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Fine-Tuning of a Protected Area Effectiveness Evaluation Tool: Implementation on Two Emblematic Spanish National Parks

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Received: 3 August 2017; Accepted: 21 September 2017; Published: 26 September 2017

Abstract: As global biodiversity trends worsen, protected area (PA) environmental effectiveness needs to be assessed to identify strengths and areas to improve. Through a participatory process including PA managers and scientists, we refined the System for the Integrated Assessment of Protected Areas (SIAPA), in order to increase its legitimacy, credibility and salience to end users in Spain. Then, we tested the optimised version of the SIAPA on two emblematic Spanish national parks (NPs): Ordesa y Monte Perdido NP (Ordesa NP) and Sierra de Guadarrama NP (Guadarrama NP). PA managers and scientists largely coincided in the ratings of SIAPA's indicators and indices. Collaboration with Ordesa NP's managers was regular, allowing a nearly complete evaluation of the NP. However, greater collaboration between PA managers and scientists remains a priority in Guadarrama NP. Results show that potential effectiveness is moderate for Ordesa NP and low for Guadarrama NP, according to the indicators that could be evaluated. For Ordesa NP, lack of data on focal habitats and other focal features determined a deficient valuation of its conservation state, although the remaining indicators in that category showed adequate or moderate values. The compilation of those data should be overriding in the NP. In contrast, only climate change posed a serious threat in that NP. The social perception and valuation of both NPs was good, suggesting broad support from local populations and eased management.

Keywords: reserve; environmental sustainability; assessment; indicator; index; SIAPA

1. Introduction

Global protected area (PA) coverage is constantly expanding to presently cover 14.7% of terrestrial and freshwater ecosystems and 4.1% of marine ecosystems [1]. However, the status of global biodiversity continues to deteriorate [2]. As a result, increased focus is being put on assessing the effectiveness of PAs as the main global policy to reduce biodiversity loss [1,3–5]. Dozens of PA assessment systems have been developed worldwide [6] and in Europe [7]. RAPPAM [8] and METT [9] are the most broadly and frequently used, especially in contexts of limited availability of data [6]. Nevertheless, issues regarding accurateness and precision of both rapid, opinion-based systems have been raised [10,11]. Some more objective PA assessment and evaluation systems chiefly based on secondary data have since been developed to estimate environmental effectiveness of PAs comprehensively. One of these was the System for the Integrated Assessment of Protected Areas (SIAPA, [12]).The SIAPA evaluates PAs based on 43 indicators that were highly valued by experts and for which common legal, scientific, technical or logical thresholds were established. SIAPA indicators were integrated in six partial effectiveness indices: State of Conservation, Planning, Management, Socioeconomic context, Social perception and valuation, and Threats to conservation. Later, these partial indices were also integrated in an overall PA Effectiveness Index, which allows comparison among PAs that belong, ideally, to the same PA network.

The SIAPA was implemented to evaluate the potential effectiveness of the PAs of the Autonomous Region of Madrid, in Spain [13]. Later on, the methodology underpinning the SIAPA was presented to the main potential users in Spain, including PA network managers, scientists, environmental NGOs and other stakeholders in a national workshop. There was limited interest in implementing the SIAPA or a similar tool to regularly and consistently assess PA effectiveness among PA managers in Spain [14]. One of the reasons was that the SIAPA had been developed for implementation in the Autonomous Region of Madrid which is little representative of the environmental and socioeconomic characteristics of the whole country. Thus, some indicators and valuation thresholds were not found useful for other Spanish regions. Another reason was exclusion of important indicators in the original SIAPA, such as 'focal ecosystems' extent'. An improved version of SIAPA was produced after valuation of the 43 original SIAPA indicators and 6 indices by workshop participants and consideration of their remarks [15]. However, comments were made on the reduced participation of scientists in this improved SIAPA compared to PA managers, which might limit its legitimacy, credibility and salience, according the Knowledge Systems for Sustainable Development Framework [16].

In this study, we: (1) increased scientists' participation to produce an optimised version of the SIAPA in which the views of two key stakeholder groups, PA managers and scientists, are more widely and equally represented; (2) assessed the relatedness in indicator and index valuations between both stakeholder groups to identify evaluation priorities.; and (3) tested the optimised version of the SIAPA to evaluate the effectiveness of two emblematic national parks (NPs) in Spain: Ordesa NP and Guadarrama NP.

2. Methods

2.1. SIAPA Optimisation

Four researchers from the DISESGLOB project [17] rated each of the 43 original SIAPA indicators according to the Likert scale (1 to 5 points) used in the SIAPA improvement workshop [15], according to their relevance for defining the partial effectiveness indices in which they were included. Those researchers also rated the six partial indices on the same scale according to their importance for the overall environmental effectiveness of a PA. We combined the responses of those scientists (n = 4) with those of the PA managers (n = 12) and scientists (n = 3) from the SIAPA workshop, to have a more balanced representation of both key stakeholder groups in Spain. Responses corresponded to staff from different institutions from the workshop's participants'. The complete responses and institutions from all ratters (workshop participants plus new scientists) are shown in Supplementary 1.

To make the final indicator selection for the optimised version of SIAPA, every indicator was ranked according to their decreasing coefficient of variation (CV; i.e., their standard deviations divided by their means) and the upper tier (percentile 33) was selected. CVs have been used to prioritise indicator selection in previous studies [14,15]. The total indicators' and indices' mean values from the workshop participants and additional scientists (n = 19) were used to assign weights for integrating them in their respective partial indices or super-index, respectively (Table 1). The original scales of each indicator and conforming variables were standardised to an ordinal 0, 1, 2 point scale showing 'adequate', 'moderate' or 'deficient' valuation, respectively. The two valuation thresholds dividing the three previous values [18,19] were established for each original scale according to: values established by law, values commonly used by specialized agencies, values found in the literature, or logical, empirical or experience-based values based on the precautionary principle [20].

Detailed profiles for each selected indicator were developed or adapted from [12] (Supplementary 2). On interpretation and comparison grounds, we used the same Effectiveness Index's cut-off values based on the Precautionary Principle as in [12].

Table 1. Calculation, valuation and interpretation of the optimised SIAPA's indices.

Index	Number of Common Indicators	Calculation Formula	Value (Interpretation)
State of Conservation Planning Management Social and Economic Context Social Perception and Valuation	6 3 4 2 2	$wI = \sum_{i=1}^{n} x_i \cdot k_i / \sum_{i=1}^{k} k_i$ where: wI = partial index x_i = indicator value (0; 1; 2) k_i = weighting factor (3.3 to 5.0)	$_wI \geq 1.5 \rightarrow$ 2 points (Adequate) $1 \leq {}_wI < 1.5 \rightarrow$ 1 point (Moderate) $_wI < 1 \rightarrow$ 0 points (Deficient)
Threats to Conservation ($_tI$)	5		$_tI \leq 0.5 \rightarrow$ 0 points (Adequate) * $0.5 < {}_tI < 1 \rightarrow$ 1 point (Moderate) * $_tI \geq 1 \rightarrow$ 2 points (Deficient) *
Effectiveness (EI)	22	$EI = \sum_{i=1}^{n} x_i \cdot k_i / \sum_{i=1}^{k} k_i$ where: x_i = index value (0; ±1; ±2) k_i = weighting factor (2.8 to 4.7)	$EI \geq 1.2 \rightarrow$ 2 points (Adequate) $0.8 \leq EI < 1.2 \rightarrow$ 1 point (Moderate) $EI < 0.8 \rightarrow$ 0 points (Deficient)

* The values of the Threats to conservation Index and their interpretations are opposite to the other partial indices that positively add to protected area effectiveness.

2.2. Index and Indicator Valuation Comparison by PA Managers and Scientists

The degree of relatedness between each group's index and average indicator valuations was analysed using Spearman rank order correlation test (α = 0.05), after checking the non-normality of the original and log-transformed variables. Differences in index and indicator valuations by stakeholder group were then analysed via Kruskall-Wallis test (α = 0.05) using SPSS version 23 software (IBM, New York, NY, USA).

2.3. Optimised SIAPA Testing

Two highly symbolic PAs were selected to test the optimised SIAPA: Ordesa NP and Guadarrama NP. Ordesa NP was designated nearly one century ago [21]. It was reclassified and expanded in 1982 to cover its current 15,608 ha that extend over six municipalities [22]. It is a high-mountain NP located in the northern Spanish province of Huesca, in the Pyrenees. Biogeographically, it is located in the Alpine region [23] (Figure 1). It contains 15 of the 27 'natural systems' (natural ecosystems and landscapes defined by their representative vegetation) in the Spanish Law on National Parks [24] and 1404 plant species, including approximately 50 Pyrenean endemic species [25]. Guadarrama NP is the most recent NP in Spain. It was designated in June 2013 over 33,960 ha of 35 municipalities [26]. It is also a medium and high-mountain NP located in the Central Mountain Range, between the provinces of Madrid and Segovia (Figure 1). Biogeographically, it belongs to the Mediterranean Region [23]. It protects 10 natural systems in the Spanish Law on National Parks [24] and more than 1000 flora species, of which 83 are endemic to the Iberian Peninsula [25].

Though from an environmental point of view the two NPs are similar, both representing mountainous Iberian biodiversity, they are socioeconomically very distinct. Ordesa NP is a peripheric, rural NP of difficult accessibility with less than 2000 local residents around it [27] in which tertiary economic activities are predominant but where primary activities are still relevant. It receives approximately 600,000 visitors every year [28]. In contrast, Guadarrama NP is a peri-urban, easily-accessible NP at only 40 min from Madrid by car. Local population around the NP is approximately 150,000, but as many as six million people live within an hour drive from the NP [27]. This results in very high visitation levels, with around 3,000,000 visitors per year [28]. Tertiary economic activities are predominant, whereas primary economic activities are residual.

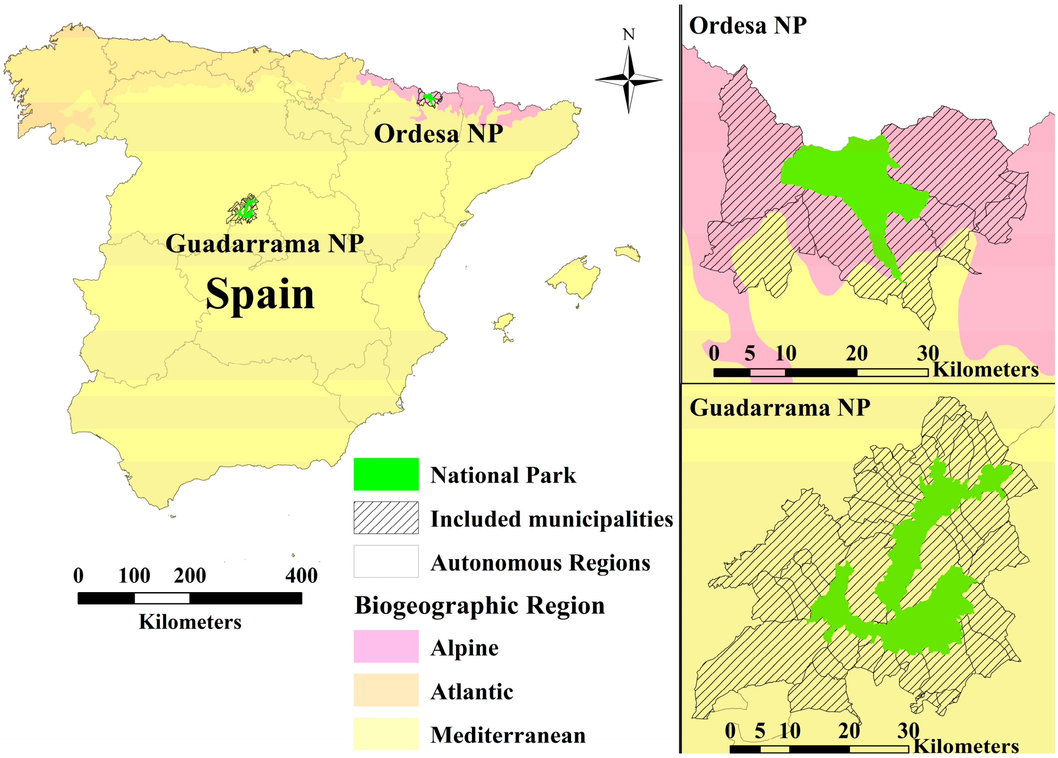


Figure 1. Location of both National Parks in the Spanish regional and biogeographic map (**left**). Perimeters of both National Parks and their conforming municipalities (**right**). Please note that the Canary Islands Region is not showing on the regional map.

Additionally to the resulting common SIAPA indicators, the evaluated NPs' managers were given the chance to identify other case-specific indicators that were most relevant to their respective PAs. Regular phone and/or face-to-face contacts with both NPs' managers were made since 2015 to ensure data provision for the calculation of each indicator. Information exchange with Ordesa NP's managers was frequent, which allowed a nearly complete implementation of the optimised SIAPA in this NP. In contrast, Guadarrama NP's managers stated interest in participating in the project but did not provide us with the required data for evaluation. As a result, only 12 indicators for which other secondary data sources could be retrieved could be evaluated. Thus, the indices of both NPs are mostly calculated from different indicators and compared on the basis of available information for each NP. Evaluations took place between June of 2016 and June of 2017.

3. Results

3.1. SIAPA Optimisation

The templates of the final selection of indicators (n = 22) according to the ratings of the complete set of PA managers and scientists (Supplementary 1) is shown in Supplementary 2. Ordesa NP's managers suggested incorporating to the evaluation of the NP the indicator: 'pasture encroachment by woody vegetation' (Supplementary 2).

3.2. Stakeholder Group Valuation of SIAPA's Indicators and Indices

The SIAPA indices' ratings by PA managers were not correlated with the average valuation of the SIAPA indicators within each index. In contrast, there was a weak, significant correlation between both by the group of scientists ($r_{s(37)}$ = 0.34; p = 0.03). There were no statistically significant differences in index ratings or average indicator ratings between both groups, for the complete set of indices and indicators, and by index. Scientists rated, however, the indicators within State of conservation almost significantly higher than PA managers ($\chi^2_{(1)}$ = 3.73; p = 0.05). The mean valuation of the six partial indices of SIAPA by both stakeholder groups is shown in Table 2.

Table 2. Valuation of the SIAPA indices by protected area managers and scientists (means and standard deviations).

SIAPA Indices	Managers (Mean ± sd)	Scientists (Mean ± sd)
State of conservation	4.91 ± 0.30	4.29 ± 1.25
Planning	4.00 ± 1.00	4.00 ± 1.00
Management	4.27 ± 1.01	4.14 ± 0.90
Socioeconomic context	2.91 ± 1.30	2.71 ± 1.25
Social perception and valuation	3.45 ± 0.93	2.71 ± 1.11
Threats to conservation	4.00 ± 1.10	4.14 ± 1.07

3.3. SIAPA Implementation Results

Summary results on the integrated assessment of Ordesa NP (Table 3) and Guadarrama NP (Table 4) are shown below. Specific results for each indicator and NP can be retrieved from Supplementary 3. 'Pasture encroachment by woody vegetation' was evaluated for Ordesa NP (Supplementary 3) but it was not included in the final effectiveness score of the NP due to its original valuation scale and also on comparison grounds.

Table 3. Summary results from the application of the optimised SIAPA to Ordesa NP.

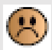
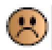
Ordesa National Park				
NP Area (ha): 15,608 Designation Date: 1918 (1982 Re-Classified)	PPZ [1] Area (ha): 19,679 Evaluation Date: 2016–2017			SIZ [2] Area (ha): 89,341 Evaluation: 1st
Index/Indicator	**Value**	**State**	**Trend**	**Evaluation Period**
STATE OF CONSERVATION	0			
Population trends of endangered species or sub-species	2		NA [3]	2012–2015
Changes in the extent of focal habitats	0		NA	2013
Changes in the features for which the PA was designated	0		NA	2012–2015
Visual impact	1		NA	2010
Surface water quality	2		↔	2014–2015
Health of vegetation [4]	1		↓	2012; 2013; 2015
PLANNING	2			
Appropriateness of protection regulation	1		NA	2017
Existence of updated management plan	2		NA	2017
Existence of updated socioeconomic plan	2		NA	2017
MANAGEMENT	1			
Degree of fulfilment of management objectives				
Effectiveness of public participation bodies	2		↔	2012–2015
Existence of sufficient management staff	1		↔	2014–2015
Existence of environmental education and volunteering activities	2		↔	2014–2015

Table 3. *Cont.*

Ordesa National Park				
NP Area (ha): 15,608 Designation Date: 1918 (1982 Re-Classified)	PPZ [1] Area (ha): 19,679 Evaluation Date: 2016–2017			SIZ [2] Area (ha): 89,341 Evaluation: 1st
Index/Indicator	**Value**	**State**	**Trend**	**Evaluation Period**
SOCIOECONOMIC CONTEXT	0			
Local population density	0		↓	2015–2016
Land use changes	1		NA	2006; 2012
SOCIAL PERCEPTION AND VALUATION	2			
Degree of knowledge of the PA	2		NA	2016
Personal importance	2		NA	2016
THREATS TO CONSERVATION	0			
Fragmentation	0		↔	2006; 2012
Density of alien invasive species	0		NA	2016
Density of visitors	1		↓	2014–2015
Activities performed by visitors	0		NA	2016
Climate change	2		NA	1976–2016
Pasture encroachment by woody vegetation [5]	0		NA	2006; 2012
EFFECTIVENESS	**1**			

[1] Peripheral Protection Zone. [2] Socioeconomic Influence Zone. [3] Non-applicable. [4] Trend was calculated comparing the last available data (2015) and the two previous available data (2012–2013). [5] NP's specific indicator.

Table 4. Summary results from the application of the optimised SIAPA to Guadarrama NP [1].

Guadarrama National Park				
NP Area (ha): 33,960 Designation Date: 2013	PPZ Area (ha): 62,687 Evaluation Date: 2016–2017			SIZ Area (ha): 173,632 Evaluation: 1st
Index/Indicator	**Value**	**State**	**Trend**	**Evaluation Period**
STATE OF CONSERVATION	1			
Population trends of endangered species or sub-species Changes in the extent of focal habitats Changes in the features for which the PA was designated				
Visual impact	0		NA	2010
Surface water quality	2		↔	2014–2015
Health of vegetation [2]	1		↑	2014–2015
PLANNING	1			
Appropriateness of protection regulation	2		NA	2017
Existence of updated management plan	0		NA	2017
Existence of updated socioeconomic plan	2		NA	2017

Table 4. *Cont.*

Guadarrama National Park				
NP Area (ha): 33,960 Designation Date: 2013	PPZ Area (ha): 62,687 Evaluation Date: 2016–2017			SIZ Area (ha): 173,632 Evaluation: 1st
Index/Indicator	**Value**	**State**	**Trend**	**Evaluation Period**
MANAGEMENT	1			
Degree of fulfilment of management objectives				
Effectiveness of public participation bodies	1		↔	2015
Existence of sufficient management staff				
Existence of environmental education and volunteering activities	2		NA	2014
SOCIOECONOMIC CONTEXT	2			
Local population density	2		↑	2015–2016
Land use changes				
SOCIAL PERCEPTION AND VALUATION	2			
Degree of knowledge of the PA	2		NA	2016
Personal importance	2		NA	2016
THREATS TO CONSERVATION	2			
Fragmentation				
Density of alien invasive species				
Density of visitors	2		↓	2014–2015
Activities performed by visitors				
Climate change				
EFFECTIVENESS	**0**			

[1] Please, note that effectiveness comparison between both national parks is not straightforward and should be made with care, as different number and type of indicators were often evaluated for each site. Valid comparisons can be made at indicator level and at partial index level (if both indices have the same indicators evaluated). [2] Trend available for plots in the province of Madrid only.

4. Discussion

4.1. SIAPA Optimisation

The 22 indicators in the optimised SIAPA are the most relevant ones to assess PA effectiveness by a relatively highly representative sample of key stakeholders on PAs in Spain. Stakeholder participation in the making of this optimised version of SIAPA is much wider than most similar global initiatives [29]. Eleven of the seventeen regional governments' representatives and the two representatives of the national bodies with some competencies on PAs participated on the managers' side, whereas seven different scientific institutions also provided input. The optimised SIAPA includes all the eight priority indicators from its improved version [15] and 15 of the 28 indicators of the original SIAPA's simplified model, aimed at increasing evaluation efficiency [12]. Fifteen of the 22 indicators of the optimised SIAPA can be currently evaluated using secondary data external to PA administrations in Spain, although some key indicators, such as species', habitats' or other focal features' status cannot. To overcome such evaluation challenge, collaboration between PA managers and scientists is essential in terms of raw data provision but also in terms of processed result return [30,31].

Despite these limitations, our results suggest that a legitimate, credible and salient PA evaluation system can be established in Spain. All the three fundamental criteria to facilitate bridging the science-implementation gap [16] have been substantially improved since the SIAPA's original version [12] by increasing key stakeholder participation. Different PA assessment tools are available in the country [12,15,32,33]. Nevertheless, the fact that PA evaluation is not considered a legal obligation in Spain, with the exception of NPs, and that other more pressuring managerial priorities exist, such as the drafting of management plans for Natura 2000 sites, are likely to still limit the salience of this and any other PA assessment tool [14]. Additionally, insufficient basic data to undertake evaluations, limited institutional interest, reluctance to assessments, and lack of culture on transparency and accountability will also probably hamper the implementation of any sort of external, regular and sound 'environmental audits' in Spanish PAs for some time [13,14].

The different versions of the SIAPA were developed in Spain with participation of Spanish stakeholders. Thus, their implementation will be most salient in Spain and other countries or regions with similar environmental and socioeconomic characteristics (i.e., Euro-Mediterranean countries). In contrast, in countries or regions from different contexts (e.g., tropical or developing countries) some different indicators and/or valuation thresholds may probably be needed according to their own characteristics. Those tailored versions of the SIAPA will increase their legitimacy, credibility and salience by using similar (or, where possible, broader) participatory processes as SIAPAs'.

4.2. Stakeholder Group Valuation Comparison

PA managers and scientists largely agreed on the most and least relevant indices for overall PA effectiveness. For both, State of conservation was the paramount index to assess PA environmental effectiveness, which aligns with mainstream claims [11]. However, they both rated the Socioeconomic context index lowly, in contrast to previous suggestions on its importance for effective conservation [7,13].

Scientists seem to provide more consistent index and indicator ratings or have closer alignment with SIAPA's indicator classification procedures within indices than PA managers. In contrast, the very weak correlation between index and indicator ratings by PA managers suggests either less consistency in their valuations or greater divergence on indicator selection or classification within the SIAPA indices. Lack of agreement on SIAPA indicator classification in indices [15] points to limited consistency in PA managers' ratings of SIAPA's indicators and indices.

4.3. Optimised SIAPA Testing: Effectiveness of Ordesa NP and Guadarrama NP

Ordesa NP scored deficiently in state of conservation and socioeconomic context. However, the poor value of the State of Conservation Index in Ordesa NP is not due to poor indicator values but to absence of data on key conservation features: geomorphological features, air quality and focal habitats. Actually, a crucial state of conservation indicator such as endangered species' population trends shows adequate valuation. Additionally, it is likely that actual values of missing indicators are good, but data are needed to provide evidence of that. Lack of data or existence of inconsistent, poor or outdated data often hamper the fulfilment of PA conservation objectives and the evaluation of PA effectiveness [34,35]. Regarding socioeconomic context, though coarse scale [36] land use-land cover changes remain stable, low and decreasing local population density is changing land management practices and ecosystem composition at finer scales [37,38]. In contrast, Ordesa NP scored positively in threats to conservation, with only two threats showing moderate or high importance. Of those, climate change is likely having the greatest impact on biodiversity in the medium term [39,40] and, opposite to visitor numbers that can be easily regulated, it is a largely unmanageable threat at local or even regional scale [41].

Guadarrama NP scored adequately on socioeconomic context and poorly on threats to conservation, though only one indicator in these indices could be evaluated. Both assessed variables showed opposing trends. Whereas local population density showed low and decreasing figures [27], visitation figures to this peri-urban NP are high and increasing [26,28]. These opposing trends suggest less residential use and rising tourist use in the area, as shown by the large proportion of holiday homes, ranging from 77% to 14% and averaging 51% in the municipalities of Guadarrama NP [42]. Guadarrama mountains have historically been a popular place for recreation [43–45]). Numerous sport and leisure activities were performed in the area before its designation as a NP [43,46,47]. It seems that since its designation as a NP, Guadarrama mountains are attracting more visitors, as it happens elsewhere [48]. Additionally, some massive sport events, such as cross-country marches or bike contests are being organised [49]. Both facts are likely to result in diverse impacts on biodiversity, cultural and geomorphological features [50], and more challenging management, especially in a PA without a management plan to officially regulate such activities yet.

Social perception and valuation was very positive in both NPs. It shows a high identification of residents with each NP which should favour conservation and ease of management [1]. Comparing the effectiveness of both NPs is risky, as different indicators were evaluated for each one, but with the necessary precautions and as guidance, results on effectiveness were better for Ordesa NP than for Guadarrama NP, according to their un-standardised EI's values. This was expected due to the different socioeconomic and managerial characteristics of both NPs. Ordesa NP is a peripheral, geographically isolated NP in which active management has been implemented for a long time [21,22]. It is currently managed by the Environmental Ministry of the Region of Aragon. In contrast, Guadarrama NP is a peri-urban NP with comparatively high residential population density and very high visitation figures [28] in which management of the whole area is very recent and divided between the two regional administrations that share managerial competencies on the NP: Madrid and Castille and Leon. Intra- and inter-administrative inefficiencies are common in Spain and likely affect PA effectiveness [51]. Its peri-urban nature also makes visual impacts in and around this NP more abundant.

Accurate, updated and regularly compiled data on the status of protected biodiversity and other relevant features is a priority task in both NPs, as in any PA [52,53]. In highly pressured Guadarrama NP [47,49], the passing and implementation of a management plan should also be an immediate priority. PA managers and territorial planners could enhance use of existing incentives for municipalities in NPs [24] to help to maintain local population and traditional activities that favour biodiversity [54,55], especially in Ordesa NP. An update of the designation norm of Ordesa NP would be advisable, although the recently passed management plan (2015) facilitates that management is performed according to current information, conservation criteria and practices.

4.4. Study Limitations

Data for evaluating Guadarrama NP were scarce. Collaboration between scientists and PA managers is complex and improvable in most places, making environmental evaluations challenging [16,56]. Spain is not different [13,14]. Thus, the results of applying the SIAPA to this PA were incomplete for four of the six partial indices, and thus its overall effectiveness value can only be regarded as a partial estimation.

Moreover, secondary data used for evaluation are assumed to be sound. Some authors highlight the need to validate raw data to ensure quality for assessments [34]. However appropriate that recommendation is, validating the very high volume and diversity of data used in this or similar evaluations seems beyond the timeframe and cost of usual projects and even beyond the scientific or technical capabilities of the evaluators.

Future studies should explore the use of finer-scale remote sensing data on land uses-land covers, as CORINE Land Cover data [36], despite its pros, depicts too coarse a scale that is insufficient to detect ecologically-relevant, fine scale land use-land cover changes. This limitation likely resulted in unchanging results for some indicators, such as 'land use changes' or 'pasture encroachment by woody vegetation'. Some alternative, finer scale data sources could be SIOSE [57], Spain's Forest Map [58] or SIGPAC [59] for Spain. In Germany, EU's Integrated Administration and Control Systems (IACS) data was used [60]. Bastin et al. [61] advocate the use of Open Source data (Web Map Services or GeoServer) and NDVI data.

5. Conclusions

Successive participatory rounds with key Spanish PA stakeholders, namely PA managers and scientists, have resulted in a highly legitimate and credible, and moderately salient, optimised version of the SIAPA. It is made of the 22 most highly ranked, widely agreed indicators. Greater salience and regular implementation of such an evaluation system or any other system seems challenging without a clear legal mandate in Spain.

The optimised SIAPA could be almost entirely tested in Ordesa NP thanks to collaboration of the NP's staff. In contrast, in Guadarrama NP, lack of collaboration by NP's managers resulted in almost half of the SIAPA indicators not being evaluated. Ordesa NP showed moderate environmental effectiveness, with negative values for 'State of conservation' (mostly due to lack of comparable data for key indicators), and positive values for 'Planning', 'Social perception and valuation', and 'Threats to conservation'. Guadarrama NP scored deficiently in 'Effectiveness', but positively in 'Socioeconomic context' and 'Social perception and valuation', although many indicators could not be evaluated and many partial indices' results are thus estimative. Greater implication of PA managers of the Autonomous Region of Madrid with researchers is a long-lasting [13] and still pending challenge.

Supplementary Materials: The following are available online at www.mdpi.com/2076-3298/4/4/68/s1. Supplementary 1: SIAPA index's and indicator's ratings by protected area managers and scientists, Supplementary 2: Optimised SIAPA's indicator profiles, Supplementary 3: Results by indicator and national park.

Acknowledgments: This paper recognises contributions through the 'sequence-determines-credit' approach. We would like to acknowledge data provision and interpretation support by Ordesa NP's administration staff. We would also like to thank Francisco Fernández Latorre, from the University of Seville, for collaborating in rating the original SIAPA indicator and indices. This study was funded by the Spanish Ministry of Economy, Industry and Competitiveness in the framework of the DISESGLOB project (CSO2013-42421-P).

Author Contributions: David Rodríguez-Rodríguez, Paloma Ibarra, Maite Echeverría & Javier Martínez-Vega collected secondary data for evaluation, rated the original SIAPA's indicators and indices, analysed results and drafted and/or reviewed the article prior to submission. Pilar Echavarría helped to produce some GIS results, such as those on visual impact.

Conflicts of Interest: The authors declare no conflict of interest. The founding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

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