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Designing Protected Areas for Social–Ecological Sustainability: Effectiveness of Management Guidelines for Preserving Cultural Landscapes

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Abstract: Rural cultural landscapes are social–ecological systems that have been shaped by traditional human land uses in a co-evolution process between nature and culture. Protected areas should be an effective way to protect cultural landscapes and support the way of life and the economy of the local population. However, nature conservation policymaking processes and management guidelines frequently do not take culturalness into account. Through a new quantitative approach, this paper analyzes the regulatory framework of two protected areas under different management categories, located in an ancient cultural landscape of the Madrid Region (Central Spain), to identify the similarities in their conservation commitments and the effectiveness of their zoning schemes. The results show some arbitrariness in the design and management of these parks, highlighting the importance of prohibited measures in their zoning schemes that encourage uses and activities more related to naturalness than to culturalness. The recognition of protected areas as cultural landscapes and their management considering both naturalness and culturalness issues are important methods of better achieving sustainable management objectives from a social–ecological approach. This methodological approach has proven useful to unravel various legislative content, and its application on a larger scale could reveal important information for the sound management of protected areas (PAs) in cultural landscapes.

Keywords: biocultural heritage; comparative law; culturalness; naturalness; protected area regulations; regulation schemes; social–ecological systems; traditional ecological knowledge; zoning consistency; zoning coherence

1. Introduction

The accelerated environmental changes that have occurred in recent decades have triggered a worldwide, growing concern for the conservation of species and ecosystems. These circumstances influence the establishment of new protected areas (PAs) or the expansion of existing ones. Most conservation strategies have traditionally been based on conserving iconic landscapes characterized by their ‘naturalness’ and ‘wilderness’ [1,2], prioritizing pristine ecosystems. Thus, the so-called proactive conservation schemes focus conservation efforts on high-priority areas, defined as those that still encompass a valuable range of biodiversity [3]. Many of the PA categories share the objective of saving nature, wilderness, or wildlife in specific locations outside man-transformed landscapes [4], although very few places have escaped the influence of human civilizations [5]. In fact, conserving biodiversity means much more than protecting charismatic, emblematic, or threatened

species in natural reserves and national parks, as many biodiversity hotspots throughout the world are found in regions with a long history of human–nature integration [6].

Millenary rural activities have given rise to a wide variety of sustainable cultural landscapes, defined as land areas that have been shaped by traditional human land uses [7]. They are an interface between nature and culture, characterized by the conservation and protection of ecological processes, natural resources, landscapes, and cultural biodiversity [8–13]. The adaptation to the local environment and the social–ecological resilience of cultural landscapes have been based on the transmission over time of a deep and empirical knowledge of resource use practices, constituting so-called traditional ecological knowledge (TEK). The growing recognition of TEK is based on its contribution to the sustainable use of natural resources and, therefore, to the conservation of ecological processes and biodiversity [14–16]. In Europe, in recent decades, significant efforts have been made to preserve TEK and cultural landscapes [17–20]. Thus, biological conservation and cultural conservation must be considered together within the social–ecological framework of biocultural heritage, which requires adequate protection and management [21–23].

One way to preserve rural cultural landscapes is to establish different categories of PAs with effective management, which should serve as references and instruments for sustainable regional development [24–26]. The success of conservation strategies should be evaluated considering how much loss of substantial conservation values has been avoided with the establishment of PAs [27]. For this reason, it is important to determine to what extent the establishment of PAs contributes to maintaining cultural landscapes and supporting the way of life and economy of the local population, core components of ecosystems, and landscapes [28]. For more effective conservation of cultural landscapes, an alignment of traditional agricultural practices and nature conservation policies is necessary, highlighting the importance of the cultural attributes of PAs [29], because most of the protected areas of the world show some degree of human use or ‘culturalness’ [30]. Thus, PAs should be managed with an eye toward culturalness, because what is being protected is also the character and attributes of the cultural landscape [13]. Management strategies for cultural landscapes must be based on sustainable planning founded on social–ecological approaches by integrating the ecological, socioeconomic, historic, and cultural dimensions that influence conservation decisions [31–33], as well as local governance strategies and stewardships [34]. In some areas of the Mediterranean basin, it is noteworthy, however, that the ancient cultural landscapes have been largely misunderstood or poorly valued in PAs [35].

The effectiveness of cultural landscape conservation mostly depends upon environmental institutions, policies, and laws involved in landscape protection [36]. However, nature conservation policymaking processes and management guidelines are frequently not aligned with the basic concept of land protection considering culturalness [37,38]. Nowadays, we contemplate another relevant problem regarding land conservation—the large number of existing protection categories and the different hierarchical legislation that regulate activities in the same area, which is particularly remarkable in Europe. In practice, this frequently implies that spatial zoning overlaps between neighboring areas, creating uncertainties about the uses and activities restricted or promoted in those areas and management inconsistencies. Furthermore, many concepts and terms are used interchangeably to refer to different aspects related to conservation policy approaches [39]. These incongruities hinder the development of integrative conservation policies, management effectiveness, and society’s understanding of the role played by PAs and also represent lost opportunities for informing people about conservation policies and management [40]. Although comparative law techniques focus on the study of legal systems, including their constitutive elements and how they differ or combine into a system, there are scarce quantitative approaches focusing on PA legislation and the protection of cultural landscapes. In fact, we did not find any results in a recent search performed in the Web of Science looking for studies that combine ‘protected areas’ and ‘comparative law’.

In Spain, natural heritage and biodiversity and national park network laws establish different categories of land protection. The two categories of hierarchically superior rank are national parks (International Union for Conservation of Nature—IUCN—management category II [41]) and natural parks (or regional parks in some areas, IUCN management category V [42]). Nowadays, there are 1773 protected areas in Spain. These include 15 national parks and 151 natural parks [43]. In accordance with the abovementioned laws, Spanish parks are defined as “natural spaces little transformed by exploitation or human activity that, because of the beauty of their landscapes, the representativeness of their ecosystems or the singularity of their flora, fauna, geological diversity or geomorphological formations, have outstanding ecological, aesthetic, cultural, educational and scientific values, whose conservation deserves special attention”. In addition, the definition of national parks refers specifically to their high ecological and cultural value and to the general interest in their conservation for the country. Thus, the main criteria for the identification, selection, and establishment of PAs are based on their rareness, singularity, threat and fragility, maturity, representativeness, species richness and diversity, ecological and scientific importance, and interest to visitors, as well as their aesthetic qualities; recreational, educational, and social values; and historical and cultural significance [26]. The current Spanish legal framework requires that PAs include planning and management tools for natural resources that establish general schemes for the use and management of parks. The two most important planning tools are the regulatory plan of natural resources and the steering plan for use and management (PORN and PRUG, respectively, according to their Spanish acronyms). These documents include norms and guidelines for planning the design, delimitation, and zoning of areas with different uses and the identification of compatible and incompatible activities with the objectives of the parks, designating the specific activities that should be promoted or prohibited in each zone.

Using a novel quantitative approach, this paper systematically analyzes the regulatory framework of two Spanish PAs under different management categories (national park and regional park), located in an ancient cultural landscape of the Madrid Region. The aims of this study are focused on the guidelines for planning and management of both PAs in order to achieve the following: (i) to identify their conservation commitments and zoning schemes; (ii) to detect their main zoning indicators and recognize the possible convergence or disparity of their management objectives; and (iii) to check the valuation of the culturalness associated with protected landscapes in their specific goals and management guidance, that is, to determine whether or not the objectives of naturalness and wild nature conservation are prioritized over the cultural and social–ecological dimensions of the landscape.

2. Study Area

The PA network of the Madrid Region (Central Spain), covering different management categories, occupies almost 40% of its territory. In this work, we selected two neighboring PAs belonging to this network, which are representative of the main Spanish PA management categories and their regulatory schemes and are suitable to provide answers to the research questions posed. We considered the selected PAs of relevant interest in order to implement the proposed methodological approach for several reasons: (i) The two PAs are located in the same territory, and their limits are partially overlapped; (ii) both PAs, therefore, have great similarities in terms of the social–ecological conditions of the territory they occupy; (iii) they, nevertheless, have different management categories (national park and regional park) and, consequently, distinct conservation objectives and degrees of protection of nature and rurality; and (iv) they are the two most emblematic PAs of the Madrid region. The regional park is the oldest of the PA network, while the national park was established recently and is the only representative of this management category in the region (it is also the most recent of the 15 Spanish national parks).

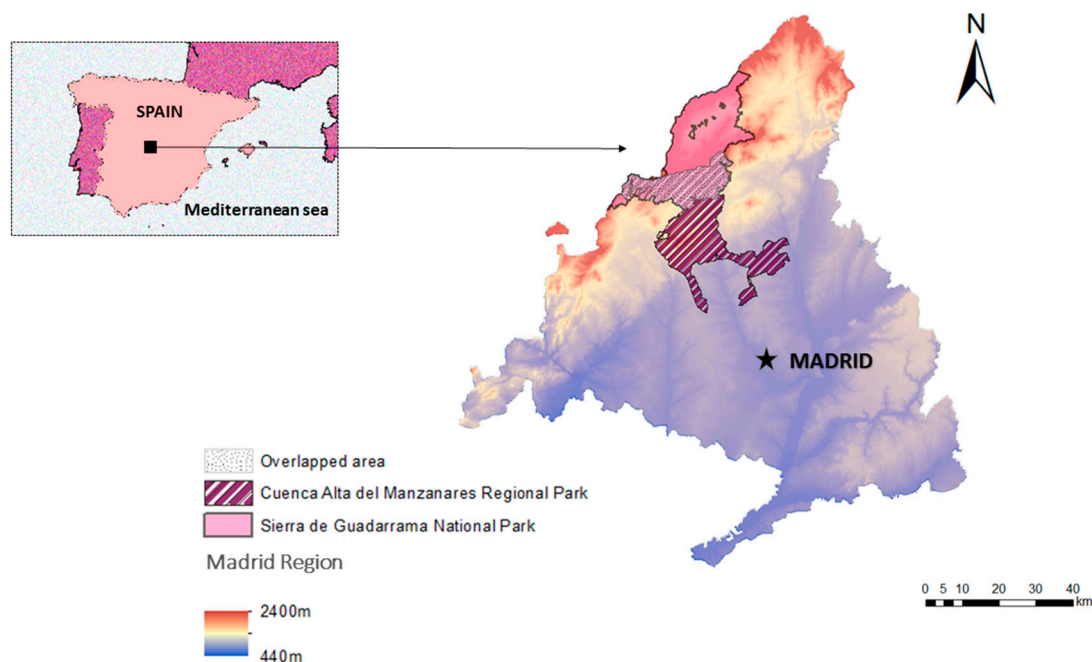


Figure 1. Study area located in the region of Madrid, encompassing the two protected areas studied—each one with a different management category (national park and regional park). Overlapping areas between both parks are shown.

The studied PAs are located under the influence of Guadarrama mountain range (Figure 1). The climate is Mediterranean-continental, and the substrate consists of granitoid rocks, a narrow strip of limestone, and lithic and dystic leptosols. The natural vegetation is a Mediterranean forest comprising different tree species (*Quercus ilex*, *Q. faginea*, and *Juniperus oxycedrus*; *Q. pyrenaica*; *Pinus sylvestris*) and scrubs (*Lavandula stoechas*, *Cistus ladanifer*, *C. laurifolius*, *Genista cinerea*, and *Cytisus scoparius*). The forest systems vary in altitudinal belts and the high mountain vegetation comprises Mediterranean shrubland of *Cytisus oromediterraneus*, *Juniperus communis nana*, and *Festuca ovina indigesta*, among others. Throughout the centuries, in the foothills of the mountain, the area has become a human-shaped landscape where original forests have been transformed into dehesas (open savannah-like woodlands used as pastures with *Quercus spp.* or *F. angustifolia* interconnected by hedgerow networks of woody vegetation that play a key role in the maintenance of biocultural diversity and associated ecosystem services [44]). This has resulted in a multifunctional silvopastoral system providing numerous provisioning and regulating ecosystem services, which has been the main traditional economic activity in this territory for centuries [25,45].

This social–ecological system, with high natural and cultural values, is under the direct influence of a major city—Madrid. This connection to the city is a major factor that has driven the transition from a silvopastoral system to another type of landscape providing cultural and accommodation services to tourists [45]. The need to protect these rural multifunctional landscapes from the high pressure of Madrid’s inhabitants, as well as the highly valued biodiversity they encompass and other ecosystem services they provide, has led to the designation of several PAs in the last 40 years. In 1985, part of this territory (52,800 ha) was designated as a regional park (‘Cuenca Alta del Manzanares Regional Park’ (RP); Figure 2a). The regional park category combines the protection and use of sustainable landscapes [46]. This category is considered to be an essential link in the dynamization process of a region, strengthening the relationship between the countryside and the city and involving public administrations and inhabitants of the area in the promotion of sustainable environmental development. The studied RP is zoned into seven sectors under different degrees of protection. The institution in charge of this PA is the government of Madrid. In 2013, the ‘Sierra de Guadarrama National Park’ (NP; Figure 2b) was designated and declared in Spain’s general interest [47]. In the Madrid Region, this PA covers nearly

22,000 ha zoned in nine areas with specific criteria of protection. National parks are under the control of the Spanish state.

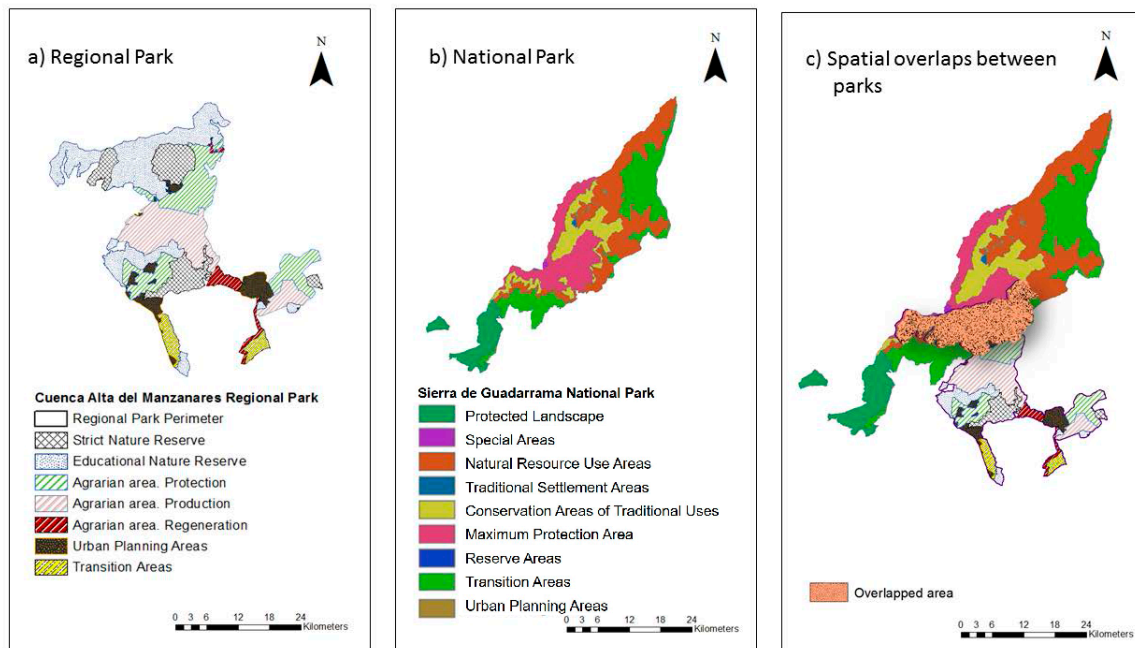


Figure 2. Zoning schemes of (a) Sierra de Guadarrama National Park and (b) Cuenca Alta del Manzanares Regional Park. (c) The overlapping area between the two parks.

Several thousands of hectares belonging to the NP overlap with the RP (Figure 2c). Thus, the overlapped area is regulated by both the management categories of national and regional parks, which differ in their protection status and the administration in charge, as well as in the elapsed time since their declaration and establishment. The conservation objectives of both PAs intend to protect the biodiversity and ecological processes that are maintained by a highly threatened, traditional, silvicultural landscape, although, according to previous studies, these goals are not being fully achieved [44,45,48,49].

3. Methods

3.1. Exploring the Regulatory Framework of Protected Areas: Identification of Relevant Descriptors

In the studied PAs, zoning schemes are conditioned by the uses and activities regulated in the planning and management documents. The degree of compatibility of human uses and activities with nature conservation is related both to the characteristics of the uses and to the ecosystem functioning. A compatible use in a zone of a PA may be incompatible in another. The compatible uses do not seriously affect social–ecological processes, whereas incompatible uses can cause irreversible changes, compromising the integrity and resilience of traditional social–ecological systems [50]. To typify the uses and activities considered in the regulatory frameworks of both PAs (PORN and PRUG, respectively), firstly, we carried out an exhaustive descriptive analysis by deconstructing these documents and itemizing them into descriptors of compatible and incompatible uses and activities (hereafter promotions and prohibitions, respectively; Figure 3a; Appendix A). This procedure, which was performed for each of the areas delimited in the zoning processes, allowed us to extract explicit information from the current regulatory framework of the two PAs following an objective approach in which we did not give a priori any importance or weight to the zoning descriptors. Secondly, we designed a series of hierarchical matrices, which were successively simplified by compression of their submatrices.

Figure 3 is a schematic overview of the procedure followed to obtain qualitative information from the planning and management documents and their subsequent quantitative analyses.

The procedure is based on three data sets composed in each case by two submatrices considering promoted and prohibited activities, according to the objectives of the parks (Figure 3).

a) Matrix of normative descriptors (Figure 3a). Its qualitative elements (a_{ij}) represent the promotion–prohibition of relevant descriptors (qualitative variables, according to the regulatory documents of the PAs). The dimensions of the submatrices were, respectively, 16 observations (zoning units of the two PAs) \times 82 variables (uses and activities promoted) and 16 observations (zoning units of the two PAs) \times 72 variables (uses and activities prohibited). Qualitative descriptors were ranked from 0 to 1, considering their absence or presence in the different zoning units.

b) Quantitative uses and activities. We synthesised the initial set of categorical variables into a more representative and easier to interpret set of quantitative descriptors, according to their management targets. Thus, as shown in Figure 3b, we reduced the information gathered from a large number of qualitative variables into a few types of synthetic descriptors of uses and activities, in order to perform better characterization analyses of the relationships among all variables. The types of synthetic descriptors were as follows (Appendix A): *(i)* fire management (related to its prevention and protection); *(ii)* research and training (associated with scientific or educational activities); *(iii)* fauna and flora protection (related to biodiversity conservation); *(iv)* environmental management (aimed at the conservation of soil, water, and air processes, among others); *(v)* land planning and management (in relation to land delimitation, construction, or landscape alteration within the PA); *(vi)* traditional uses (rural activities such as livestock, agriculture, and forestry); and *(vii)* public use and local development (related to tourism and sustainability of local population development). The dimensions of the two submatrices were 16 observations (zoning units of the two PAs) \times 7 variables (uses and activities promoted and prohibited, respectively). Their elements, b_{ij} , quantify the absolute frequency of each type of use and activity, previously reclassified.

c) Summary matrix. It is based on the classification matrix of synthetic descriptors (Figure 3b) but nullifies the specific details of the internal zoning processes (Figure 3c). Thus, the dimension of these submatrices was 2 observations (national park and regional park) \times 7 variables (uses and activities promoted and prohibited, respectively). The elements of this summary matrix (c_{ij}) quantify the relative frequency of the types of regulated uses and activities in each PA (see Section 3.3 for the calculation procedure). This comparative simplification allowed us to highlight overall management criteria contained in the regulatory systems of the two PAs.

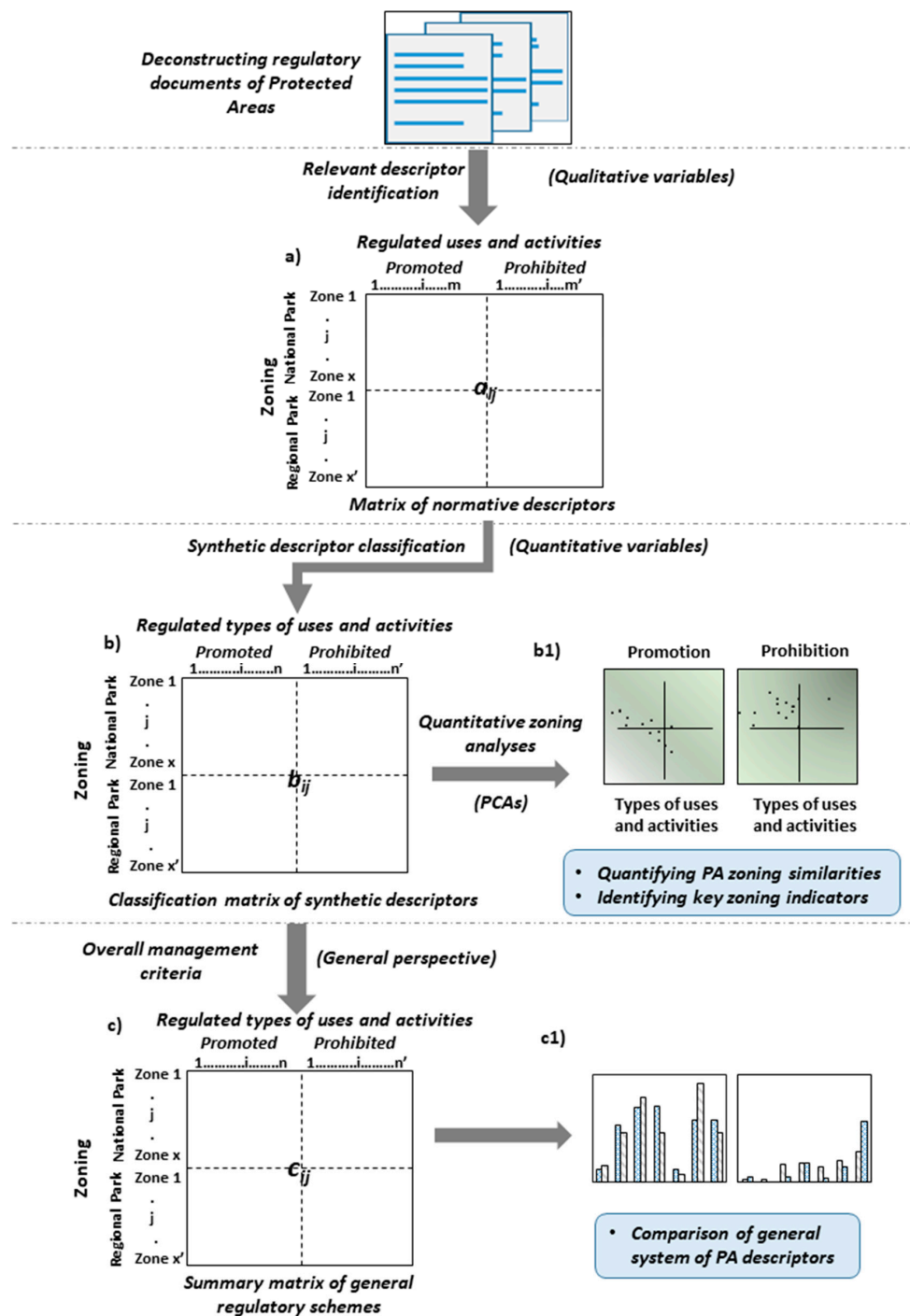


Figure 3. Schematic overview of the different methodological steps followed. Initially, we deconstructed the regulatory documents of planning and management of the protected areas (PAs) studied, which allowed us to itemize them into descriptors of uses and activities promoted and prohibited. In a second step, we designed a series of hierarchical matrices that were successively simplified by compression of their submatrices, each one composed, respectively, by the following: (a) elements a_{ij} representing qualitative information of relevant promoted and prohibited descriptors; (b) elements b_{ij} quantifying the absolute frequency of synthetic descriptors (uses and activities classified into seven types); (b1) multivariate ordination analyses of synthetic descriptor submatrices; (c) elements c_{ij} quantifying the relative frequency of synthetic descriptors; (c1). Bar diagrams of the general system of PA descriptors.

3.2. Identification and Quantification of Similarities and Disparities of Protected Area Zoning Regulations

In order to detect and quantify affinities and dissimilarities across the regulatory schemes of the PAs, each of the two quantitative submatrices, composed of b_{ij} elements and derived from the classification matrix of synthetic descriptors (Figure 3b), was analyzed by means of principal component analyses (PCA; Figure 3(b1)). PCA allows the projection of observations from a p-dimensional space, with p variables, to a k-dimensional space, with k variables (where $k < p$), conserving the maximum amount of information, measured by means of the total data variance of the initial matrix analyzed [51]. This multivariate ordination analysis enabled us to detect quantitative indicators from the initial set of descriptors of the internal zoning of both PAs through their factor loadings in the main PCA axes.

3.3. Characterizing Overall Management Criteria of Protected Areas

To accomplish a general comparison of the overall management criteria of the studied PAs, we calculated the relative frequency (F_r) of the types of synthetic descriptors of regulated uses and activities in each PA (c_{ij} elements of the summary matrix; Figure 3c).

F_r was calculated according to the following:

$$F_r = \frac{\sum f_i}{\sum f_t} \times 100 \quad (1)$$

where f_i is the frequency of the descriptors corresponding to each type of uses and activities (i) and f_t is the total frequency of all the types of descriptors (t) considered in both PA regulatory documents (PORN and PRUG, respectively).

4. Results

4.1. Quantifying Protected Area Zoning Similarities: Identification of Zoning Indicators

We performed two PCAs on the classification matrix of synthetic descriptors (Figure 3(b,b1)), which allowed us to project the PA zoning units onto two ordination planes (Figure 4). The dimensions of each plane represent the main tendencies of variation of the types of descriptors promoted and prohibited (Figures 4a and 4b, respectively) and facilitate the identification of the key types of zoning indicators, in accordance with the loadings of the synthetic descriptors.

The analysis based on the types of promoted uses and activities shows a clear segregation of the NP and RP on the PCA plane (Figure 4a; explained variance axis 1 = 88.62%, axis 2 = 9.43%). While in the RP, the zoning units established by the regulations do not differ from each other, in the NP, three zones are differentiated: a group of 'strict nature reserve and maximum protected area', a group of 'traditional use conservation areas' and 'natural resource areas', and a group that brings together the rest of the zones, thus identifying a total similarity between them (those delimited and named in the PA documentation as 'traditional settlement areas', 'urban planning areas', 'protected landscape', 'special areas', and 'transition areas'). Promotion of 'traditional uses' (factor loading axis 1 = -0.98) is the only indicator characterizing the RP. In the case of the NP, the promotion indicators are 'environmental management', 'research and training', 'fauna and flora protection', 'public use and local development', and 'land planning and management', with very similar factor loadings in PCA axis 1 (Table 1a).

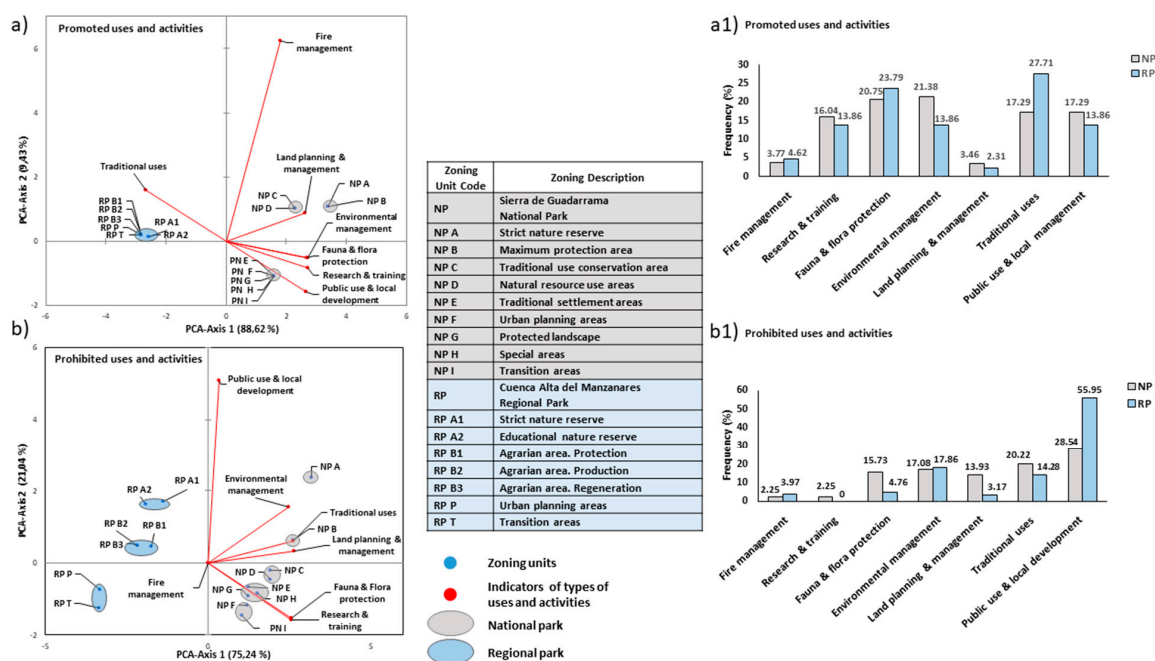


Figure 4. Zoning analyses of Sierra de Guadarrama National Park (NP) and Cuenca Alta del Manzanares Regional Park (RP) based on the quantitative synthetic descriptors classified from the identification matrix of normative descriptors (see Figure 3). Projection on principal component analyses (PCA) planes of zoning units and descriptors of types of (a) promoted and (b) prohibited uses and activities. Bar charts indicate the relative frequency of the types of promoted and prohibited regulated uses and activities (a1) and (b1), respectively) in each PA (e_{ij} elements of the summary matrix; Figure 3c).

The projection of the zoning units on the PCA plane based on types of prohibited uses and activities highlights that the zoning designations of the PAs respond to a scheme of intensity of the prohibitions (Figure 4b). This plane indicates that, in the RP, three groupings of zoning units can be distinguished according to the similarity between them: (i) the ‘strict nature reserve with educational reserve’, (ii) the three ‘agrarian areas’ (protection, production, and regeneration), and (iii) ‘urban planning’ together with ‘transition areas’. The zoning analysis of the NP based on restrictions differentiates five management areas: strict nature reserve; maximum protection area; the group formed by the areas of traditional use conservation and natural resource use; the group formed by traditional settlement areas, protected landscape, and special areas; and finally, urban planning areas together with transition areas. In this PCA plane, prohibition indicators refer only to the NP, highlighting those related to land planning and management and traditional uses (Table 1b).

Table 1. PCA results. Loadings on the ordination plane of the synthetic descriptors of uses and activities promoted (a) and prohibited (b). The variance absorption of the two first axes of the PCA is shown in brackets. Descriptors are ordered in relation to their factor loadings on axis 1. The descriptors with the highest projections (square cosine) along the first two axes are highlighted in bold. The greater the square cosine of a descriptor, the greater its link to the corresponding axis.

(a) Promoted Uses and Activities				
Synthetic Descriptors	Axis 1 (88.62%)		Axis 2 (9.43%)	
	Factor Loadings	Square Cosines	Factor Loadings	Square Cosines
Traditional uses	−0.975	0.951	0.191	0.036
Fire management	0.658	0.433	0.747	0.559
Land planning and management	0.959	0.921	0.106	0.011

Table 1. Cont.

(a) Promoted Uses and Activities				
Synthetic Descriptors	Axis 1 (88.62%)		Axis 2 (9.43%)	
	Factor Loadings	Square Cosines	Factor Loadings	Square Cosines
Public use and local development	0.975	0.951	−0.191	0.036
Fauna and flora protection	0.983	0.966	−0.063	0.004
Research and training	0.994	0.989	−0.100	0.010
Environmental management	0.996	0.992	−0.061	0.004
(b) Prohibited Uses and Activities				
Synthetic descriptors	Axis 1 (75.24%)		Axis 2 (21.04%)	
	Factor Loadings	Square Cosines	Factor Loadings	Square Cosines
Fire management	0.000	0.000	0.191	0.000
Public use and local development	0.127	0.016	0.747	0.971
Environmental management	0.911	0.829	0.106	0.089
Fauna and flora protection	0.943	0.890	−0.191	0.088
Research and training	0.946	0.894	−0.063	0.095
Traditional uses	0.965	0.931	−0.100	0.014
Environmental management	0.977	0.829	−0.061	0.089

4.2. General Management Criteria for Conservation: Comparison between Protected Area Categories

The comparison, by means of bar charts, of the Fr , obtained from the c_{ij} elements of the summary matrix (Figure 3c), offers synthetic descriptors promoted and prohibited in each PA, as displayed in Figure 4(a1,b1). Bar diagrams (Figure 3(c1)) illustrate the general system of PA descriptors and the convergence or disparity of the conservation management objectives they represent.

In terms of promotions (Figure 4(a1)), conservation efforts (descriptor frequencies higher than 20%) are in the RP, mainly addressed to traditional uses (27.71%) and fauna and flora protection (23.79%). The NP's legislation devotes more attention to environmental management (21.38%) and fauna and flora protection (20.75%). The rest of the descriptor types do not reach frequency values $\geq 18\%$ in both PAs. Descriptors receiving meaningfully less attention in the PA regulation are fire management (4.62% in the RP and 3.77% in the NP) and land planning and management (2.31% and 3.46% in the RP and the NP, respectively).

Regarding the activities and uses considered prohibited in the PA regulation documents (Figure 4(b1)), public use and local development is the most restrictive in the RP, with a relative frequency (55.95%) that is much higher than those of the rest of the descriptors, which do not reach values $\geq 20\%$ in any case. In the NP, similarly, both public use and local development and traditional uses are the two main prohibited descriptors collected from the legal documents (frequencies of 28.54% and 20.22%, respectively). Descriptors with considerably lower frequencies in the NP are fire management and research and training, both with 2.25%.

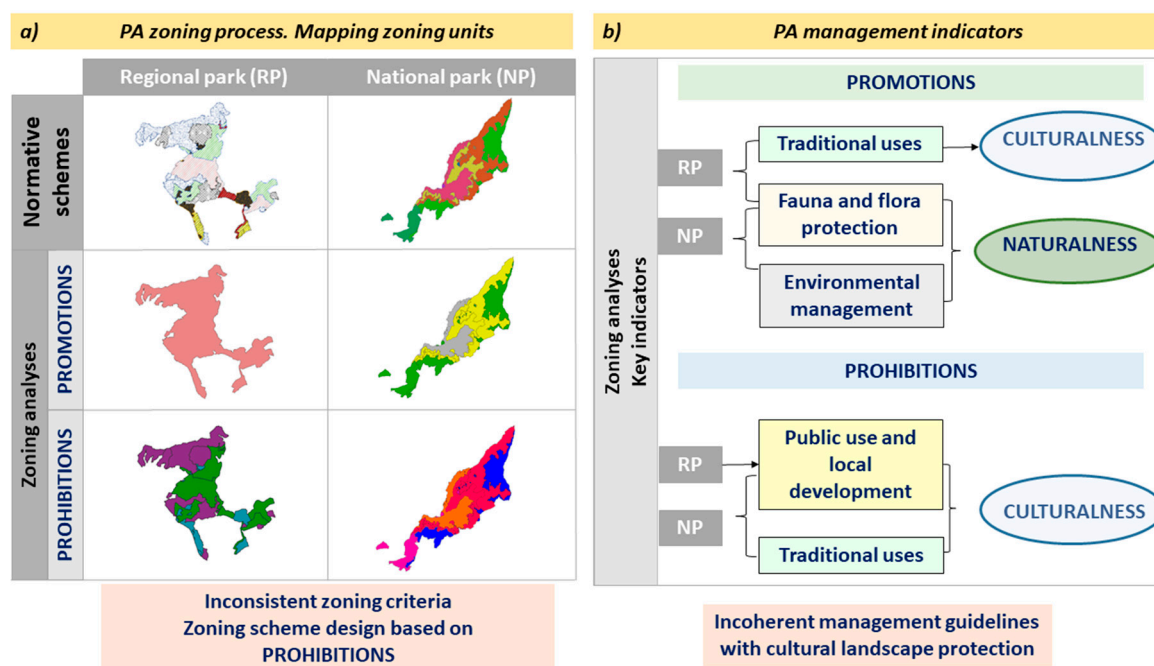


Figure 5. General outline highlighting the main results obtained from the deconstruction process of the regulatory documents that establish the guidelines for the planning and management of PAs and the subsequent hierarchical process of quantitative analyses.

5. Discussion

Successful conservation strategies depend largely on the effective management of PAs [52]. Usually, effectiveness assessments refer to aspects related to the design and management of a PA, but the effectiveness of the zoning process has been poorly addressed [53–55]. In this sense, we conducted a systematic analysis that allowed us to quantify the similarities and differences in the conservation strategies and zoning schemes of two PAs with different legal statuses, established in neighboring territories with similar social–ecological characteristics. Figure 5 summarizes the main results obtained from the deconstruction of the regulatory documents that establish the guidelines for planning and management of PAs and the subsequent hierarchical process of quantitative analyses.

The analyses performed highlight the inconsistencies in the zoning design of the two categories of parks, which show clear differences in their management criteria despite the important spatial overlap between several zones of the two PAs, as can be seen in Figure 2c. Thus, some zoning units of the RP under different management guidelines specified in the PRUG document, such as educational nature reserve (mainly designed for the development of educational and cultural activities), strict nature reserve (with scientific research as the dominant use), and area of agrarian protection (addressed to the active conservation of transformed landscapes), are zoned in the NP as parts of areas regulated by means of the PORN document with other protection regimes, such as area of maximum protection (designed for the integral conservation of its resources and the maintenance of traditional activities), areas of traditional use conservation (reconciles maintaining current agricultural uses and traditional uses), and areas of use of natural resources (with a specific protection regime, adapted to their peculiarities and compatible with agricultural practices and traditional uses). The results obtained show a clear disparity between the zoning units that belong to overlapping areas between parks (Figure 4). This reveals the application of contradictory management guidelines to the same land area, depending on the regulatory document that is considered (corresponding to the RP or NP). The dissimilar results that emerge from different nature conservation prioritization schemes can be interpreted as the consequence of inadequately defined conservation objectives [56], especially in territories with very similar or identical natural and cultural values, as occurs in the case studied here.

Similarly, the procedure followed allowed us to detect in both PAs a smaller number of zoning units than those specified in the regulatory documents, from points of view of both the promoted activities and the prohibited activities (Figure 4). Therefore, we can understand that the zoning processes developed in the normative documents provided for each of the PAs a series of very similar zones that do not justify their different degrees of protection and management. Similarly, the descriptors analyzed reveal that management guidelines attach great importance to the restrictive and prohibited measures in their zoning schemes, which encourage uses and activities that are more related to naturalness than to culturalness (Figure 4(a1,b1)). Setting priorities for nature conservation is a key issue both in conservation science and applied aspects [57]. In the RP, the main conservation efforts are focused on the promotion of traditional uses (Figure 4(a,a1); Table 1a), which seems to be consistent with the main objectives of this type of park, as they involve the recovery and implementation of traditional activities as a means of protection and conservation of rural systems [25,44,58]. However, the most prominent synthetic descriptor in the RP refers to the prohibition of uses and activities linked to public use and local development (relative frequency: 55.95%; Figure 4(b1)). This result reveals a remarkable lack of coherence in the design of the management guidelines that, on the one hand, promote traditional uses, whose maintenance depends on the support of local populations and their TEK, while on the other hand, significantly prohibiting and restricting the uses and activities related to local development. A similar situation occurs in the NP, which regulates public use and local development and traditional uses and activities with high promotion values (both with a relative frequency of 17.29%, only just below that of environmental management and fauna and flora protection), while emphasizing their prohibition or limitation with the highest values (relative frequencies of 28.54% and 20.22% for public use and local development and traditional uses, respectively; Figure 4(b1)).

Both PA categories prioritize the promotion of aspects related to the protection of flora and fauna, as can be deduced both from the zoning indicators (factor loadings; Table 1) and from the general descriptors of the PAs (Figure 4(a1,b1)). In Spain, the requirements to assign the status of national park seem stricter than in other countries and are mainly aimed at preserving the natural values, paying special attention to the uniqueness of flora and fauna [59]. This aligns with the concern for naturalness, based on the interpretation of national parks as wild and pristine areas, which has provided the basis for conservation measures worldwide [60]. All this is true, despite the fact that the Spanish law on national parks mentions among its objectives promoting public use, improving the knowledge of cultural values, and encouraging sustainable development, in addition to the primary goal of nature conservation [61]. Conservation strategies are, nevertheless, currently evolving from the protection of wild areas to the maintenance of landscapes influenced by human management [25], particularly in Europe. Nowadays, locations designated as PAs receive protection due not only to their natural or ecological values, but also to their recognized cultural values [41]. However, until recently, cultural landscapes have been forgotten or misinterpreted in PAs [13,35] and in practice, the management of some PAs related to cultural landscapes does not seem to be effective with respect to this conservation objective [62]. This study reveals inconsistencies in the regulations that hinder the achievement of conservation objectives linked to the protection of cultural landscapes [25,48,63]. Several studies in the Mediterranean region highlight that PAs' policies restrict rural activities, such as traditional grazing, resulting in the decrease and loss of natural and biocultural diversity [64,65] and the promotion of rural abandonment [44]. This restrictive approach focuses on problems and regulates the users' demand inside the park, generating the development of opportunities outside its limits, in a typical 'inside-out' park planning process [66]. However, it has been found that conservation based on the declaration of isolated spaces is insufficient. Currently, conservation requires not only the establishment of protected areas specifically dedicated to the conservation of biodiversity, but also the integration of those spaces into land planning and policies for the management of land uses and natural resources, as well as establishing ecological networks that connect them functionally, ensuring the conservation of natural resources and social–ecological systems inside and outside the limits of PAs [67].

Restrictions imposed by PAs on the use of natural resources and land use options affect local incomes [68]. These conservation measures further exacerbate the process of rural abandonment, forgetting the important contribution of the local population to the maintenance of cultural landscapes [44]. Currently, there are many initiatives to link protected areas with local socio-economic development. The integration of nature conservation and rural development aims at reconciling PAs' management with the social and economic needs of the local people, sustaining local livelihoods [69–72]. Thus, PAs can generate new incomes for local communities by attracting tourism, enhancing local food production with added value, supporting sustainable agriculture, inducing the investment and development of infrastructures, or increasing the flows of environmental services of economic importance. This socio-ecological framework that integrates nature and culture as interdependent systems is an adequate way to face sustainable development [12,73]. Successful planning needs to incorporate public participation as a fundamental and on-going component. However, the revision of the prohibitions shows that the variables related to public use and local development constitute the highest relative frequency in both parks, being in the case of the RP more than 50%. Thus, in the case study, the establishment of PAs does not sufficiently support either the way of life or the economy of the local population. On the contrary, our research shows that the regulation schemes of the analyzed PAs devote more attention to the restriction of rural development rather than its promotion (Figure 5a). It would be advisable for all stakeholders, not only the institutions, but also the local population and other social actors, to take part in the decision-making and the setting up of conservation measures so that PAs could better achieve their objectives. In relation to this, several studies in the last decades underlined the idea of governance as a key factor in the effectiveness of the management of PAs [74]. This study refers to a territory with very ancient cultural landscapes, as occurs, among other places, in the Mediterranean basin. In many other regions of the world, the 'culturalness–naturalness' relationship may be less obvious or relevant and nature conservation strategies may be applied with a social–ecological perspective adapted to the characteristics of each territory.

The results obtained seem to indicate some arbitrariness and imprecision in the design and management of these PAs (Figure 5). The same problem with respect to the arbitrariness and inconsistency in the objectives and criteria of conservation, as well as in the design of the jurisdictional limits of PAs, has been highlighted by other authors in different PAs [41,59,75–77]. Conservation and management of PAs are complex tasks that require knowledge about the ecological and socio-economic factors involved and the use of tools that facilitate scientific support for management decision-makers [78]. Therefore, management decisions taken by policymakers and conservation practitioners should be founded on evidence-based conservation, reinforced by the use of the best possible knowledge about the resources that are being administered [79,80]. The recognition of PAs as valuable cultural landscapes and their management taking culturalness into consideration in order to maintain the landscape character [13] are important methods of promoting a social–ecological approach to conservation planning and to achieving more sustainable management objectives.

6. Conclusions

This paper uses the conceptual framework of social–ecological systems, based on the interaction between natural and cultural processes and the management effectiveness of PAs. The coherence of PA regulation schemes is justifiably being questioned owing to longstanding research that has highlighted the inadequacy of the norms and guidelines used for planning the design of PAs to protect cultural landscapes. It is remarkable that despite the severity of the problem, a detailed analysis of these types of regulation had never been done before. Therefore, an in-depth study of PAs' legislation, focused on the evaluation of the guidelines for planning and management from a scientific perspective, was imperative. This was achieved through the deconstruction of normative documents into quantitative descriptors and their subsequent analysis. To our knowledge, this is the first quantitative approach focused on exploring in a systematic and objective way the normative documents that establish the planning tools of PAs.

According to the research questions proposed, the analysis performed has allowed us to identify the conservation priorities and zoning schemes of the PAs studied, as well as the similarities and differences in their management objectives. The results obtained reveal some weaknesses and inconsistencies in the zoning design of these parks that show clear differences in their management criteria. Additionally, the importance of the measures prohibited in their zoning schemes is noteworthy; such prohibited measures encourage uses and activities more related to naturalness than to culture, causing negative consequences to the cultural landscape that, contradictorily, these legal instruments claim to protect.

The methodological approach used has proven to be a useful tool to analyze normative documents and unravel multiple legislative contents, allowing us to detect coherence problems in PA zoning schemes, at regional, national, and international levels. This procedure can be applied to different regions and countries with various environmental and socioeconomic conditions, rural landscape typologies, and PA categories. In addition, it can also be useful in contexts where different administrations legislate on the same area (e.g., protected areas in Europe reveal, in many cases, considerable geographical overlap between different land protection types at several administrative levels). Its application could reveal important information for the effective and sustainable management of protected cultural landscapes.

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Appendix A

Table A1. List of the promotion descriptors identified from the normative documents of protected areas and their classification into synthetic descriptor categories.

Qualitative Descriptors of Promoted Uses and Activities	Synthetic Descriptors
Controlled burning Rural fires prevention Forest fires prevention	Fire management
Natural resource databases Scientific research Hunting species inventory Fish species inventory Dissemination of informative publications Points of geological interest inventory Assessment of the conservation status of species and habitats Technical and scientific training Scientific collection of specimens Inventory and protection of cultural heritage and historical memory Inventory and conservation of valuable landscapes Publications on preservation and interpretation of landscapes Cultural initiatives for preserving natural, cultural, and tourist resources	Research and training

Table A1. Cont.

Qualitative Descriptors of Promoted Uses and Activities	Synthetic Descriptors
<p>Reintroduction of extinct species Prevention of the extinction of native species Genetic rescue programs Control of out-of-balance species Birds of prey protection Eradication of non-native animal species Additional protection of high-risk species Maintenance of the health state of the fauna Conservation of the habitat of wild birds of special protection Definition of the protection perimeter during the reproduction of risk species Prevention and correction of dangerous infrastructures for fauna Revegetation programs for recovering potential vegetation Elimination of non-native forest species Forestry and phytosanitary treatments of protected species Monitoring of native, singular, or endangered plant taxa Preservation and natural regeneration of protected tree species</p>	Fauna and flora protection
<p>Erosion control Interventions against disturbances Restoration of areas affected by abandoned extractive activities Environmental monitoring Restoration of damages by human activities Ecological and cultural regeneration Geological preservation Limiting access to special conservation areas Pollution assessment and reduction Soil quality and singularity preservation Provision of safe drinking water and basic sanitation Water resources restoring Maintaining aquatic ecosystems Waste management Favoring ecological succession of the most slightly altered systems Landscape preservation management Efficient use of renewable energy</p>	Environmental management
<p>Demarcation and delimitation of woodlands of public utility Public land increase Support of land planning, improvement, and restoration of private forest properties Conservative traditional uses and their infrastructures Adjusting the actual livestock loading to the potential one Encouraging native livestock breeds Harnessing unexploited resources using goats and horses Promoting apiculture Recovery and preservation of cattle routes Young farmer support Cork oak development Grasslands, pastures, and scrublands improvement Health management plans and improvement of agriculture and livestock productivity Training activities for improving farm efficiency Maintenance of hedgerows, troughs, and other traditional elements Shepherding limitations Promotion of grazing in abandoned areas Promotion of ecological agriculture Demonstrative experiences of sustainable management systems Population control of certain species through selective hunting Limitation or prohibition of hunting and fishing for wildlife resources protection</p>	<p>Land planning and management</p> <p>Traditional uses</p>
<p>Ecolabeling Visitor census Recreational potentiality and carrying capacity assessment Support for environmental education in schools Information activities for local population Information for visitors Research lefts, visitor lefts, and information systems for users Sustainable local development measures Attraction of private investment Investment in infrastructures and basic equipment Rural tourism encouragement Activities to promote volunteerism</p>	Public use and local development

Table A2. List of the prohibition descriptors identified from the normative documents of protected areas and their classification into categories of synthetic descriptors.

Qualitative Descriptors of Promoted Uses and Activities	Synthetic Descriptors
Stubble burning Making or causing fire outdoors	Fire management
Unauthorized archaeological and paleontological works	Research and training
Alteration of habitats and protected species Afforestation by terracing Afforestation with non-native species Extracting, collecting, cutting, or pruning protected plant species Clear cutting of forest mass Introduction of non-native animal species Enclosures in non-urban or underdeveloped lands that can limit or block the passage of fauna or that can cause their electrification	Fauna and flora protection
Activities affecting aquatic systems Production of noises, lights, or flashes of non-agrarian origin Unauthorized capture, damage, or collection of biological or geological material Modification of water courses and water composition Creation of dumping sites or littering Making inscriptions, marks, signs, or drawings on any natural or cultural element Stuffing or draining any pond or natural wetland Aggregate extraction Installation of unauthorized overhead power lines	Environmental management
Construction of temporary and permanent buildings Construction of permanent buildings Construction of wind farms or any other power generation left, except solar power plants Construction of industrial plants Restorations or unauthorized alterations of any site of cultural value Construction of new urban areas, towns, or isolated residential areas Construction of buildings or infrastructures that significantly alter the traditional landscape Construction or expansion of ski resorts Total or partial substitution of traditional hedgerows	Land planning and management
Free mushroom collecting Mushrooms commercialization and collection of protected mushrooms Unauthorized hunting using ferrets or falconry birds Hunting with traps, snares, limes, or poisons Hunting except for population control Hunting of special conservation species Unauthorized hunting and fishing Non-traditional fishing Fishing except for scientific purposes or for population control Timber harvesting Pastoral use New intensive farming exploitations or those that badly damage vegetation or soil Forage crops Artificial pasture lands Extractive activities and mining, sandboxes, gravel, and similar activities Transformation of forestry land into farms	Traditional uses
Unauthorized swimming Unauthorized commercial filmmaking Overflying in the area at a height of less than 3000 m Overflying in the area at a height of less than 2000 m Overflying in the area at a height of less than 500 m Use of megaphones or high-volume instruments Sports activities with motorized means Drilling and placing expansion nails to open new climbing routes Use of magnesium or corrosive materials on rocks in the practice of climbing Unauthorized practice of sports with infrastructure or equipment The practice of paragliding, hang gliding, and parachuting Leisure activities and equestrian tours The circulation of mountain bikes and velocipedes Snowboarding, sledding, and sledding with dogs Mountain skiing or cross-country skiing Track or alpine skiing The practice of hiking The practice of mountaineering The transit and parking of unauthorized motor vehicles outside the authorized routes The circulation and parking of non-agricultural vehicles outside the appropriate vials	Public use and local development

Table A2. Cont.

Qualitative Descriptors of Promoted Uses and Activities	Synthetic Descriptors
Outdoor advertising, except for public use Unauthorized travel outside the trails and itineraries established for public use The practice of Olympic shooting with bows and the use of shotguns and all kinds of weapons different from those used for hunting, when this is authorized, or those carried by the agents of the authority. The release of gas or fire balloons The use of kites The practice of aeromodeling Fireworks Staying overnight in a bivouac or outdoors Camping without permission	

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