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Federal protected areas management strategies in Brazil: sustainable financing, staffing, and local development

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ABSTRACT

The leading response to environmental challenges has been the creation of protected areas, yet they constantly are jeopardized by problems of staffing, sustainable finance and local development. Documentation of alternative strategies that could enhance success of protected area management is still at a nascent stage. To evaluate such strategies we built an on-line questionnaire to be answered by all Federal protected areas in Brazil. Just 12.8% confirmed and explained the strategies sought. Partnerships seemed to underpin most strategies cited. We believe that the low percentage of managers seeking alternative strategies is a result of the increasing lack of a strong, coherent and comprehensive policy for protected areas in Brazil, which will only change if a new breakthrough on conservation policy is made.

Introduction

Natural resources are under pressure worldwide; loss of biodiversity stands out (Pimm et al., 2014). The leading response to such challenge has been the creation of protected areas (PA). Today, worldwide, 15.4% of terrestrial and inland water areas and 3.4% of oceans are protected, covering a total of 20.6 million km^2 (Juffe-Bignoli et al., 2014). Brazil has the largest PA system in the world; currently, there are 1930 locally-termed as Conservation Units in Brazil that cover 1,513,366 km^2, which represents 17.20% of terrestrial and inland water areas and 1.5% oceanic areas (Ministério do Meio Ambiente, 2015), and 585 Indigenous Lands that cover 1,131,211 km^2 which represents 13.2% of the Brazilian Territory (FUNAI, 2015).

However, while PAs are a well-established tool for biodiversity conservation, on the other hand, they face serious questions as to whether they meet their targets or not. There are several concerns, such as negative changes in conservation status through downsizing, downgrading and degazettement in recent years (Bernard et al., 2014), reduction in game populations inside National Parks (Ogutu et al., 2011) and overuse

of natural resources of Sustainable Use PAs (Peres et al., 2003). This negative scenario raises the urgent need to establish the main struggles of PA management and identify strategies which could bring them closer to targets.

Analysis of effectiveness and its challenges can be used as a good indicator to better understand PA management difficulties. The most widespread of such analysis is the Rapid Assessment and Prioritization of Protected Area Management (RAPPAM) (Ervin, 2003). In Brazil the methodology was applied twice in the federal PAs (2005–2006 and 2010). In the first one, Staffing emerged as the main struggle; in the second, Sustainable Finance was the main challenge (ICMBio and WWF-Brasil, 2015). These results show us that Staffing and Sustainable Finance need a great attention from managers, policy makers and other stakeholders to tackle conservation targets in PAs.

Although not directly addressed in the RAPPAM analysis, a third axis highly important to the effectiveness of PA is Local Development. Scholars have widely reported negative outcomes due to physical and economic displacement of local people imposed by the creation of PA (Adams and Hutton, 2007). Some argue that, to solve these problems, PA managers should seek participative approach and co-management with local communities (Homewood et al., 2013). Therefore, even though there are some contrary opinions (Soulé, 2013), Local Development is a theme that cannot be left out of such discussions.

While the main challenges are more or less understood, on the other hand, the strategies to solve them are not. Legally all PAs in Brazil need to have a management plan for the reserve and an Advisory Board and Deliberative Council set up. Be that as it may, the understanding of strategies being applied in day to day of PA management, the documentation of such achievements, and the key issues faced are still at a nascent stage (Kothari et al., 2013). Moreover, first, even though the literature present us with a variety of possible strategies to better manager a PA according to its specific goals, we do not have a clear idea as to whether it is possible to put them into practice in context of the Brazilian legal and bureaucratic reality. Secondly, although innovative strategies, whether by the adaptation of known strategies in new realities, or creation of new tools, might be applying in the day-to-day management of PAs, have yet to undergo systematic evaluation for the Brazilian Federal Protected Area System.

Therefore, our purpose was to understand alternative strategies of PA management regarding Staffing, Sustainable Finance and Local Development in federal PA answering the following questions: (1) What are the most commons alternative strategies of management brought to bear on these three main challenges; (2) Are there innovative ways of doing it? (3) Do managers of PA seek different alternative management strategies depending on the type of PA and their specific goals?

Material and methods

In order to answer our questions, we used an Internet questionnaire survey. The questionnaire was sent to all 312 Federal PAs in Brazil, and it was available to be answered during 20 days (from July 27, 2012 until August 15, 2012). The questionnaire included closed questions to, first, understand patterns about fixed information (such as PAs' biome and type of category), and open-ended questions to get more broad descriptions of management strategies sought (Bernard, 2006). It was divided into three main blocks: staffing, Sustainable Finance, and Local Development (on-line supplementary material).

We used descriptive statistics to assess the number and frequency of answers. Then, we used content analysis to build categories of responses from the descriptive answers. These categories were set apart on a presence/absence table where we could visualize which mechanisms were sought by each PA. Table S1 clarifies all strategies and categories.

Working from on the presence/absence table of management strategies sought, we investigated whether certain PA types favor some strategies over others according to their goals or not. Thus, we considered each strategy as a variable and ordinated it using a Non-Metric Multidimensional Scaling (NMDS). We tested goodness of fit, first, through a Scree Plot of different stress values of models with one, two, three, four, and five dimensions (Wickelmaier, 2003). The results showed that two dimensions model had the best model fit; secondly, we built a Shepherd Diagram based on two dimensions model which showed a low points dispersion confirming its goodness of fit (Fig. S1). Using both the dimensions of the NMDS analysis as the dependent variables and the PA types as the independent variables, we applied a Multivariate Analysis of Variance using Pillai's Trace as a post hoc test to verify if the types and quantity of management strategies sought by PA of Sustainable Use and Strictly Protected were significantly different.

Results

We obtained 125 responses from Federal PAs in Brazil, representing 40% of the total. Just 40 (32%) of the 125 responses explained the alternative management tool applied, which represented 12.8% of the total federal PA in Brazil. Table 1 lists all the strategies, showing the total number and frequency of each one and Table S1 explains them.

The alternative management strategies sought by Strictly PAs and Sustainable Use PAs did not show a significant difference ($F = 0.25$; $p = 0.61$) (Fig. 1). Our results suggest that managers do not strengthen a group of strategies over another according to the type of Protected Area they are running.

Discussion

Different biomes and types of protection were roughly equally represented in our analysis. The distribution of Federal PA in our sample among the different biomes: Amazon, Atlantic Forest, Cerrado, Caatinga, Pantanal was 32%, 32.8%, 12%, 8%, and 0% respectively and the real distribution is 38.1%, 31.8%, 14.6%, 7.8%, and 0.06% (Ministério do Meio Ambiente, 2015) respectively on the same order. The percentage of PA of Sustainable Use and Strictly Use in our sample was 48% and 52% respectively; the real distribution is 55.3% and 44.6% respectively on the same order (Ministério do Meio Ambiente, 2015). We faced

Table 1 – Number of times each strategy was cited by managers of federal protected areas in Brazil to solve challenges in staffing, sustainable finance, and local development.

Mechanism	Partner	Number	Frequency (%)
Staffing			
Training		11	27.5
Management focused on results		21	52.5
Exchange of staff	Public institutions	21	52.5
	Protected areas	3	7.5
	Civil society	10	25
Hiring new employees through projects		3	7.5
Volunteers		9	22.5
Sustainable finance			
Environmental compensation		7	17.5
Tax refund		1	2.5
Endowment fund		1	2.5
Tourism		4	10
Capitalizing services	Public institutions	8	20
	Conservation units	2	5
	Civil society	3	7.5
Capitalizing Goods	Public institutions	3	7.5
	Civil society	4	10
Local development			
Conservation unit's jobs		10	25
Income generation through natural resources		18	45
Environment education		32	80
Empowering local associations		12	30
Scientific research		8	20
Participatory monitoring		2	5
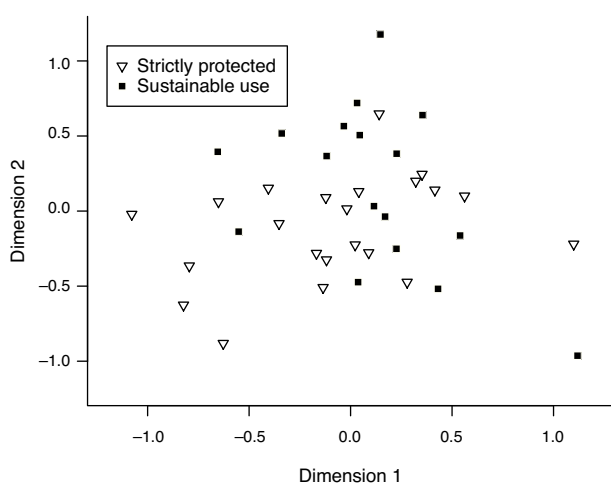
Fig. 1 – The two dimensions of the NMDS analysis illustrating the variance between the two types of protected areas.

overrepresentation from Marine and Coastal PA; which in reality account for just 0.5% of the total PAs, yet in our sample represented 15.2%. Even facing this one overrepresentation, we believe that we were able to capture a fair cross-section of alternative management strategies from the different parts of Brazil and types of PAs, avoiding possible bias such as local needs that are not important from a national perspective.

In the questionnaire, the small percentage of managers that pointed out yes for alternative management and explained it (12.8%) rise the question whether this small number is due to the bias of the internet questionnaires, which is known that people tend to not spend too much time answering it (Bernard, 2006), or if just roughly 12% of the managers indeed sought alternative management strategies. We believe there is a mix of both, but it can be said that there are few managers seeking alternative management tools.

Within the descriptive answers, partnerships and a greater approximation with other stakeholders seemed to underpin most strategies cited. The crucial advantage of this strategy is in the synergies that can be achieved by combining the strengths of each partner (Kothari et al., 2013). In our survey, managers supported those ideas, as described by a manager regarding Staffing, "*through partnerships with universities and other institutions we had the participation of 93 researchers who helped in the evaluation of PA' Management Plan*". Or in the answers given to solve Sustainable Financing Challenges, in which most of them were related to capitalization of services and goods, both strongly dependent on a closer approximation with surrounding stakeholders.

This approach emerged as especially important with respect to Local Development, as described in hereafter "The selection process for the firemen in the PA is directed exclusively for people who live in the surroundings of the PA... the result is a reduction in the index of deforestation, fire, poaching inside and outside of the PA". Among the strategies related to participation environmental education stood out as the most cited management strategy. The mechanism included activities from bringing schools to visit the PA to talks and courses about the importance to protect the environment within reserves.

It is important to note that, although we saw partnerships incorporating most of strategies cited, our answers, as already

discussed, represent little more than roughly 12% of the PAs. In the most PAs, authors have been showing that the majority of the actions are still built on a command and control basis despite the existence of some national laws endorsing partnerships for the management of PAs (e.g. law project number 4573/2004, Regarding co-management in PA) (de La Mata and Riega-Campos, 2015). Therefore, even though managers' answers showed that partnerships are crucial to face challenges in the PA management, they still need a great support from government, civil society and other stakeholders to become widespread all over the PA national system.

Some strategies were not very often cited in the survey; however, they are worth describing due to their very positive impact on the management of PA. On the Local Development axis, we highlight participatory monitoring or citizen science initiatives. This approach of engagement through biological monitoring is presented as an effective way to understand the systems and rules that dictate the use of resources and management needs (Costa and Marchand, 2014). Even though just two PAs cited this strategy, we believe it is rapidly spreading to other now it is already happening in several state PA in the Amazon (Costa and Marchand, 2014).

On the Sustainable Finance axis, first we highlight ICMS – Ecológico, which is return of part of the Goods Circulation Tax to the municipality to incentive environmental activities calculated based on the proportion of the municipality that is protected for conservation purposes. However, its application management of PAs depends on political priorities at the municipality and on the negotiation power of the manager as described hereafter "there is an Intermunicipality Consortium for environment themes (CORIPA) in the region. Even though there was never signed a formal agreement for this partnership, the Coripa gives several small grants to the Unit coming from the ICMS – Ecológico". The second one was the endowment fund. This is a type of trust fund set up in a way that just the interest of the money is used, which gives an *ad eternum* characteristic for the resource. However, although common in several countries, in Brazil there is no local legislation that promotes that strategy, which reduces the chances of its being replicated (Lanna, 2012).

Different from the expected result, certain PA types do not strengthen a group of strategies over another by virtue of their goals. Hence, even though there are some legal differences between strictly and sustainable use PA regarding management strategies, such as the use of natural resources is just legally permitted in PA of sustainable use, when looking at the group of actions sought, there is no such difference between one another. We tend to believe that this result is closely linked with the low frequency of managers who pointed out alternative management strategies (roughly 12% from the total). In the recent decades the Brazilian National System of PA have been facing an increasing lack of a strong, coherent and comprehensive policy. For instance, funds designated to the management of PA remained almost unchanged, on the other hand, the area protected has sharply increased, which led to a funds/hectare ratio decrease of roughly 40%; moreover, changes in PA status have been more evident in the recent years, especially after 2007; even though there was an increase in the total area protected, up to date 5.2 million hectares of PA were degazetted or downsized in Brazil (Bernard et al.,

2014). This pessimistic scenario leads the PAs to a situation in which alternative management strategies are more related to serendipity, good opportunities and personal will of each manager than a toolbox that he/she can choose depending on the goals of the PA.

To conclude, PA is the main action of conservation biology and probably it will continue to be; however, there will need to be a great change on investment and a breakthrough on policy for conservation to be successful.

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgments

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.ncon.2015.05.003.

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