR_P7P8 = MR_P7P8_DIF	0.093	1.220e−02
MR_P6P8 = MR_P6P8_WA	0.086	1.725e−02
MR_P3P7 = MR_P3P7_NAT	0.130	2.011e−02
MR_P4P8 = MR_P4P8_NAT	0.095	2.587e−02
MR_P5P7 = MR_P5P7_IDE	0.116	3.431e−02
MR_P2P8 = MR_P2P8_NAT	0.148	4.100e−02
MR_P3P7 = MR_P3P7_BE	− 0.101	4.945e−02
MR_P5P7 = MR_P5P7_BE	− 0.089	4.616e−02
MR_P2P5 = MR_P2P5_BE	− 0.097	4.480e−02
MR_P1P5 = MR_P1P5_DIF	− 0.133	2.787e−02
MR_P7P8 = MR_P7P8_BE	− 0.077	2.309e−02
AgeRec = Young	**−** 0.251	2.039e−02
MR_P4P8 = MR_P4P8_WB	− 0.131	1.773e−02
MR_P3P4 = MR_P3P4_WB	− 0.159	9.463e−03
Sex = Men	− 0.185	1.696e−14
AgeRec = Adult	− **0.618**	**1.670e−76**
OcRec = EAP	− **0.564**	**3.386e−160**

c) Dimensión 2

Categories Dimension 2	Estimated inertia	p value
EnvRec = Rural	**0.369**	**8.642e−43**
Sex = Men	**0.272**	**1.141e−41**
AgeRec = Older Adult	**0.638**	**1.452e−16**
AgeRec = Adult	0.247	1.162e−13
MR_P5P7_IDE	**0.151**	**2.829e−03**
MR_P4P8_DIF	0.134	1.078e−02
MR_P3P6_WA	0.046	3.782e−02
MR_P3P4_BE	0.091	4.255e−02
MR_P2P5_IDE	0.100	4.495e−02
MR_P3P6_BE	− 0.046	3.782e−02
MR_P6P8_WB	− 0.084	3.517e−02
MR_P3P8_BE	− 0.080	3.381e−02
MR_P4P8_WB	− 0.102	1.945e−02
MR_P3P4_NAT	− 0.113	5.124e−03
Sex = Women	− **0.272**	**1.141e−41**
EnvRec = Urban	− **0.369**	**8.642e−43**

Table 3 (continued)

c) Dimensión 2		
Categories Dimension 2	Estimated inertia	p value
AgeRec = Young	**− 0.885**	**1.882e−97**

b) Description of the categories of variables for Dimension 1 (horizontal X axis). In the first column, the categories that the variables take. EAP: economically active population; EIP: economically inactive population. Also: the MR (main reasons for choice): BE: for its beauty; DIF: because it is unique or different; WA: because of the presence of water: NAT: because it connects me with nature; WB: because it gives me a sense of well-being; IDE: because it identifies me. The second column shows the inertia for each category, and in the third column, the p value (in bold highly significant differences). c) Description of the categories of variables for Dimension 2 (vertical Y axis). In the first column, the categories that the variables take. EAP: economically active population; EIP: economically inactive population; Also: the MR (main reasons for choice): BE: for its beauty; DIF: because it is unique or different; WA: because of the presence of water: NAT: because it connects me with nature; WB: because it gives me a sense of well-being; IDE: because it identifies me. The second column shows the inertia for each category, and in the third column, the p value (in bold highly significant differences)

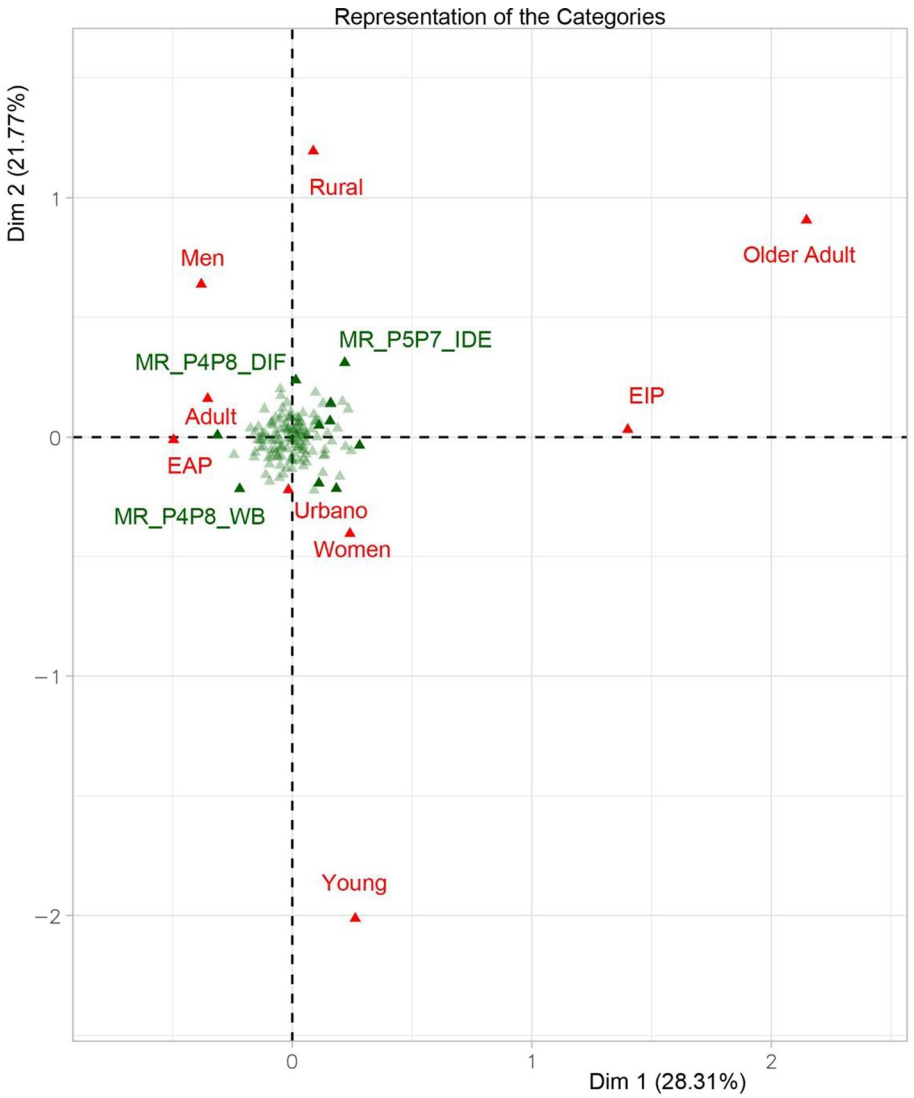

Fig. 4 Representation of the first two factors (dimensions 1 and 2) of the MCA, and the contribution of the categories and variables to the two factors. The green dots correspond to the cases. MR is the main reason for choice between pairs of landscapes P1 to P8

With regard to the motivations underpinning a positive aesthetic response (the beauty of natural landscapes) by the general population, the categories "young" and "urban" are seen as a characteristic feature. As for the population with higher education—predominantly female—it can be interpreted that a higher level of education had an influence on more elaborated and complex affective and cognitive responses (well-being), based on the scientific knowledge derivative of a higher level of education [105].

According to Vidart [51], city dwellers tend to think and behave in more abstract terms, distancing themselves from physical or manual labour. Their existence is marked by a constant discomfort due to a hectic and stressful life. In similar terms, the continuous exposure to stimuli generates latent anxiety and creates an environment that, although full of opportunities, generates tension and discomfort. The urban dweller is disconnected from nature and lacks the knowledge and practical experience of nature that a rural dweller has.

The feeling of beauty is a pleasurable affective response that occurs when one connects with the natural environment, even before cognitive evaluation (or understanding of the landscape), and is mediated by previous experiences and associations [71, 74]. In actuality, it is linked to the preceding affective state. This is why he argues that people interact with the natural environment to promote their well-being. This can explain the motivations behind the urban dweller's choice of natural landscapes that they consider beautiful. For the urban dweller in Uruguay, typical expressions such as "going outside" (referring to leaving the city), or "going inland" (referring to going into the country's territory)—with the latter being a very common expression in the capital city, originally a walled city—could express this desire or the need to "go out", yearning to slow down the rhythm imposed by the cities and connect with nature.

On the other hand, the preference for those landscapes with which people identify themselves (Palmares de Rocha, Tres Cerros del Cuñapirú, Montes del Queguay), has as a common denominator between both populations, the rural and economically inactive categories. Therefore, according to the profiles defined for both populations, a familiarity with everyday natural landscapes determines their preference for them. Furthermore, rural people are deeply connected to their environment, have an intimate and detailed knowledge of it, and consider their life as part of a natural cycle. For both rural men and women, landscapes are a reflection of their own life history, embedded in meanings that also give a definition to the place and differentiate it from the rest of the world [52, 61].

These results suggest that beauty is a relevant value in the perceptions of the average population profiles. It can also foster an ethical attitude of the individual towards the environment [75]. An ethical attitude implies being aware that all human actions (individual or collective) can affect the socio-ecosystem, since the survival of the social subsystem depends on the maintenance of the ecological subsystem, of which humans are a part of as a species, and with which they evolve together [106].

From a historical perspective, afforestation in Uruguay has been defended as something positive, as a harmless productive activity to develop unproductive territories [10, 107, 108]. However, the environmental and social costs are very high in relation to the claimed benefits [13, 109]. Furthermore, the soya business—which is not intended to satisfy the food needs of the population, but rather to be exported for the breeding of livestock outside the national territory—generates harmful consequences for the health of ecosystems and the human population [2, 24].

The proposed methodology can be a valid tool to bring to the surface the conflict between predominant productive practices and the conservation of landscapes valued by the population of Uruguay, as it gives importance to natural, socio-cultural and identity values that are often put in second place to those related to economic development. In this sense, the recognition of the importance of the values highlighted by the study could broaden the elements to be considered in territorial governance in order to work on balanced solutions that take into account the related moral conflicts [64, 110]. For instance, the expansion of afforestation threatens the conservation of natural landscapes that are highly valued by the population. This process not only transforms the physical environment but also suppresses the territorial and cultural identity of the rural inhabitant, since the rich diversity of forests, grasslands and hills is replaced by the monotony of a monospecific forest of planted exotic species. It also deprives the view into the typical horizon of the rural cattle-raising landscape. It is the "non-place" that strips society of the beauty of the natural landscape and its spiritual significance. According to Nogué [61], we are facing a crisis of values, of a model of society and of ways of life. Likewise, according to the results of the present work, the historical construction of an idea of a place, leads to territorial identities that create attachments and accompany life trajectories [51].

In the context of this crisis, the feelings of the new generations of young Uruguayans are crucial, and their appreciation towards the beauty of natural landscapes seems encouraging. However, questions arise about the influence that could or should be exerted by an urban population that does not inhabit them and therefore is not identified by them. Similarly, it is open to question whether future generations of rural workers who settled in rural areas will have less of a symbolic attachment to the environment. Therefore, there is great uncertainty looming over the future of Uruguay's natural landscapes in case of the absence of explicitly targeted conservation policies [26].

On the other hand, if Uruguay's natural landscapes are considered as common goods that belong to and benefit society as a whole, their protection should require specific actions to maintain resilient natural landscapes. In consequence, they should be able to provide the ecosystem services that society needs, including beauty and spiritual well-being, traditionally associated exclusively with cultural services due to an economistic and anthropocentric logic [111–115].

8 Conclusions

Life histories, including place of residence, age, occupation, education and sex, are relevant aspects that influence people's perceptions of natural landscapes. In Uruguay and Latin America, environmental policies have often been based on conservationist (e.g. biodiversity) and social causes when deciding what to conserve. Other policies, such as economic and productive ones, are perceived as preventing us from moving away from marginal conservation, which places natural landscapes in a situation of extreme fragility. Alternatively, environmental policies should focus on the aesthetic and spiritual values that are still evident in the Uruguayan society. They should also focus on the reasons and for whom to effectuate their conservation endeavours. They will also necessarily integrate dynamic management and improvement strategies that consider the evolution of social, cultural and economic processes. Moreover, these values should guide the actions of people and institutions in a responsible and intergenerationally empathetic manner (e.g. the aforementioned Punta Ballena case). As mentioned above, beauty can play a key role as part of the socio-cultural factors that drive conservation. By protecting landscapes, as socio-ecosystems, not only are the natural subsystems protected (their ecological value and services), but also the social subsystem (rootedness, belonging and empathy). Aesthetic beauty could therefore serve as an umbrella for conservation, as it represents the link that a society has with its environment, with which it identifies and values as a source of well-being.

For future work, in order to reinforce the conclusions drawn in this study, it is proposed that perceptions of landscapes related to situations labelled as threats, such as afforestation and continuous monoculture agriculture, could be collected in a survey. The present study could be enriched by these new analyses related to negative and positive perceptions.

Finally, future work will consider including a broader figure, that of the "inhabitant". This concept also includes travellers, tourists, all the people who "live" in the place, extending the analysis to these groups in order to better understand how the Uruguayan territory is experienced. In addition, the complexity of affective, identity- based, and conflictual relationships with the landscape would benefit from qualitative approaches such as participatory observation, focus groups, and community meetings. These methods can capture insights that are not provided by standardized questionnaires.

Acknowledgements This work is part of the doctoral thesis in Environmental Sciences by M. Cervetto at the Faculty of Science, University of the Republic, Uruguay. It was carried out with the support of a grant from the National Postgraduate Grants Programme of ANII (National Agency for Research and Innovation, Uruguay). O. Gutiérrez, W. Norbis and D. Panario are part of the National System Researchers (SNI) of the ANII. We also thank D. Norbis for his help with the English version of the manuscript. Finally, we would like to thank the three anonymous reviewers who contributed to the improvement of the article with their suggestions and contributions.

Author contributions MC conceived the presented idea supervised by OG and DP. MC collected the data and took all the photographs used in the research and prepared the tables and figures. MC and WN analysed and interpreted the results. All authors discussed the results and worked on the manuscript (writing, review and editing).

Funding The manuscript has not had any funding.

Data availability Data is provided within the manuscript or supplementary information files.

Declarations

Ethics approval and consent to participate The authors submitted the survey protocol to the University of the Republic before starting the research, following the policy of the Academic Committee of the Doctorate in Environmental Sciences of the Faculty of Sciences of the University of the Republic, which confirms that no formal approval is required. In our study, all research involving human participants was conducted in accordance with the Declaration of Helsinki, relevant national guidelines and regulations and their regulatory bodies (National Research Ethics Commission and National Bioethics Commission), which subscribe to the declaration. The National Research Ethics Commission (CNEI), created by Decree No. 158/019, waived the need for informed consent.

Consent for publication NA.

Competing Interests The authors declare no competing interests.

References

1. Achkar M, Blum A, Bartesaghi L, Ceroni M. Escenarios de cambio uso del suelo en Uruguay. Montevideo: Informe Técnico. Convenio MGAP/PPR—Facultad de Ciencias/Vida Silvestre/Sociedad Zoológica del Uruguay/CIEDUR; 2012.
2. Paruelo J, Guerschman JP, Piñeiro G, Jobbágy EG, Verón SR, Baldi G, et al. Cambios en el uso de la tierra en Argentina y Uruguay: marcos conceptuales para su análisis. Agrociencia. 2006;10:47–61. https://doi.org/10.31285/AGRO.10.929.
3. Santos C, González M, Rodríguez P, Vázquez M, Bergós L, Ligrone A. 30 años no es nada: una aproximación a las políticas ambientales en Uruguay. Cuad Claeh. 2022;41:127–45. https://doi.org/10.29192/claeh.41.2.8.
4. Céspedes-Payret C, Piñeiro G, Achkar M, Gutiérrez L, Panario D. The irruption of new agro-industrial technologies in Uruguay and their environmental impacts on soil, water supply and biodiversity: a review. Int J Environ Health. 2009;3:175–97. https://doi.org/10.1504/IJENVH.2009.024877.
5. Tiscornia G, Achkar M, Brazeiro A. Efectos de la intensificación agrícola sobre la estructura y diversidad del paisaje en la región sojera de Uruguay. Ecol Austral. 2014;24:212–9. https://doi.org/10.25260/EA.14.24.2.0.24.
6. Mello AL, Lezama F, Baeza S. Patrones y controles regionales de la fragmentación de pastizales naturales en Uruguay. Ecosistemas. 2023;32:1–10. https://doi.org/10.7818/ecos.2534.
7. Gligo N. Institucionalidad pública y políticas ambientales explícitas e implícitas. Rev de La CEPAL. 1997. https://doi.org/10.18356/5b3eabca-es.
8. Gligo N, Alonso G, Barkin D, Brailovsky A, Brzovic F, Carrizosa J, et al. La tragedia ambiental de América Latina y el Caribe. Santiago: Libros de la CEPAL, N° 161 (LC/PUB.2020/11-P), Comisión Económica para América Latina y el Caribe; 2021. https://doi.org/10.18356/9789210047425.
9. Gligo N, Barkin D, Carrizosa J, Durán H, Fernández Seyler P, Gallopín G, et al. América Latina y el Caribe: Una de las últimas fronteras para la vida. Santiago de Chile: Universidad de Chile, Facultad de Gobierno, Centro de Análisis de Políticas Públicas; 2024.
10. Gutiérrez O, Panario D. Implementación de un complejo forestal Industrial, ¿una política de Estado? Estudio de caso: Uruguay. CLACSO; 2014.
11. Gudynas E. Debates sobre el desarrollo y sus alternativas en América Latina. Más Allá Del Desarrollo Grupo Permanente de Trabajo Sobre Alternativas al Desarrollo. 2011. pp. 21–54.
12. El GE. pegajoso mito del crecimiento económico y la crítica al desarrollo. Nuestramérica. 2020;8:21. https://doi.org/10.5281/zenodo.6481748.
13. Panario D, Mazzeo N, Eguren G, Rodríguez C, Cayssialis R, Altesor A, et al. Síntesis de los efectos ambientales de las plantas de celulosa y del modelo forestal en Uruguay. Montevideo. 2006. https://doi.org/10.13140/RG.2.1.2929.0483.
14. Sejenovich H, Panario D. Hacia otro desarrollo. 2nd ed. Montevideo: Editorial Nordan Comunidad; 1998.
15. Gutiérrez O, Panario D, Terradas L, Céspedes-Payret C. Cambio Global. De la prehistoria al presente. Cambio ambiental global, metabolismo social local, gobernanza y alternativas: desastres ambientales y catástrofes sociales: rutas del capitalismo depredador, Boletín del Grupo de Trabajo Cambio ambiental global, metabolismo social local, vol. 4, Buenos Aires: CLACSO; 2022, pp. 10–7.
16. Renfrew D. Uruguay: políticas ambientales, agua y sociedad. In: Santos C, Renfrew D, Baldomir S, Iglesias V, editors. Aguas en movimiento: la resistencia a la privatización del agua en Uruguay, Montevideo. 2006. pp. 77–84.
17. Tscharntke T, Klein AM, Kruess A, Steffan-Dewenter I, Thies C. Landscape perspectives on agricultural intensification and biodiversity—ecosystem service management. Ecol Lett. 2005;8:857–74. https://doi.org/10.1111/j.1461-0248.2005.00782.x.
18. Achkar M, Brazeiro A, Bartesaghi L. Evaluación de las principales presiones y amenazas a la biodiversidad de Uruguay. In: Brazeiro A, editor. Eco-Regiones de Uruguay: Biodiversidad, Presiones y Conservación. Aportes a la Estrategia Nacional de Biodiversidad, Montevideo: Facultad de Ciencias, CIEDUR, VS-Uruguay, SZU; 2015. pp. 70–85.
19. Baldi G, Paruelo J. Land-use and land cover dynamics in South American Temperate grasslands. Ecol Soc. 2008. https://doi.org/10.5751/ES-02481-130206.
20. Paruelo J, Jobbágy EG. The Grasslands and Steppes of Patagonia and the Río de la Plata Plains. In: Veblen T, Youg K, Orne A, editors. The physical geography of South America. New York: Oxford University Press; 2007. p. 232–49. https://doi.org/10.1093/oso/9780195313413.003.0022.
21. Terradas L, Gutiérrez O, Céspedes-Payret C, Panario D. Cambio de uso del suelo, comercio y cambio climático en la Cuenca del Río de la Plata. Boletín del Grupo de Trabajo Cambio ambiental global, metabolismo social local, gobernanza y alternativas. América Latina y el Caribe frente a la crisis climática, vol. 3, Buenos Aires: CLACSO; 2022, p. 36–41.
22. Vega E, Baldi G, Jobbágy E, Paruelo J. Land use change patterns in the Río de la Plata grasslands: the influence of phytogeographic and political boundaries. Agric Ecosyst Environ. 2009;134:287–92. https://doi.org/10.1016/j.agee.2009.07.011.
23. Proyecto MapBiomas Uruguay. Colección [1.0] de la Serie Anual de Mapas de Cobertura y Uso del Suelo de Uruguay 2025. https://uruguay.mapbiomas.org/wp-content/uploads/sites/6/2023/12/Factsheet_MapBiomas_Uruguay-col-1.pdf. Accessed 17 June 2025.
24. Achkar M, Domínguez A, Pesce F. Principales Transformaciones Territoriales en el Uruguay Rural Contemporáneo. PAMPA. 2006;1:219–42. https://doi.org/10.14409/pampa.v1i2.3137.
25. Carrasco-Letelier L, Eguren G, Castiñeira C, Parra O, Panario D. Preliminary study of prairies forested with *Eucalyptus* sp. at the northwestern Uruguayan soils. Environ Pollut. 2004;127:49–55. https://doi.org/10.1016/S0269-7491(03)00258-6.
26. Gautreau P. Forestación, territorio y ambiente: 25 años de silvicultura transnacional en Uruguay, Brasil y Argentina. 1st ed. Montevideo: Trilce; 2014.
27. Berthrong ST, Schadt CW, Piñeiro G, Jackson RB. Afforestation alters the composition of functional genes in soil and biogeochemical processes in South American grasslands. Appl Environ Microbiol. 2009;75:6240–8. https://doi.org/10.1128/AEM.01126-09.

28. Céspedes-Payret C, Piñeiro G, Gutiérrez O, Panario D. Land use change in a temperate grassland soil: afforestation effects on chemical properties and their ecological and mineralogical implications. Sci Total Environ. 2012;438:549–57. https://doi.org/10.1016/j.scitotenv.2012.08.075.
29. Farley KA, Piñeiro G, Palmer SM, Jobbágy E, Jackson RB. Stream acidification and base cation losses with grassland afforestation. Water Resour Res. 2008;45:1–11. https://doi.org/10.1029/2007WR006659.
30. Säumel I, Ramírez LR, Tietjen S, Barra M, Zagal E. Back to the future? Conservative grassland management can preserve soil health in the changing landscapes of Uruguay. SOIL. 2023;9:425–42. https://doi.org/10.5194/soil-9-425-2023.
31. Terradas L, Gutiérrez O, Céspedes-Payret C, Panario D. Cultivos genéticamente modificados en Uruguay. Cambios en la tenencia de la tierra en una geografía extractiva. In: Fernández Soriano A, Gutiérrez O, Islas Vargas M, Jacobi P, editors. Expresiones del metabolismo social capitalista en América Latina. Sujetos, conflictos y contrapropuestas. 1st ed. Buenos Aires: CLACSO; 2024. pp. 167–94.
32. Ortiz MS, Taks J, Schmid B, Thimmel S, editors. Entre el desierto verde y el país productivo. El modelo forestal en Uruguay y el Cono Sur. 1st ed. Montevideo: Edición Casa Bertolt Brecht y Redes Amigos de la Tierra; 2005.
33. García Préchac F, Ernst O, Arbeletche P, Perez Bidegain M, Pritsch C, Ferenczi A, et al. Intensificación agricola: oprtunidades y amenazas para un país productivo y natural. Montevideo: UDELAR CSIC; 2010.
34. Terradas L, Gutiérrez O, Panario D. Extractivismo, capitalismo cognitivo y metabolismo social. Boletín del Grupo de Trabajo Metabolismo Social/Justica Ambiental Exploraciones críticas e imaginarios alternativos #2. 2023. pp. 9–14.
35. Piñeiro D, Cardeillac J. Población rural en Uruguay: Aportes para su reconceptualización. Rev Cienc Soc. 2014;27:53–70.
36. Vidart D. El paisaje uruguayo. El medio biofisico y la respuesta cultural de su habitante. Volúmen II. Montevideo: Editorial Alfa; 1967.
37. González BF. Ecología y paisaje. Madrid: Blume; 1981.
38. Panario D, Gutiérrez O. The continental Uruguayan Cenozoic: an overview. Quatern Int. 1999;62:75–84. https://doi.org/10.1016/S1040-6182(99)00025-7.
39. Panario D, Gutiérrez O, Sánchez Bettucci L, Peel E, Oyhantçabal P, Rabassa J. Ancient Landscapes of Uruguay. In: Rabassa J, Ollier C, editors. Gondwana Landscapes in southern South America. Dordrecht: Springer; 2014. p. 161–99. https://doi.org/10.1007/978-94-007-7702-6_8.
40. Cabrera A, Willink A. Biogeografía de América Latina. Monografia 13, Serie Biologica 1973:122.
41. Morrone JJ. Biogeographic areas and transition zones of Latin America and the Caribbean islands based on panbiogeographic and cladistic analyses of the entomofauna. Annu Rev Entomol. 2006;51:467–94. https://doi.org/10.1146/annurev.ento.50.071803.130447.
42. Cabrera AL. Fitogeografía de la República Argentina. vol. 14. 1971.
43. Panario D. Evolución y tendencia de la vegetación nativa uruguaya I; La pradera. Boletín Técnico No 13, Contribución de los estudios edafológicos al conocimiento de la vegetación en la República Oriental del Uruguay, Montevideo: Dirección de Suelos y Aguas. MGAP; 1994. pp. 37–47.
44. Baeza S, Gallego F, Altesor A, Paruelo J. Cartografía de los pastizales en las regiones geomorfológicas de Uruguay predominantemente ganaderas. Bases ecológicas y tecnológicas para el manejo de pastizales. 2010. p. 22.
45. Paruelo J, Lezama F, Baeza S, Pereira M, Altesor A. Campo natural: ¿es todo lo mismo? Las comunidades de pastizal natural de Uruguay. Revista INIA Uruguay. 2020;62:32–7.
46. Gutiérrez O, Panario D, Achkar M, Bartesaghi L, Brazeiro A. Identificación y delimitación de corredores de conservación. In: Brazeiro A, editor. Eco-Regiones de Uruguay: Biodiversidad, Presiones y Conservación. Aportes a la Estrategia Nacional de Biodiversidad, Montevideo: Facultad de Ciencias, CIEDUR, VS-Uruguay, SZU; 2015. pp. 100–14.
47. Chebataroff J. Algunos aspectos evolutivos de la vegetación de la Provincia Fitogeográfica Uruguayense. Apartado de La Revista Nacional 1960;201.
48. Panario D, Gutiérrez O, Achkar M, Bartesaghi L, Ceroni M. Clasificación y mapeo de ambientes de Uruguay. In: Brazeiro A, editor. Eco-Regiones de Uruguay: Biodiversidad, Presiones y Conservación. Aportes a la Estrategia Nacional de Biodiversidad, Montevideo: Facultad de Ciencias, CIEDUR, VS-Uruguay, SZU; 2015. pp. 32–45.
49. SNAP. Plan Estratégico 2015–2020. Dirección Nacional de Medio Ambiente, MVOTMA. Montevideo: 2015.
50. Balée W. The research program of historical ecology. Annu Rev Anthropol. 2006;35:75–98. https://doi.org/10.1146/ANNUREV.ANTHRO.35.081705.123231/CITE/REFWORKS.
51. Vidart D. La vida rural uruguaya. vol. 1. 1st ed. Montevideo: Talleres Gráficos "33" SA; 1955.
52. Vidart D. El rico patrimonio de los orientales. Montevideo: Ediciones de la Banda Oriental; 2003.
53. Berrouet LM, Machado J, Villegas-Palacio C. Vulnerability of socio-ecological systems: a conceptual Framework. Ecol Indic. 2018;84:632–47. https://doi.org/10.1016/j.ecolind.2017.07.051.
54. Cumming GS. Spatial resilience in social-ecological systems. Cape Town: Springer; 2011. https://doi.org/10.1007/978-94-007-0307-0.
55. Gallopín G, Gutman P, Maletta H. Global impoverishment, sustainable development and the environment: a conceptual approach. Int Soc Sci J. 1989;41:375–97.
56. Berkes F, Colding J, Folke C, editors. Navigating social-ecological systems. New York: Cambridge University Press; 2001. https://doi.org/10.1017/CBO9780511541957.
57. Biggs R, Preiser R, de Vos A, Schlüter M, Maciejewski K, Clements H. What are social-ecological systems and social-ecological systems research? In: Biggs R, de Vos A, Preiser R, Clements H, Maciejewski K, Schlüter M, editors. The Routledge handbook of research methods for social ecological systems. 1st ed. London: Routledge; 2021. p. 3–26. https://doi.org/10.4324/9781003021339.
58. Folke C, Carpenter SR, Walker B, Scheffer M, Chapin T, Rockstrom J. Resilience thinking: integrating resilience, adaptability and transformability. Ecol Soc. 2010;15:20.
59. Ostrom E. A general framework for analyzing sustainability of social-ecological systems. Science. 1979;2009(325):419–22. https://doi.org/10.1126/science.1172133.
60. Walker B, Salt D. Resilience thinking: sustaining ecosystems and people in a changing world. Washington: Island Press; 2006.
61. Nogué J. El Reencuentro con el lugar: nuevas ruralidades, nuevos paisajes y cambio de paradigma. Doc Anal Geogr. 2016;62:489–502. https://doi.org/10.5565/rev/dag.373.
62. Ortega N. Paisaje e identidad nacional. In: Mateu Bellés J, Nieto M, editors. Retorno al paisaje. El saber filosófico, cultural y científico del paisaje en España, Valencia: EVREN, Evaluación de Recursos Naturales, S.A.; 2008. pp. 173–216.

63. Franco-Moraes J, Clement CR, de Cabral Oliveira J, de Oliveira AA. A framework for identifying and integrating sociocultural and environmental elements of indigenous peoples' and local communities' landscape transformations. Perspect Ecol Conserv. 2021;19:143–52. https://doi.org/10.1016/j.pecon.2021.02.008.
64. Castro A, Otamendi-Urroz I, Quintas-Soriano C, Suárez Alonso ML, Vidal-Abarca MR, Martín-López B. Repensar la conexión con la naturaleza a través de las emociones. Ecosistemas. 2023;32:2502. https://doi.org/10.7818/ecos.2502.
65. Tatarkiewicz W. Historia de seis ideas: Arte, belleza, forma, creatividad, mímesis, experiencia estética. 6th ed. Madrid: Tecnos; 2001.
66. Prada JM. David Hume y el juicio estético. Rev Filosofía. 2017;73:259–79. https://doi.org/10.4067/S0718-43602017000100259.
67. Kant I. Crítica del Juicio. Madrid: Tecnos; 2007.
68. Yu D, Shepard G. Is beauty in the eye of the beholder? Nature. 1998;396:321–2.
69. Carlson A. Environmental aesthetics, ethics, and ecoaesthetics. J Aesthet Art Critic. 2018;76:399–410. https://doi.org/10.1111/jaac.12586.
70. Carlson A. Appreciation and the natural environment. J Aesthet Art Critic. 1979;37:267–75. https://doi.org/10.2307/430781.
71. Ulrich R. Aesthetic and affective response to natural environment. In: Altman I, Wohlwill JF, editors. Behavior and the natural environment. Boston: Springer, US; 1983. p. 85–125. https://doi.org/10.1007/978-1-4613-3539-9_4.
72. Kaplan R, Herbert E. Cultural and sub-cultural comparisons in preferences for natural settings. Landsc Urban Plan. 1987;14:281–93. https://doi.org/10.1016/0169-2046(87)90040-5.
73. Kaplan R, Kaplan S. The experience of nature: a psychological perspective. New York: Cambridge University Press; 1989.
74. Ulrich R. Visual landscapes and psychological well-being. Landsc Res. 1979;4:17–23. https://doi.org/10.1080/01426397908705892.
75. Brady E. Aesthetics in practice: valuing the natural world. Environ Val. 2006;15:277–91. https://doi.org/10.3197/096327106778226202.
76. Brady E. Aesthetic value, nature, and environment. In: Gardiner SM, Thompson A, editors. The Oxford handbook of environmental ethics. New York: Oxford University Press; 2017. p. 186–96. https://doi.org/10.1093/oxfordhb/9780199941339.013.17.
77. Brady E, Prior J. Environmental aesthetics: a synthetic review. People Nat. 2020;2:254–66. https://doi.org/10.1002/pan3.10089.
78. Cooper N, Brady E, Steen H, Bryce R. Aesthetic and spiritual values of ecosystems: recognising the ontological and axiological plurality of cultural ecosystem 'services.' Ecosyst Serv. 2016;21:218–29. https://doi.org/10.1016/j.ecoser.2016.07.014.
79. MEA. Ecosystems and human well-being: synthesis. Washington: Island Press; 2005.
80. Barrasa S. Valoración de la calidad estética de los paisajes de La Habana (Cuba) con métodos de participación social. Estud Geogr. 2013;74:45–66. https://doi.org/10.3989/estgeogr.201302.
81. Barrasa S, López C, Rodríguez-Terrones S, Collantes-Chávez-Costa AL, Franch-Pardo I. Aportaciones metodológicas de González Bernáldez para los estudios del paisaje en México: el test de pares de fotos. Ecosistemas. 2023;32:2491. https://doi.org/10.7818/ECOS.2491.
82. Corraliza J, de Frutos B, Moll A. Naturaleza y belleza escénica: Estudio de los juicios de preferencia en paisajes naturales. Ecosistemas. 2023;32:1–9. https://doi.org/10.7818/ecos.2466.
83. Bacchetta V. La batalla de Punta Ballena. El poder de la sociedad civil organizada. Montevideo: El Zumbido Ediciones; 2025.
84. Brazeiro A, Panario D, Soutullo A, Gutiérrez O, Segura A, Mai P. Identificación y delimitación de eco-regiones de Uruguay. In: Brazeiro A, editor. Eco-Regiones de Uruguay: Biodiversidad, Presiones y Conservación. Aportes a la Estrategia Nacional de Biodiversidad, Montevideo: Facultad de Ciencias, CIEDUR, VS-Uruguay, SZU; 2015. pp. 46–59.
85. Apple Inc. Photos [software] 2023.
86. Adobe Inc. Adobe Photoshop [software]. 2023.
87. INE. Variables Estadísticas Relevantes Durante el Siglo XX - 1 Población. 2022.
88. IMM. Informe Censos 2011: Montevideo y Área Metropolitana. Montevideo: 2013.
89. de Díaz Rada V. Ventajas e inconvenientes de la encuesta por internet. Rev Sociol. 2012;97:193–223. https://doi.org/10.5565/rev/papers/v97n1.71.
90. de Díaz Rada V. Eficacia de las encuestas por Internet: un estudio preliminar. Rev Esp Psicol. 2010;13:49–79.
91. de Díaz Rada V. Problemas de representatividad en las encuestas con muestreos probabilísticos. Pap Rev Sociol. 2004;74:45. https://doi.org/10.5565/rev/papers/v74n0.1081.
92. Otzen T, Manterola C. Técnicas de Muestreo sobre una Población a Estudio. Int J Morphol. 2017;35:227–32. https://doi.org/10.4067/S0717-95022017000100037.
93. Leeuw E, Hox J. Internet surveys as part of a mixed-mode design. In: Das M, Ester P, Kaczmirek L, editors. Social and behavioral research and the internet: advances in applied methods and research strategies. New York: Routledge; 2018. p. 45–76. https://doi.org/10.4324/9780203844922.
94. Arroyo Menéndez M, Finkel L. Encuestas por Internet y nuevos procedimientos muestrales. Panorama Soc. 2019;30:41–53.
95. de Díaz Rada V. Influencia de los aspectos visuales en los cuestionarios autoadministrados. Pap Rev Sociol. 2015;100:75. https://doi.org/10.5565/rev/papers.607.
96. González Bernáldez F, Parra F. Dimensions of Landscape Preferences from Pairwise Comparisons. In: Proceedings of our national landscape: a conference on applied techniques for analysis and management of the visual resource, Nevada: USDA Proceedings of our national landscape: a conference on applied techniques for analysis and management of the visual resource; 1979. pp. 256–2.
97. Ruiz JP, Gonzalez-Bernaldez F. Landscape perception by its traditional users: the ideal landscape of Madrid livestock raisers. Landsc Plan. 1983;9:279–97. https://doi.org/10.1016/0304-3924(83)90008-4.
98. Galiano E, Abelló R-P. Una metodología para la valoración del paisaje en estudios de ordenación territorial. Su aplicación al Término municipal de la granja de San Ildefonso. Ciudad y Territorio 1984. pp. 53–8.
99. Cochran W. Sampling techniques. 3rd ed. Hoboken: John Wiley & Sons, Inc.; 1977.
100. Greenacre M. La práctica del análisis de correspondencias. Bilbao: Fundación BBVA; 2008.
101. Jamovi. JAMOVI (version 2.3) [Computer Software]. 2022.
102. MEDA. Multivariate exploratory data analysis [software]. 2023.
103. Basilio A, Horjales R, Mesa MN, Regueira V. La Udelar desde una perspectiva de género. 2017.
104. MEC. Panorama de la educación terciaria 2018. 2019.
105. Carlson A. Aesthetic appreciation and the natural environment. In: Nature and landscape: an introduction to environmental aesthetics. Columbia University Press, JSTOR; 2009. pp. 22–37. https://doi.org/10.7312/carl14040.7.

106. Mass M. Los sistemas socio-ecológicos desde el enfoque socioecosistémico (SES). In: Ávila Foucat VS, Perevochtchikova M, editors. Sistemas Socio-Ecológicos: Marcos Analíticos y Estudios de Caso En Oaxaca. 1st ed. México: Universidad Nacional Autónoma de México, Instituto de Investigaciones Económicas; 2019. p. 19–67. https://doi.org/10.22201/iiec.9786073013109e.2019.
107. Panario D, González A, Céspedes-Payret C, Caffera RM, Gutiérrez O. Hacia una evaluación de efectos ambientales de la forestación en Uruguay con especies introducidas. In: Pérez Arrarte C, editor. Desarrollo forestal y medio ambiente. Montevideo: CIEDUR/Hemisferio Sur; 1993. p. 157–206.
108. Gutiérrez O. Impactos ambientales. Impactos de la forestación en Uruguay, Montevideo: Item/Redes; 1995, pp. 29–34.
109. Panario D, Gutiérrez O. La política forestal industrial del Estado uruguayo. Política y Pasteras en el Río Uruguay: Medio Ambiente, Modelos Productivos y Movimiento Social. 2007.
110. Hepburn R. Landscape and the metaphysical imagination. Environ Val. 1996;5:191–204. https://doi.org/10.3197/096327196776679320.
111. Ostrom E, Chang C, Pennington M, Tarko V. Future of the commons : beyond market failure and government regulation. 2012.
112. Ostrom E. El gobierno de los bienes comunes. Una Evolución de las instituciones de acción colectiva. México DF: Universidad Autónoma de México. Centro Regional de Investigaciones Multidisciplinarias. Fondo de Cultura Económica; 2000.
113. Berkes F. Rethinking community-based conservation. Conserv Biol. 2004;18:621–30.
114. Gudynas E. Derechos de la naturaleza: Ética biocéntrica y políticas ambientales. Lima. 2014. https://doi.org/10.2307/j.ctv1rcf17d.7.
115. Folke C. Resilience (Republished). Ecol Soc. 2016. https://doi.org/10.5751/ES-09088-210444.