Article

What Do the IUCN Categories Really Protect? A Case Study of the Alpine Regions in Spain

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Abstract: Protected area (PA) coverage is used as an indicator of biodiversity protection worldwide. The effectiveness of using PAs as indicators has been questioned due to the diversity of categories encompassed by such designations, especially in PAs established for purposes other than biodiversity protection. Although international standards have been developed by the International Union for Conservation of Nature (IUCN), the policies on the ground have been developed independently of the IUCN categories, thus making the IUCN categories dubious measures of biodiversity conservation. Management plans are crucial for the effective management of parks and for guidance on how biodiversity maintenance should be prioritized relative to other goals. We therefore analyzed the aims and regulations of the management plans of alpine PAs in Spain as a first step in evaluating conservation performance. We used content analysis and correspondence analysis of instrumental variables (CAiv) to assess how aims and regulations vary in relation to three explanatory factors: IUCN categories, vegetation zones and autonomous communities. We found that the aims of many parks were vague, without clear indications of how to prioritize biodiversity goals. Furthermore, only 50% of the parks studied had any management plan, which strengthens our argument concerning the lack of clear guidance in PA management. Although certain aims were correlated with the IUCN categories, the regulations showed no clear relationship to international policies, which indicates that these aims do not necessarily influence management practices. Devolution to autonomous communities could be one explanation for the large variation in management practices among parks. Further studies are needed to evaluate the impact of such management policies on biodiversity.

1. Introduction

Protected areas (PAs) have been widely used as a tool to address biodiversity loss. A well-designed network of PAs is usually intended to preserve species richness, habitats and ecosystem processes, thus reducing the rate of species loss. However, many PAs were established for purposes other than biodiversity protection, with emphases on recreation or unique cultural values on the national level [1,2]. Together with wide variations in management practices, the aims and regulatory systems of PAs tend to vary extensively. To understand how PAs could better conserve biodiversity, the differences among PAs must be investigated, including the history and context in which the PAs and their policies have evolved.

Since the first national park was established in Yellowstone in 1872, many different PA categories have been developed, representing a diversity of interests and purposes. The greatest increase in the establishment of PAs (and also in the creation of new categories) has occurred since the 1980s, with international conventions such as the World Parks Congress in Bali in 1982 and the Convention on Biological Diversity (CBD) in 1992 promoting the expansion of PAs [3,4]. The conference of parties defined PA coverage as one of the key measures of the effectiveness of biodiversity conservation [5], and targets of 17% of terrestrial land and inland water areas, and 10% of coastal and marine areas were set as minimum areas to be effectively protected by the year 2020 [6]. However, Butchart *et al.* [7] suggested that there is no evidence to indicate that biodiversity loss has slowed despite the increase in PA coverage. As a result, scholars have questioned the use of PA coverage as an indicator of compliance with the 2020 targets and have begun to focus instead on the management effectiveness and conservation performance of PAs [8,9].

Hockings [10] identified inappropriate policies as being among the factors threatening PAs. He argued that the analysis of policies and management plans (the planning stage of the management effectiveness guidelines proposed by the World Commission on Protected Areas (WPCA) [11]) is essential for the evaluation of management effectiveness. These documents define the conservation aims of the PA and provide specific regulations concerning human use. According to Stolton [12] and Hobbs *et al.* [13], the articulation of clear purposes and human activities that are acceptable for meeting conservation goals is imperative for effective management of PAs. In practice, however, these aims are often unclear and are highly influenced by social, economic and political goals other than biodiversity protection [8,14]. Aims and regulations vary among countries, and in some cases, they can also vary among regions within countries. Moreover, certain parks have only weak regulations and enforcement capacity; such parks are sometimes referred to as "paper parks" [15] because they are considered PAs only "on paper" and often fail to achieve conservation goals because they are not supported by legislation and/or funding [16]. According to Erwin [17], any type of protection should be welcomed due to the rapid and continuous degradation of the environment. Although paper parks

could protect biodiversity despite lacking management plans, increasing their funding to manage and regulate human activities will likely improve their effectiveness [18].

The historical diversification, the great variation in aims and management practices, and the increase in protected land surface area of PAs have heightened the necessity of international standards. The International Union for Conservation of Nature (IUCN), founded in 1948, defines a protected area as follows: "*A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values*" [4]. The IUCN has developed six PA categories for a globally standardized classification of parks. These categories define different levels of protection, depending on the aims and the degree of restrictiveness of the parks. This standardized categorization is a relatively new system that was used for the first time in 1978 and was further adapted in 1994 and 2008. The relatively recent development of the IUCN classification system poses a challenge to the categorization of PAs that were established before the introduction of this system [19]. The IUCN later developed several guidelines for the assignment of categories based on management aims and the level of human use. Joppa *et al.* [20] argued that parks in categories I–IV are managed for biodiversity protection, whereas those in categories V and VI are managed for the sustainable use of resources, with lesser contributions to biodiversity conservation. In recent years, the definition of the last two categories has allowed for the inclusion of PAs that integrate conservation with traditional sustainable uses and livelihood concerns [21]. Dillon [19] argues that it is important to analyze how the IUCN category system is implemented in terms of national laws and policies. While differences in management practices between countries have been well documented [11,18,22], there have been few studies comparatively evaluating the variation in policies within countries.

The purpose of our study was to analyze the alignment between the policies of PAs and the designation of IUCN categories in Spain. We identified differences and similarities in management aims and regulations of the parks, including their relationship to autonomous communities. To ensure the comparability of the PAs analyzed herein, we limited our analysis to alpine parks expected to have similar patterns of land use, namely, the Alpine south and the Mediterranean mountains, as defined by Mücher *et al.* [23].

Protection in Spain

Land and sea protection have varied over time depending on the political and economic conditions of different countries. Spain is a good example because of its history (*i.e.*, pronounced political and social changes over short time periods, such as during the Civil War (1936–1939), the Second World War (1939–1945) and Francisco Franco's dictatorship (1939–1975)). Before the Civil War, policies concerning PAs were considered progressive; Spain was among the first European countries to establish PAs (preceded only by Sweden, Switzerland and Germany) [24].

In 1916, the first law creating national parks in Spain was passed (Ley de 7 de diciembre de 1916, de Creación de Parques Nacionales). The law did not clearly define PAs, but it was the first step toward the official designation of parks. The first national park, the Parque Nacional de la Montaña de Covadonga, was established in 1918. Authorities soon realized that a high percentage of natural Spanish lands were privately owned, and to avoid conflicts between conservation goals and owners'

goals, the government chose to focus on public lands. The focus on public lands strongly influenced later PA policies.

In 1927, a new Royal Decree was passed to create "natural sites", a less restrictive and more flexible class than that of national parks. The revised decree also introduced a compulsory purchase clause. Consequently, the State could purchase private lands by paying the owner a certain amount of money in compensation. However, a lack of funding for the purchase of private lands limited the acquisition of new territories from private owners. During the following years, only a few new PAs were established, partly because of a lack of funding but also because of the political instability and conflict that resulted in the Civil War. The consequences of this war and the Second World War caused a decrease in the rate of environmental protection; however, 23 PAs had been established by 1970.

In 1971, the National Institute for Nature Conservation (ICONA) was created, and conservation strategies became more important in the subsequent decade. In 1975, a new law was passed (Ley de 2 de mayo de 1975, de Espacios Naturales Protegidos), defining four different classes for both new and previously established PAs. The establishment of this law was followed by the establishment of 24 new areas within three years. In 1978, the Spanish Constitution ceded PA authority to the governments of autonomous communities (with the exception of the national parks, although the authority over these parks was ceded in later years). Autonomous communities are territories with similar histories, cultures or economies that have their own governments and the right to declare and execute laws. This event resulted in the sudden declaration of many PAs (see Figure 1) but with notable differences in the extent of protection of PA lands in different parts of the country [25].

Figure 1. Cumulative curve of nationally designated protected areas in Spain. The bar below indicates the periods during which parks were regulated by different protection laws. Source: Redrawn from Troitiño [26], Mulero [27] and EUROPARC-España [28].
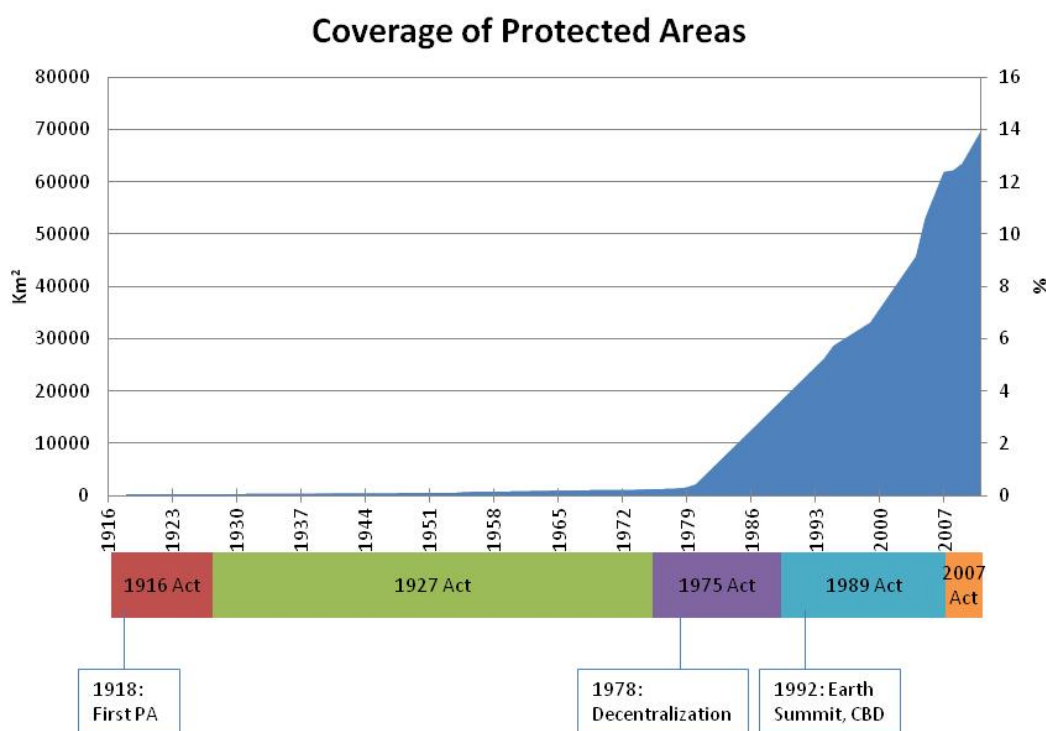
In 1989, a new law was passed (Ley 4/1989, de 27 de marzo, de Conservación de los Espacios Naturales y de la Flora y Fauna Silvestre) aiming to create protective networks for the most important and representative ecosystems, among other goals. Five PA classes were defined, but the law also provided the opportunity for autonomous communities to create new classes as necessary. The law introduced a requirement for a management plan for natural resources (PORN, Plan de Ordenación de los Recursos Naturales), and some PA classes also require a plan for use and management (PRUG, Plan Rector de Uso y Gestión) [29]. The PRUG regulates the intensity, type and zoning of traditional use and recreational activities [25] in PAs. In general, a PORN should be developed before the establishment of a PA to describe the overall condition of the site and provide guidelines for the restriction of activities.

The late establishment of this law caused problems that the PA system is still facing today. Some autonomous communities began to exercise their rights to manage natural areas prior to the passage of the 1989 Act, which resulted in a mismatch between the legislation of autonomous communities and national policy. In addition, the opportunity to create new PA classes others than the ones defined by the 1989 Act resulted in a large diversity of classes (47 in 2002). In addition, there was insufficient coordination and cooperation among autonomous communities and the central government [27]. The lack of communication and the opportunity to create new protection classes were the major reasons for the extreme diversification of PA classes.

In 2007, a new law was passed (Ley 42/2007, de 13 de diciembre, del Patrimonio Natural y la Biodiversidad). According to Mulero [30], this new law was important for PA management. The social aspect of conservation gained a considerable degree of importance, involving those affected by PAs in the decision-making process and emphasizing traditional knowledge. Economic development and the sustainable use of resources were also considered in the policy. The law also improved the definition and content of the management plans, with the intent of enhancing the management effectiveness of the parks. The classification system, which had been problematic in previous years, was greatly improved, and the relevant concepts were more clearly stated. At the same time, international agreements, such as the Natura 2000 network (established under the 1992 Habitats Directive), were included in the law to promote a broad approach to conservation. Natura 2000 is a network of European PAs established for the long-term preservation of the most valuable and threatened species and habitats [31]. This program includes the establishment of networks and ecological corridors for more effective preservation of resources and biodiversity.

The failure to develop national policies that would have coordinated the PA management of central and local governments since the declaration of the 1978 Act has most likely resulted in large variations in the aims and regulations of Spanish PAs. We analyzed how this variation affects the performance of PAs using the international category system established by the IUCN, which aims to standardize PA classes to enable comparisons within and between countries and to prioritize investments for countries with low coverage of certain IUCN categories [32].

2. Methods and Data Analysis

In this study, we analyzed whether PA management policies are adequate to meet international standards. We also used one variable to capture variation in local management or vegetation zones with respect to aims and regulations concerning human activities.

2.1. Study Site Selection

There were 1547 PAs in Spain in December 2010 [33]. We applied the following four criteria when selecting parks. First, we selected parks in alpine areas that were expected to have similar human use patterns but different management practices. Areas located above 1500 meters of elevation are highly protected (73% of this territory) in Spain, partly because of their vulnerability to soil erosion [28]. Only parks with 50% or more of their area covered by alpine vegetation were selected using maps from Alterra [23]. The second criterion was that the PAs must be larger than 10 km^2. This criterion was important for the establishment of PAs under the IUCN guidelines in 1994 [34]; we also expected that larger parks would have multiple aims and variable management practices. The selection of alpine parks larger than 10 km^2 was conducted using ESRI ArcGIS 10.0 [35]. The third criterion was that the park had to have a designated IUCN category. There is a high variability of category designation in Spain [24], and we wanted to test how the IUCN designations correlate with this variability. The IUCN categories associated with the Spanish PAs were obtained from a Spanish governmental database prepared by Banco de datos de la Naturaleza [33].The fourth criterion was that the parks must have a management plan (PORN, PRUG and/or public use programs) in current use (in either English or Spanish). This criterion was imposed to permit the evaluation of the management practices in the different parks based on comparable aims and management regulation parameters.

Two map sources were used in this process: a vegetation zone map from Mücher *et al.* [23] and a Spanish PA boundary map developed by EUROPARC-España [36]. The first map, LANMAP2 (Alterra), is a Pan-European Landscape Database that classifies 350 different European landscapes [23]. We selected sites that were classified as Alpine south or Mediterranean mountain vegetation zones. The map from EUROPARC was updated in December 2009 and includes Spanish PAs defined by the Law 42/2007 of Natural Heritage and Biodiversity and by the Natura 2000 network that were included in the autonomous community's legislation [36]. The EUROPARC map does not include PAs established under other international agreements.

2.2. Variable Selection

We expected that three variables would explain the variation in aims and regulations among the parks: (1) the IUCN category, (2) the vegetation zone in which the PA is located (Alpine south and Mediterranean mountain vegetation zones) and (3) the date of park creation. The IUCN categories were used instead of the national designations because of the high diversity of PA categories in Spain. In addition, the vegetation zones in which the PAs are located could reflect different management practices between the Alpine south and Mediterranean mountain vegetation zones. These zones are differentiated by climate and topography [23] but usually exhibit similar patterns of land use by humans. The autonomous community is a potentially important explanatory variable because the devolution of authority has been a determinant in the development of community-specific conservation laws. To analyze the relative importance of the IUCN category, vegetation zones and autonomous communities to the aims and regulations of the PAs, we used content analysis combined with a correspondence analysis of the instrumental variables [37–39]. This method allowed us to partition the

variance of the aims and regulations with respect to the IUCN categories, vegetation zones and autonomous communities [40].

We collected general information about each park according to EUROPARC guidelines [41], such as the name of the park, the Spanish designation, the IUCN category, the vegetation zone and the autonomous community to which it belongs. The IUCN categories are designated according to the aims of the parks [34]; therefore, we analyzed the management goals for each park. We used directed content analyses [42] of the available management plans (PORN, PRUG and/or public use programs) as a first step in determining the park objectives. We applied categories that were developed according to the goals defined by the 1994 IUCN guidelines [34] (Appendix Appendix **A1**). The IUCN distinguishes between primary objectives, secondary objectives and potentially applicable objectives. However, the ranking of aims has not been implemented in PA classification in Spain. We therefore recorded the aims only as mentioned ("yes") or not mentioned ("no") in the management plans.

IUCN categories are also intended to regulate certain human activities at the national and international levels [28]. Thus, the classification of PAs according to their aims should correspond to management practices because biodiversity protection in some cases may require stricter regulation of human activities. Although not sufficient for evaluating the performance of PA management, the analyses of the regulations could indicate whether aims are implemented in practice. We did not consider regulations that were applied to only a few parks (e.g., dog entrance, winter sports, climbing). We classified the variables according to four different ordinal levels (see Table 1). The variables and their definitions can be found in Appendix Appendix A2.

Table 1. Coding and definitions used for the classification of management regulations.

Code	Definition
No	Activities are not allowed within the PA boundaries.
Permits	Activities require a permit.
Restrictions	Activities are temporally or spatially restricted.
Not regulated	Activities are not mentioned in the management plan. This category also includes activities that could be regulated if harmful to PA objectives.

Three predictors were expected to influence the aims and management of a park: (1) the IUCN category, (2) the vegetation zone in which the PA is located (Alpine south or Mediterranean mountain vegetation zone) and (3) the autonomous community to which the park belongs. The influence of autonomous communities was analyzed by classifying the parks into three categories based on the major eras of PA policies. Category 1 autonomous communities are those that established their own law before the 1989 Act was passed. Category 2 autonomous communities are those that declared their law after the 1989 Act was declared. Category 3 autonomous communities are those that did not pass their own legislation for PAs until 2000.

2.3. Statistical Analysis

In this paper, we used CAiv to partition the variation in aims and regulations explained by the IUCN categories, vegetation zones and autonomous communities [40]. The main advantage of this method compared to logistic regression or log-linear models is that a linear combination of explanatory

variables (*i.e.*, IUCN categories, vegetation zones and autonomous communities) can be used to predict multiple aims and regulations simultaneously. The principal component analysis on instrumental variables (PCAiv) function [43] in the *ade4* library package for the R environment [44] permits constrained analyses of the duality diagrams of both numerical and categorical data (see [45]). We used multiple correspondence analysis as the unconstrained analysis to predict the effects of the three explanatory variables on aims and regulations. Multiple correspondence analysis (MCA) is an extended version of correspondence analysis and is suitable for sets of homogenous variables that are closely associated [37–39]. We aimed to determine how well the different regulations of human activities are associated with each other, but we were also interested in understanding the relationships in levels of restrictions (e.g., whether typical visitor activities, such as camping and campfires, are allowed in the IUCN categories characterized by the highest level of protection).

The PCAiv could also be compared to partial canonical correspondence analysis (PCCA) [46], which considers both additive effects and interactions between explanatory variables [47,48]. Given the limited number of parks included in our analyses, we decided to explore only the additive effects of predictor variables. The pattern derived from the constrained analysis (CAiv) was visually compared to the unconstrained MCA to ensure that key structures in the data had not been missed in the analysis. Finally, we performed a Monte Carlo test on the percentage explained by the models (n = 999), which is the sum of the eigenvalues divided by the inertia of the unconstrained analysis. All analyses were performed and graphics were generated using the software R version 2.15.00 [49] with the *ade4* package [44].

3. Results and Discussion

A total of 36 PAs met all our criteria. The parks were homogeneously distributed along Alpine zones. More parks were located in the northern part of Spain due to its greater extent of Alpine areas (Figure 2).

Figure 2. Map of the selected PAs. Source: LANMAP2 (Alterra [23]) and EUROPARC maps (Background from ©INSTITUTO GEOGRÁFICO NACIONAL DE ESPAÑA [50]), redrawn in ESRI ArcGIS 10.0. The numbers correspond to the PAs.
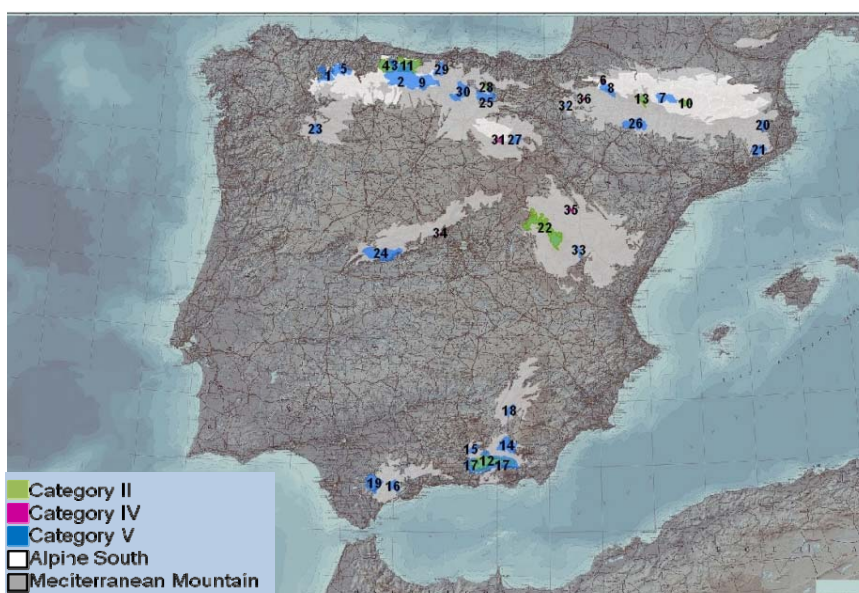
The EUROPARC-España maps included 109 PAs larger than 10 km^2 with more than 50% of their area in the Alpine south and/or Mediterranean mountain zones. Of these PAs, 21% were not associated with an IUCN category (Figure 3). Of the remaining PAs, 45% lacked a management plan and were therefore discarded from our analysis. These PAs were mainly category V, corresponding to the PEIN class in Catalonia, which generally lack individual management plans such as PORNs or PRUGs. In total, 38 PAs were assigned an IUCN category and had a management plan available in either Spanish or English, thus meeting our study criteria. Two parks from this set were discarded because there was only one park in each category (one in category Ib and another in category III). Of the PAs selected, 91% were established after 1978, which means that the majority were created by the autonomous communities. The proportion of parks in category V was also higher (66.67%) than the proportions of parks in categories II or IV.

Figure 3. Selection of PAs larger than 10 km^2 located in Alpine zones. The percentage of PAs that have no IUCN category assigned (No IUCN) and the distribution of IUCN categories among parks without a management plan (NoMP) and with management plans available (IUCN+MP) are shown.
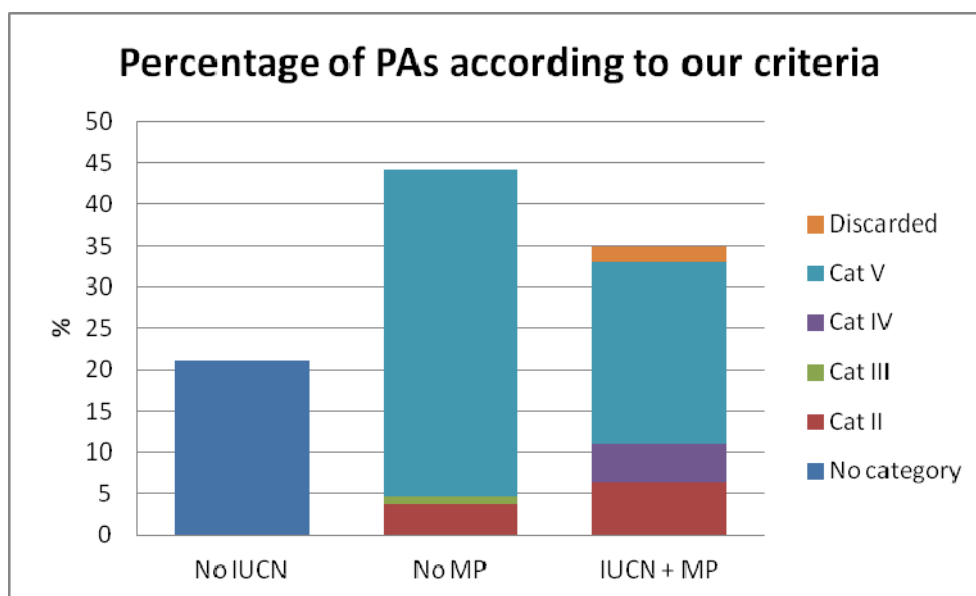
3.1. Aims of PAs

We found that the IUCN categories explained most of the variance of the aims in the parks (17.05%), whereas the autonomous community (3.25%) and vegetation zone (1.19%) had minor impacts on the differences in aims among parks (Table 2). The plot of the additive models of the three predictive variables (24.01%; P = 0.04) did not differ substantially from the unconstrained MCA analysis results, indicating that no major explanatory variables were missed in the CAiv analysis.

The variance was mainly explained by the first axis (83.15%) (Figure 4d), which was associated with the IUCN categories (Figure 4a). In general, unlike category II, categories IV and V do not have clearly stated aims; no aims, such as the maintenance of traditional attributes or the sustainable use of resources, were recorded for category IV or V parks. The second axis (9.57%) represents the difference in policies between the autonomous communities that passed laws earlier and those that

passed their laws later. There were no substantial differences between parks in the Alpine south and Mediterranean mountain vegetation zones.

Table 2. The percentage of variance in aims and regulations explained by each variable, as obtained from the CAiv, and the corresponding significance level determined by Monte Carlo permutation tests.

	AIMS		REGULATIONS	
	%	P	%	P
IUCN	17.05		7.89	
Community Group	3.25		9.85	
Zone	1.19		3.52	
IUCN+Zone	19.36	0.01	11.1	0.07
IUCN+Community Group	22.28	0.02	17.93	0.008
Community Group+Zone	4.25	0.92	13.51	0.01
IUCN+Community Group+Zone	24.01	0.04	21.28	0.002

Figure 4. CAiv for aims. **(a)** Covariance between the aims and parks is shown along the two first dimensions. The numbers represent the PAs included in our analysis (see Appendix Appendix **A3**). The colors of the labels indicate the presence (green) or absence (pink) of aims. Aims that are closer to one another in the diagram are more likely to co-occur in the parks. Likewise, parks that have the same scores along the axes are likely to have the same aims; **(b)** The linear combination of IUCN categories, autonomous communities and vegetation zones; **(c)** Projection of the axes of the correspondence analysis into the CAiv. Axis 1 explains 83.14% of the variation, and the second axis explains 9.57% of the variation; **(d)** Histogram of eigenvalues.
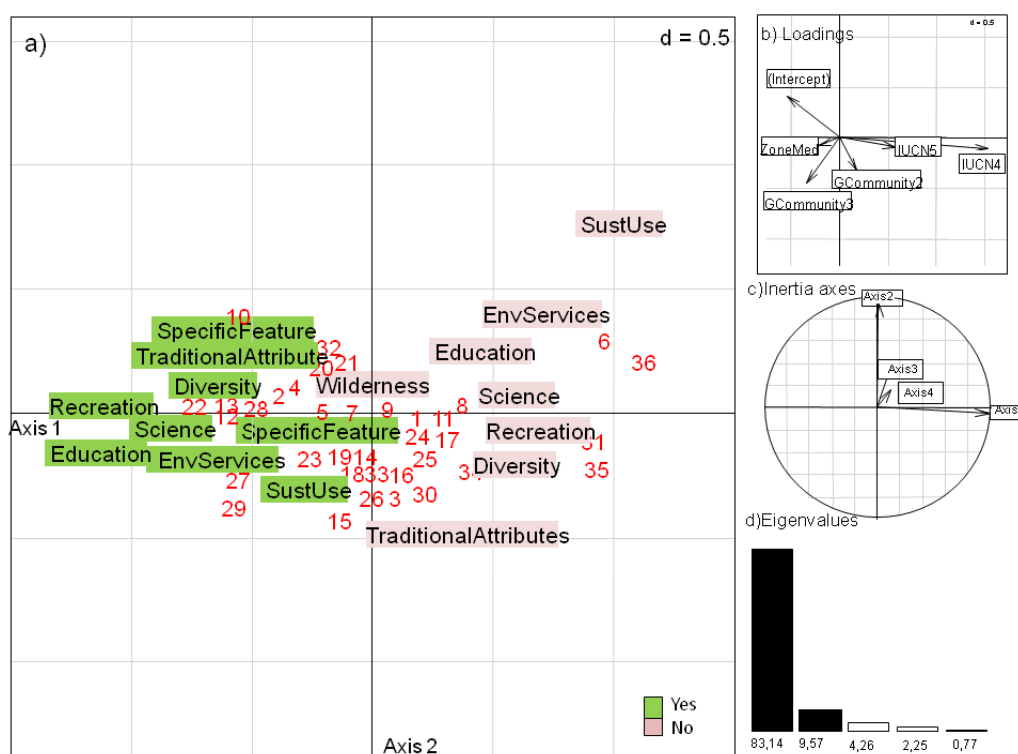
3.2. Management Regulations

The effects of the IUCN categories, vegetation zones and autonomous communities on management practices in the parks were analyzed using 12 different categories of regulation of human activities. In general, the management practices exhibited greater diversity than did the aims. While the aims were partially correlated with the IUCN category, the IUCN category explained less of the variance in management practices (7.89%) than did the autonomous communities (9.85%) (Table 2). There were, however, some weak gradients that could be explored further. The parks in categories II and IV have higher frequencies of activities classified as "No" and "Permits" (Figure 5), such as campfire building, sport competitions, fishing and hunting activities and intensive farming and building. Category V parks also tend to lack regulation of some activities. Camping is generally restricted in all categories, and the use of motorized vehicles is usually limited to local residents. Low-impact activities, such as biking, horse riding and extensive harvesting and collecting, are generally not restricted in any category of park due to the low risk of damage to the PA. The use of resources for scientific purposes requires a permit in most of the parks.

Figure 5. Percentage of the different levels of restriction ("No", dark red; "Permits", light red; "Restrictions", pink; "Not regulated", blue) for each regulated activity in the IUCN category II, IV and V PAs.
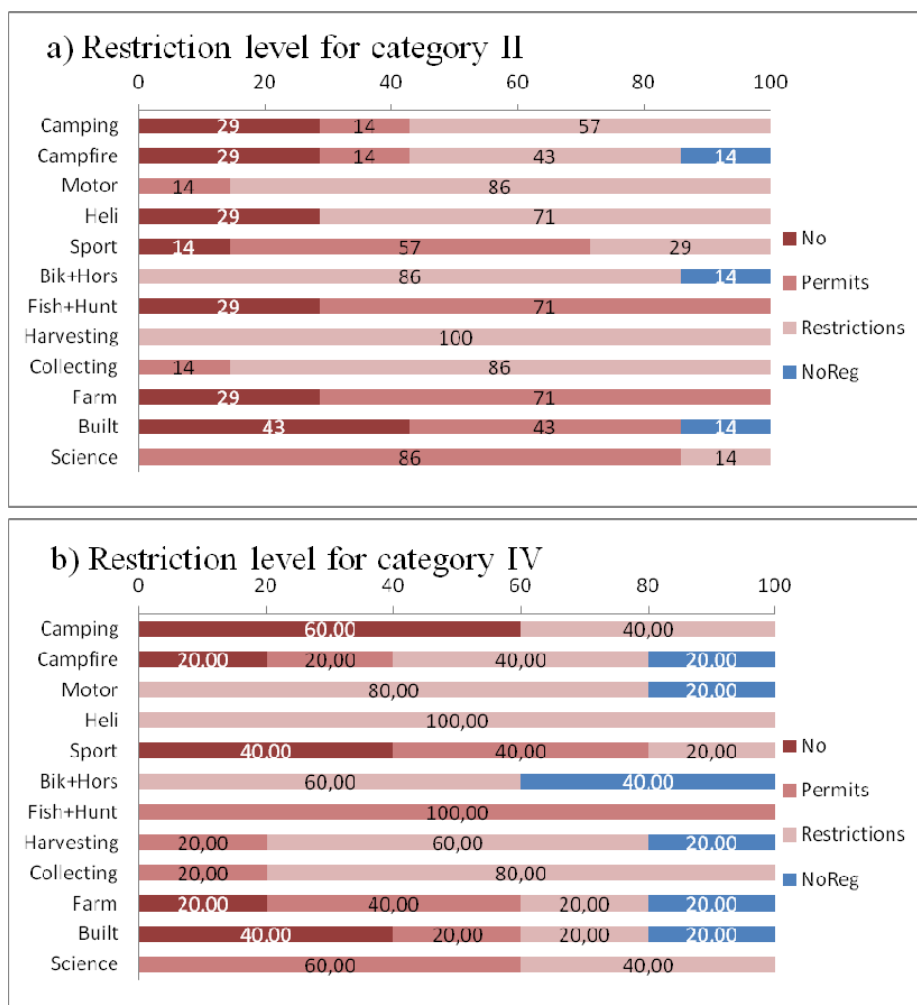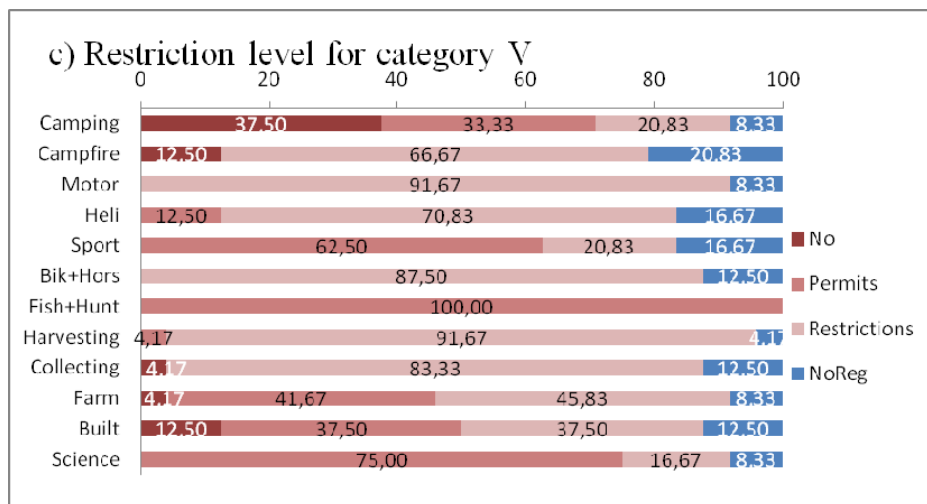
Figure 5. *Cont.*

The autonomous communities that established their own management policies at earlier dates tend to feature more restrictive management of human activities (higher percentages of "No"; see Table 3). The vegetation zone explains only a small part of the variance (3.52%), which could be associated with somewhat more restrictive policies in the Alpine vegetation zones (see Table 3). However, according to the CAiv analyses of regulations, there are no strong patterns related to any of our three response variables (Table 2).

Table 3. Percentage of management regulations at each restriction level in each autonomous community and vegetation zone (Alp, Alpine south; Med, Mediterranean mountains).

	Not Regulated	Restrictions	Permits	No
Autonomous Community				
1	22.22	27.78	30.56	19.44
2	6.48	55.86	29.94	7.72
3	11.11	52.78	33.33	2.78
Vegetation Zone				
Alp	6.82	50.76	28.03	14.39
Med	10.67	51.00	31.33	7.00

The additive effect of the IUCN, autonomous community and vegetation zone variables (Figure 6) explains 21.28% of the variance ($p = 0.002$; see Table 2). The autonomous community (first axis, 37.65%) and the IUCN (second axis, 30.67%) account for most of the variance. The IUCN category II and the autonomous communities that first established their own laws tend to have a greater occurrence of high regulation levels ("Permits" and "No") (Table 3), but the diagram shows that this apparent tendency is due mainly to a few parks that are very restrictive. The first axis distinguishes parks that use "restrictions" as their major tool versus the parks that do not specify any regulations of typical recreational activities, such as making campfires, riding bikes and horses or driving motorized vehicles within the park boundaries (Figure 6a and d). The second axis better reflects the general tendencies of IUCN category II parks to have stricter regulations, with higher frequencies of prohibited activities than category IV and V parks. The comparison with the

unconstrained analysis shows approximately the same general pattern. However, most parks are aggregated around the origin, and there are no indications of a strong relationship between the regulations and the predictors considered.

> **Figure 6.** CAiv ordination for management regulations. **(a)** Management regulations and park covariance is shown along the two first dimensions. The numbers represent the PAs included in the analysis (see Appendix **Appendix A3**). The labels show the scores of restriction levels ("No", dark red; "Permits", light red; "Restrictions", pink; "Not regulated", blue). Parks with the same scores along the axes are likely to have the same restriction levels; **(b)** The linear combination of IUCN categories, autonomous communities and vegetation zones; **(c)** Projection of the axes of the correspondence analysis into the CAiv. The first axis explains 37.65% of the variation, and the second axis explains 30.67% of the variation; **(d)** Histogram of the eigenvalues.
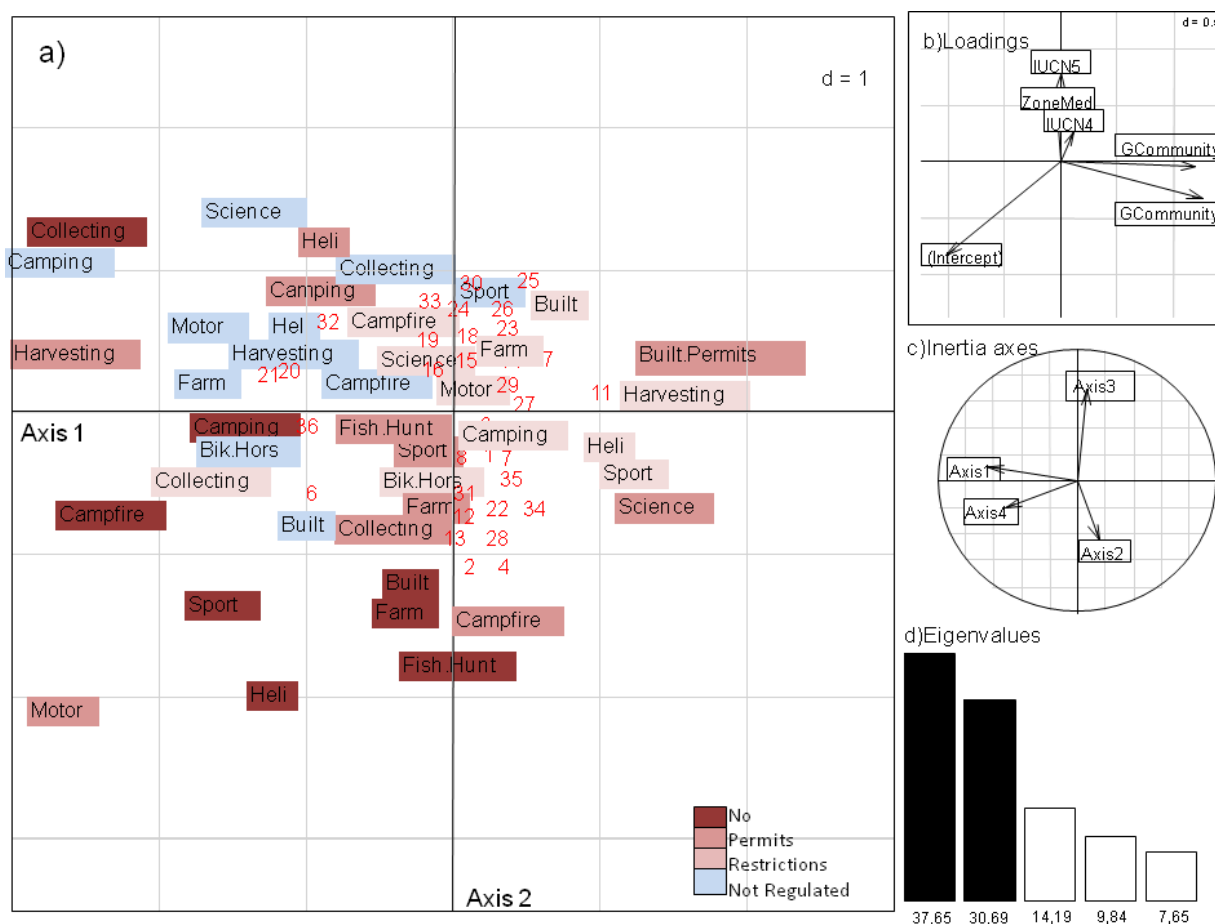
3.3. Discussion

In this paper, we asked the question "What do the IUCN categories really protect?" Given the strong emphasis on PA coverage as a key measure of biodiversity conservation, this question needs to be answered. Our systematic study of policies in alpine PAs in Spain showed that many of the parks have vague aims and do not clearly state how biodiversity should be prioritized relative to the other aims of the parks. Although the aims of the Spanish PAs appear to be aligned with their IUCN

categorizations, their management practices are at best weakly associated with these categories. It is unclear whether the strictest categories (I–IV) reflect greater restriction levels in practice, which calls the reliability of category I-IV PA coverage as a measure of biodiversity protection in Spain (as proposed by [51]) into question. These categories do not provide effective guidance for managers about how to prioritize biodiversity among other goals. The lack of management plans in 50% of the PAs [52] also strengthens the argument that biodiversity conservation in Spanish PAs is only weakly regulated. Despite the lack of conservation measures available for analysis to comprehensively answer our question, we share the concerns of scholars who claim that the IUCN designations do not necessarily reflect the stated intention of halting biodiversity loss. There is a need to develop policies regarding measures of biodiversity protection that reflect the international standards established by the IUCN classification system.

Clear management objectives play a crucial role in the adaptive management of ecosystems [53]. Clear, measurable and agreed-upon objectives permit performance evaluation and the identification of uncertainties in management practices and increase the effectiveness of PA management. As in many other countries (e.g., [2,21]), the PAs in Spain have vague aims, and the tradeoffs made between contradictory aims are not clearly stated [54]. Usually, biodiversity protection is mentioned together with other social, economic and political aims, without clear guidance for on-site management [8,14]. Recently developed evaluation frameworks such as SIAPA (System of Integrated Assessment for Protected Areas) permit the assessment of the effectiveness of a protected area even in the absence of available management aims and plans [54]. For conservation purposes, however, on-site management requires both guidance to prioritize biodiversity among other competing aims and regulatory policies that allow this prioritization.

The IUCN categories provide a standard framework that permits comparisons among PAs [14]. A study conducted by Dillon [19] suggested that the Spanish 1989 Act was mostly consistent with the 1978 IUCN category system, but the results of our study show mismatches with the 1994 IUCN category system. Although there are several guidelines, there is no regulated procedure for category assignment [55]. The lack of a regulated procedure for assigning IUCN categories makes evaluation more difficult due to the subjectivity of the authority that performs the assignment. A study conducted by Mierauskas [56] in Lithuania analyzed the policy performance of categories Ia and Ib at the national level and showed that the PA system and management goals diverge substantially from the IUCN categories. He concluded that the aims and regulations defined in the law did not correspond to the IUCN-defined categories. Locke and Dearden [51] argued that IUCN categories V and VI are often designated for human use rather than for biodiversity conservation. We also found that Spain is far from assigning international categories to Spanish PAs (a compromise adopted by the 2007 Act). According to EUROPARC-España [52], only 30% of Spanish PAs have been assigned to an IUCN category, and category V is the most common designation.

Our study shows that for management regulations, the autonomous community explains as much of the variance as the IUCN category. In particular, autonomous communities that passed their laws at later dates regulate human activities in the park to larger extents. Such patterns are also evident in other countries because management is usually adapted to a larger system of PAs that are already in place [13] rather than to the IUCN categories. The devolution of authority has become a core issue in recent years. The outcome of community-based management is mixed and often depends on a range of

conditions other than the governing body [57–61]. Our data demonstrate only a weak correlation between higher restriction levels and the strictest categories. Only 7.89% of the variance was explained by IUCN categories, which implies that there are no strong differences in management practices to reflect the IUCN categories. Our study results do not provide an analysis of the conservation performance of the parks, but the lack of a general pattern in management regulations (except for the weak effect of the date of establishment by autonomous communities) indicates that management practices are governed individually by the autonomous communities rather than being standardized according to international policies.

Our results should be interpreted with caution as they are based on a relatively small sample size of parks and a high number of regulations. Although no strong patterns were detected, there might be singular variables that could reflect differences between the parks. The activities with the greatest potential effects on biodiversity, such as farms, building, fishing, hunting, camping and campfires, are more frequently prohibited or limited to use by permit holders in the strictest categories of PAs (Figure 5).

Management aims and regulations influence management actions and thus outputs and outcomes. The use of content analysis as a standardized method for the evaluation of aims and regulations allows comparisons between different countries and could provide a rough indicator of the extent of prioritization of biodiversity goals in PAs. The lack of appropriate management plans calls for the use of approaches other than policy performance evaluation for the analysis of PA effectiveness. Some studies have focused on the level of human disturbances in PAs, such as the level of naturalness of the area [62–65] or the ecological integrity of the system [66,67]. However, these analyses must be applied carefully because such evaluations have sometimes been criticized for confusing terms such as "naturalness", "rarity" and "representativeness" and the use of overly broad concepts (e.g., genetic diversity, species diversity and ecosystem diversity) [68,69]. Furthermore, it is difficult to compare data obtained from monitoring populations or biodiversity between sites [70]. In practice, the most common approaches to evaluation have been qualitative, involving the use of scorecards, expert judgments and experience-based knowledge [70–73]. These evaluation methods do not necessarily directly link conservation interventions and conservation effects, except through the experts' own evaluations [70]. According to scholars of evidence-based conservation, such experience-based knowledge is not sufficient, and more research is needed to assess conservation outcomes and the associated causes [72,74,75]. Analyses of gaps in conservation policy could, in such cases, guide the selection of PAs that require in-depth analyses of conservation outcomes.

Management plans are crucial for the use of PA coverage as an indicator of the prioritization of biodiversity conservation because policy performance assessment is necessary for a complete evaluation of management effectiveness [76]. In the current study, we selected only parks with management plans, thereby reducing the number of PAs available for our analysis. Although this approach could introduce some biases, the lack of management plans for many PAs strengthens our argument that there is a general lack of guidance for the prioritization of biodiversity versus other goals. Such analyses of management plans are not particularly costly and could identify potential weaknesses in the PA systems as well as the need for further system monitoring and evaluation.

4. Conclusions

A systematic evaluation of park management plans could be an efficient first step in identifying potential management weaknesses, such as the lack of explicit prioritization of biodiversity among other needs, prior to other evaluation and monitoring programs in the Spanish alpine PAs. Aims and regulations should also be analyzed with respect to the authority in charge of management because different governing systems may affect the level of restrictions applied to the PA. The results of our study show that the park designation by the autonomous communities according to different conservation laws was as important as the IUCN category designation in explaining patterns of regulations. The overall weak correspondence of management practices to IUCN categories also indicates that management is influenced by factors other than international standards. Among other factors, the lack of a procedure for IUCN category assignment increases the variation in management planning among different regions and the interpretation by non-expert assessors [55].

The first step of policy analysis should be followed by a more complete evaluation of management effectiveness, such as PAME [76]; PA effectiveness evaluations, such as SIAPA [54]; or simply in-depth biological studies in PAs for which our analyses detected mismatches in international and local policies. To truly answer our question, these policy analyses must be combined with analyses of threats and conservation outcomes, either through expert assessments or through evidence-based conservation analyses.

Acknowledgments

Conflict of Interest

The authors declare no conflict of interest.

References

1. Eagles, P.F.J.; McCool, S.F. *Tourism in National Parks and Protected Areas: Planning and Management*; CABI: England, UK, 2002; p. 320.
2. Borgerhoff Mulder, M.; Coppolillo, P. *Conservation: Linking Ecology, Economics and Culture*; Princeton University Press: Princeton, NJ, USA, 2005; p. 347.
3. Brooks, T.M.; Bakaar, M.I.; Boucher, T.; da Fonseca, G.A.B.; Hilton-Taylor, C.; Hoekstra, J.M.; Moritz, T.; Olivieri, S.; Parrish, J.; Pressey, R.L.; *et al.* Coverage provided by the global protected-area system: Is it enough? *BioSience* **2004**, *54*, 1081–1091.
4. Dudley, N. *Guidelines for Applying Protected Area Management Categories*; IUCN: Gland, Switzerland, 2008; p. 86.
5. CBD, Decisions adopted at the Conference of Parties to the Convention of Biological Diversity at its Eighth meeting. UNEP Convention of Biological Diversity: Curitiba, Brazil, 2006.
6. CBD, Decisions adopted at the Conference of Parties to the Convention of Biological Diversity at its Tenth meeting. UNEP Convention of Biological Diversity: Nagoya, Japan, 2010.

7. Butchart, S.H.; Walpole, M.; Collen, B.; van Strien, A.; Scharlemann, J.P.; Almond, R.E.; Baillie, J.E.; Bomhard, B.; Brown, C.; Bruno, J.; *et al.* Global biodiversity: indicators of recent declines. *Science* **2010**, *328*, 1164–1168.

8. Chape, S.; Harrison, J.; Spalding, M.; Lysenko, I. Measuring the extent and effectiveness of protected areas as an indicator for meeting global biodiversity targets. *Philos. Trans. R. Soc.* **2005**, *360*, 443–455.

9. Coad, L.; Burgess, N.D.; Fish, L.; Ravillious, C.; Corrigan, C.; Pavese, H.; Granziera, A.; Besançon, C. Progress towards the Convention on Biological Diversity terrestrial 2010 and marine 2012 targets for protected area coverage. *Parks* **2004**, *17*, 35–42.

10. Hockings, M. Systems for assessing the effectiveness of management in protected areas. *BioSience* **2003**, *53*, 823–832.

11. Leverington, F.; Costa, K.L.; Pavese, H.; Lisle, A.; Hockings, M. A global analysis of protected area management effectiveness. *Environ. Manag.* **2010**, *46*, 685–698.

12. Stolton, S.U.E. Issues that arise for the categories in a changing world. *Parks* **2004**, *14*, 63–71.

13. Hobbs, R.J.; Cole, D.N.; Yung, L.; Zavaleta, E.S.; Aplet, G.H.; Chapin, F.S.; Landres, P.B.; Parsons, D.J.; Stephenson, N.L.; White, P.S.; *et al.* Guiding concepts for park and wilderness stewardship in an era of global environmental change. *Front. Ecol. Environ.* **2010**, *8*, 483–490.

14. Chape, S. Systematic assignment of protected area management categories: an opportunity for achieving a measurable framework. *Parks* **2004**, *14*, 51–57.

15. Rand, M.; Spalding, M.; Sanjayan, M. Paper parks re-examines: Building a future for "MPAs-in-Waiting". *MPA News* **2012**, *13*, 1–3.

16. Stoll-Kleemann, S.; Job, H. The Relevance of Effective Protected Areas for Biodiversity Conservation: An Introduction. *GAIA* **2008**, *17*, 86–89.

17. Erwin, T.A. An evolutionary basis for conservation strategies. *Science* **1991**, *253*, 750–752.

18. Bruner, A.G.; Gullison, R.E.; Rice, R.E.; da Fonseca, G.A. Effectiveness of parks in protecting tropical biodiversity. *Science* **2001**, *291*, 125–127.

19. Dillon, B. The use of the categories in national and international legislation and policy. *Parks* **2004**, *14*, 15–22.

20. Joppa, L.N.; Loarie, S.R.; Pimm, S.L. On the protection of "protected areas". *Proc. Natl. Acad. Sci. USA* **2008**, *105*, 6673–6678.

21. Naughton-Treves, L.; Holland, M.B.; Brandom, K. The role of protected areas in conserving biodiversity and sustaining local livelihoods. *Annu. Rev. Environ. Resour.* **2005**, *30*, 219–252.

22. Gaston, K.J.; Charman, K.; Jackson, S.F.; Armsworth, P.R.; Bonn, A.; Briers, R.A.; Callaghan, C.S.Q.; Catchpole, R.; Hopkins, J.; Kunin, W.E.; *et al.* The ecological effectiveness of protected areas: The United Kingdom. *Biol. Conserv.* **2006**, *132*, 76–87.

23. Mücher, C.A.; Wascher, D.M.; Klijn, J.A.; Koomen, A.J.M.; Jongman, R.H.G. A New European Landscape Map as an Integrative Framework for Landscape Character Assessment. In *Landscape Ecology in the Mediterranean: Inside and Outside Approaches*; Bunceand, R.H.G., Jongman, R.H.G., Eds.; Proceedings of the European IALE Conference 29 March–2 April 2005; IALE Publication Series 3: Faro, Portugal, 2006; pp. 233–243.

24. Vacas Guerrero, T. Los Espacios Naturales Protegidos: Figuras de Protección en España. In *XIX Congreso de Geógrafos Españoles: Espacios públicos, Espacios Privados*, Asociación de Geógrafos Españoles; Universidad de Cantabria.: Santander, Spain, 2005.

25. Tolón Becerra, A.; Lastra Bravo, X. Los Espacios Naturales Protegidos. Concepto, evolución y situación actual en España. *M+A Revista Electrónica de Medioambiente UCM* **2008**, 1–25.

26. Troitiño Vinuesa, M.A. Espacios Naturales Protegidos y Desarrollo Rural: Una Relación Territorial Conflictiva. *Boletín de la A.G.E.* **1995**, *20*, 23–37.

27. Mulero Mendigorri, A. *La protección de Espacios Naturales en España. Antecedentes, contrastes territoriales, conflictos y perspectivas (Protection of Natural Sites in Spain. Background, territorial contrasts, conflicts and prospects)*; Mundi Prensa: Madrid, 2002; p. 309.

28. EUROPARC-España *Anuario EUROPARC-España del estado de los espacios naturales protegidos 2009 (Yearbook EUROPARC-Spain on the state of protected natural areas 2009)*; FUNGOBE: Madrid, Spain, 2010; p. 104.

29. Ley 42/2007, de 13 de diciembre, del Patrimonio Natural y de la Biodiversidad. In *Boletín Oficial del Estado*; BOE no. 299, pp. 51275–51327.

30. Mulero Mendigorri, A. Notas en torno a la Ley del Patrimonio Natural y de la Biodiversidad (Ley 42/2007, de 13 de diciembre): Alcance y aportaciones básicas (Notes on the Natural Heritage and Biodiversity Law (Law 42/2007, 13th December): scope and basic contributions). *Revista de Estudios regionales* **2008**, *88*, 265–313.

31. Natura 2000 Network. Available online: http://ec.europa.eu/environment/nature/natura2000/index_en.htm/ (accessed on 7 August 2012).

32. Boitani, L.; Cowling, R.M.; Dublin, H.T.; Mace, G.M.; Parrish, J.; Possingham, H.P.; Pressey, R.L.; Rondinini, C.; Wilson, K.A. Change the IUCN protected area categories to reflect biodiversity outcomes. *PLoS Biol.* **2008**, *6*, 66.

33. List IUCN, Common Database Designated Areas-CDDA. In *Banco de Datos de la Naturaleza*; Ministerio de Agricultura, Alimentación y Medio Amnbiente: Madrid, Spain, 2011.

34. IUCN. *Guidelines for Protected Area Management Categories*; IUCN: Gland, Switzerland and Cambridge, UK, 1994; p. 261.

35. ESRI. *ArcMap 10.0*; Environmental Systems Research Institute: Redlands, California, 2010.

36. EUROPARC-España. *Observatorio de los Espacios Protegidos 2009. Manual del usuario (Protected Area Observatory 2009. User guide)*; Fundación Interuniversitaria Fernando González Bernáldez para los Espacios Naturales: Madrid, Spain, 2010; p. 27.

37. Tenenhaus, M.; Young, F.W. An analysis and synthesis of multiple correspondence analysis, optimal scaling, dual scaling, homogeneity analysis and other methods for quantifying categorical multivariate dat. *Psychometrika* **1985**, *50*, 91–119.

38. Greenacre, M.J. From Simple to Multiple Correspondence Analysis. In *Multiple Correspondence Analysis and Related Methods*; Greenacre, M.J., Blasius, J., Gelman, A., Rabe-Hesketh, S., Eds.; Chapmana & Hall/CRC: Boca Raton, FL, USA, 2006; pp. 41–76.

39. Greenacre, M.J. *Correspondence Analysis in Practice*, 2nd ed.; Academic Press: London, UK, 2007; p. 296.

40. Lebreton, J.D.; Sabatier, R.; Banco, G.; Bacou, A.M. Principal Component and Correspondence Analyses with Respect to Instrumental Variables: An Overview of Their Role in Studies of

Structure-activity and Species-environment Relationships. In *Applied Multivariate Analysis in SAR and Environmental Studies*; Devillers, J., Karcher, W., Eds.; 1991; pp. 85–114.

41. EUROPARC-España. *Herramientas para la evaluación de las áreas protegidas: modelo de memoria de gestión (Protected Area evaluation tools: management report model)*; Fundación Interuniversitaria Fernando González Bernáldez para los Espacios Naturales: Madrid, Spain, 2010, p. 121.

42. Hsieh, H.; Shannon, S. Three approaches to qualitative content analysis. *Qual. Health Res.* **2005**, *15*, 1277–7288.

43. Rao, C.R. The use and interpretation of principal component analysis in applied research. *Indian J. Stat. Series A* **1964**, *26*, 329–358.

44. Dray, S.; Durfour, A.B. The ade4 package: implementing the duality diagram for ecologists. *J. Stat. Softw.* **2007**, *22*, 1–20.

45. Thioulouse, J. Simultaneous analysis of a sequence of paired ecological tables: A comparison of several methods. *Ann. Appl. Stat.* **2011**, *5*, 2300–2325.

46. Ter Braak, C.J.F. Canonical correspondence analysis: A new eigenvector technique for multivariate direct gradient analysis. *Ecology* **1986**, *67*, 1167–1179.

47. Hausner, V.H.; Yoccoz, N.G.; Ims, R.A. Selecting indicator traits for monitoring land use impacts: Birds in Northern Coastal Birch Forests. *Ecol. Appl.* **2003**, *13*, 999–1012.

48. Killengreen, S.T.; Strømseng, E.; Yoccoz, N.G.; Ims, R.A. How ecological neighbourhoods influence the structure of the scavenger guild in low arctic tundra. *Divers. Distrib.* **2012**, *18*, 563–574.

49. R Development Core Team. *R: A Language and Environment for Statistical Computing*; R Foundation for Statistical Computing: Vienna, Austria, 2011.

50. *Mapas generales de España*; Instituto Geográfico Nacional de España, Ministerio de Fomento: Madrid, Spain, 2012.

51. Locke, H.; Dearden, P. Rethinking protected area categories and the new paradigm. *Environ. Conserv.* **2005**, *32*, 1–10.

52. EUROPARC-España. *Anuario 2011 del estado de las áreas protegidas en España (Yearbook 2011 on the state of protected areas in Spain)*; Fundación Fernando González Bernáldez: Madrid, Spain, 2012; p. 186.

53. Williams, B.K. Adaptive management of natural resources-framework and issues. *J. Environ. Manag.* **2011**, *92*, 1346–1353.

54. Rodríguez-Rodríguez, D.; Martínez-Vega, J. Proposal of a system for the integrated and comparative assessment of protected areas. *Ecol. Indic.* **2012**, *23*, 566–572.

55. EUROPARC-España. *Procedimiento para la asignación de las categorías internacionales de manejo de áreas protegidas de la UICN (IUCN international category assignment procedure for protected areas)*; Fundación Fernando González Bernáldez: Madrid, Spain, 2008; p. 140.

56. Mierauskas, P. An evaluation of the strict nature reserves management in Lithuania and their correspondence to international requirements. *Environ. Res. Eng. Manag.* **2004**, *3*, 62–70.

57. Hayes, T.M. Parks, people, and forest protection: An institutional assessment of the effectiveness of protected areas. *World Dev.* **2006**, *34*, 2064–2075.

58. Bray, D.B.; Durán, E.; Merino, L.; Torres, J.M.A. *Nueva Evidencia: Los Bosques Comunitarios de México. Protegen el Ambiente, Disminuyen la Pobreza y Promueven la paz Social (New evidence: Community forests of Mexico. They protect the environment, reduce poverty and promote social peace)*; Consejo Civil Mexicano para la Silvicultura Sostenible, A.C.: Mexico F.D., Mexico, 2007.

59. Ostrom, E. A diagnostic approach for going beyond panaceas. *Proc. Natl. Acad. Sci. USA* **2007**, *104*, 15181–15187.

60. Schelhas, J.; Pfeffer, M.J. When global environmentalism meets local livelihoods: policy and management lessons. *Conserv. Lett.* **2009**, *2*, 278–285.

61. Berkes, F. Devolution of environment and resources governance: Trends and future. *Environ. Conserv.* **2010**, *37*, 489–500.

62. Liu, J.; Linderman, M.; Ouyang, Z.; An, L.; Yang, J.; Zhang, H. Ecological degradation in protected areas: the case of Wolong Nature Reserve for giant pandas. *Science* **2001**, *292*, 4.

63. Ellis, E.A.; Porter-Bolland, L. Is community-based forest management more effective than protected areas? A comparison of land use/land cover change in two neighboring study areas of the Central Yucatan Peninsula, Mexico. *For. Ecol. Manag.* **2008**, *256*, 1971–1983.

64. Nagendra, H. Do Parks Work? Impact of Protected Areas on Land Cover Clearing. *AMBIO: A J. Human Environ.* **2008**, *37*, 330–337.

65. Leroux, S.J.; Krawchuk, M.A.; Schmiegelow, F.; Cumming, S.G.; Lisgo, K.; Anderson, L.G.; Petkova, M. Global protected areas and IUCN designations: Do the categories match the conditions? *Biol. Conserv.* **2010**, *143*, 609–616.

66. Parrish, J.; Braun, D.P.; Unnasch, S. Are we conserving what we say we are? Measuring ecological integrity within protected areas. *BioSience* **2003**, *53*, 851–860.

67. Karr, J.R. Beyond definitions: Maintaining biological integrity, diversity, and environmental health in national wildlife refuges. *Nat. Resour. J.* **2004**, *44*, 26.

68. Smith, P.G.R.; Theberge, J.B. A review of Criteria for evaluating natural areas. *Environ. Manag.* **1986**, *10*, 715–734.

69. Cole, D.N.; Yung, L.; Zavaleta, E.S.; Aplet, G.H.; Chaplin, F.S.I.; Graber, D.M.; Higgs, E.S.; Hobbs, R.J.; Landres, P.B.; Millar, C.I.; *et al*. Naturalness and Beyond: Protected Area Stewardship in an Era of Global Environmental Change. *George Wright Forum* **2008**, *25*, 36–56.

70. Stem, C.; Margoluis, R.; Salafsky, N.; Brown, C. Monitoring and Evaluation in Conservation: a Review of Trends and Approaches. *Conserv. Biol.* **2005**, *19*, 295–309.

71. Ervin, J. Protected area assessments in perspective. *BioSience* **2003**, *53*, 819–822.

72. Cook, C.N.; Hockings, M.; Carter, R.B. Conservation in the dark? The information used to support management decisions. *Front. Ecol. Environ.* **2010**, *8*, 181–186.

73. Quan, J.; Ouyang, Z.; Xu, W.; Miao, H. Assessment of the effectiveness of nature reserve management in China. *Biodivers. Conserv.* **2011**, *20*, 779–792.

74. Pullin, A.S.; Knight, T.M. Effectiveness in Conservation Practice: Pointers from Medicine and Public Health. *Conserv. Biol.* **2001**, *15*, 50–54.

75. Sutherland, W.J.; Pullin, A.S.; Dolman, P.M.; Knight, T.M. The need for evidence-based conservation. *Trends Ecol. Evol.* **2004**, *19*, 305–308.

76. Hockings, M.; Stolton, S.U.E.; Leverington, F.; Dudley, N.; Courrau, J. *Evaluating Effectiveness: A framework for Assessing Management Effectiveness of Protected Areas*; Gland, Switzerland and Cambridge, UK, 2006; p. 105.

Appendix

Appendix A1. List of the management aims studied. 1, primary objective; 2, secondary objective; 3, potentially applicable objective; -, not applicable. Source: IUCN guidelines 1994.

Management objective	Ia	Ib	II	III	IV	V	VI
Scientific research	1	3	2	2	2	2	3
Wilderness protection	2	1	2	3	3	-	2
Preservation of species and genetic diversity	1	2	1	1	1	2	1
Maintenance of environmental services	2	1	1	-	1	2	1
Protection of specific natural / cultural features	-	-	2	1	3	1	3
Tourism and recreation	-	2	1	1	3	1	3
Education	-	-	2	2	2	2	3
Sustainable use of resources from natural ecosystems	-	3	3	-	2	2	1
Maintenance of cultural / traditional attributes	-	-	-	-	-	1	2

Appendix A2. List of the regulations and the question posed for each regulation.

Activity code	Definition
Camping	Is camping allowed everywhere?
Campfire	Are campfires allowed?
Motor	Are motorized vehicles allowed within the park boundaries?
Heli	Is the use of air vehicles allowed?
Sport	Can sports competitions be played?
Bik+Hors	Are bike riding and horse riding allowed within the park boundaries?
Fish+Hunt	Are fishing and hunting allowed?
Collecting	Can mushrooms, fruits and plants be collected?
Harvesting	Is extensive harvesting allowed (grazing, firewood extraction)?
Farm	Is new intensive farming allowed?
Built	Is building allowed (private homes and tourism infrastructure)?
Science	Are scientific activities allowed?

Appendix A3. List of PAs that satisfied our criteria. The ID numbers correspond to the numbers shown in the figures above.

ID	Name of the PA	IUCN
1	Fuentes del Narcea, Degaña e Ibias	5
2	Picos de Europa	2
3	Ponga	5
4	Redes	2
5	Somiedo	5
6	Larra	4
7	Posets-Maladeta	5

Appendix A3. *Cont.*

ID	Name of the PA	IUCN
8	Valles Occidentales	5
9	Fuentes Carrionas y Fuente Cobre-Montaña Palentina	5
10	Aigüestortes i Estany de Sant Maurici	2
11	Picos de Europa	5
12	Sierra Nevada	2
13	Ordesa y Monte Perdido	2
14	Sierra de Baza	5
15	Sierra de Huétor	5
16	Sierra de las Nieves	5
17	Sierra Nevada	5
18	Sierra de Castril	5
19	Sierra de Grazalema	5
20	Zona Volcànica de la Garrotxa	5
21	Massís del Montseny	5
22	Alto Tajo	2
23	Lago de Sanabria y alrededores	5
24	Sierra de Gredos	5
25	Montes Obarenes-San Zadornil	5
26	Sierra y Cañones de Guara	5
27	Sierra Cebollera	5
28	Valderejo	2
29	Saja-Besaya	5
30	Hoces de alto Ebro y Rudrón	5
31	Lagunas Glaciares de Neila	4
32	Montes de Valdorba	5
33	Pinares de Rodeno (Rodeno de Albarracín)	5
34	Pinar de Abantos y Zona de la Herrería del Real Sitio de San Lorenzo del Escorial	4
35	Laguna de Gallocanta	4
36	Foz de Arbayún	4