Chapter

TOURISM ATTRACTIVENESS INDEX OF PROTECTED AREAS OF BRAZIL *

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ABSTRACT

Recreation opportunities are formed by four elements: visitors searching for *recreation activities*, in *particular settings* to have *experiences* that lead to *benefits*. The notion of Recreation Opportunities is the core concept of the framework Recreation Opportunity Spectrum (ROS). The purpose of this chapter is to apply ROS to develop a Tourism Attractiveness Index of protected areas (PA) in Brazil. ROS works with indicators of three different attributes: physical, social and managerial. The chapter adapted indicators for each of these attributes for the Brazilian reality. However, visitors also consider other factors outside PAs when deciding their destination. To address this factors, a new dimension of external physical, social and managerial attributes was also developed. The federal protected area (PA) system of Brazil encompasses 76 million hectares divided into 326 units of which 71 are designated as national parks and 65 as national forests. The chapter collected data from 94 national parks and forests to present a panorama of different recreation

opportunities offered in Brazil based on PA's internal and external settings. The internal indicators considered were natural and cultural variety, scenic attractiveness, activities, density, facilities, services, staff, budget, internal access, land tenure and regulations. The external variables considered were regional attractions, access, hospitality establishments, socioeconomic context, and population density. The results present a general classification of recreational opportunities for Brazilian PAs. The classification can assist decision makers and managers to define visitors' profiles, allocate resources, prioritize investment, and ensure conservation and sustainability for the system.

INTRODUCTION

Brazil is a continental nation containing various ecosystems and mega biodiversity. The natural beauty is so inherent that the country is considered the most competitive tourism destination in the world in the category of natural resources (Crotti and Misrashi 2015). Even though the most beautiful natural landscapes are located inside protected areas (PA), the country receives a comparatively small volume of tourists. In 2015, PAs of Brazil received 8 million national and international visitors in an total area of 79 million hectares (ICMBio 2016). This territory is more than double the area managed by the North American National Parks System, which received around 300 million visitors at the same year (Cullinane and Koontz 2016). To maintain visitation growth, Brazil needs to better understand the dynamics of the tourism industry within the context of PAs. For example, why do some PAs receive high volumes of visitors while others remain unknown? Do the settings and activities offered by each area, influence visitors choices? How the destintation where the PA is located also influence visitors demand?

The IUCN states that: "All protected areas should also aim, where appropriate, to deliver recreational benefits consistent with the other objectives of management" (Dudley 2008, p. 11). To provide these benefits, PAs use the concept of classes of recreational opportunities or zones originated from a framework called Recreation Opportunity Spectrum (ROS) (Brown, Driver and McConnell, 1978; Clark and Stankey 1979; Driver and Brown, 1978) Over the years, ROS concepts were incorporated into most important visitors management systems (Stankey et al., 1985; Graefe, Kuss and Vaske, 1990; Brown et al., 2009). ROS states that recreation opportunities are derived from activities in different settings. These settings have three different attributes: physical, social, and managerial (Manning 2011, pp. 11-22). From the attributes combinations, visitors have different experiences, which turn into benefits for individuals, communities, environments, and economies. Understanding the

relationships between the various settings with different activities is strategic for an adequate analysis of recreation opportunities (Aukerman and Associates 2011). Based on a recreation plan, the territory of a PA is divided into different classes or zones to offer these different possibilities. The same principle can be used at system level, where different PAs are managed to offer specific recreation opportunities (Brown et al., 2009).

The initial ROS model only considers physical, social and managerial attributes within the PAs without taking into account the external setting of the tourist destinations. However, a site is considered by visitors within the larger context of a destination and is evaluated based on its tourism attractiveness (Formica & Uysal, 2006). The concept has been widely used to classify destinations, and has also been applied within the context of protected areas (Choi, 2012; Deng et al., 2002; Lee et al., 2010). Studies have found that the number of visitors is correlated to external settings of the PAs (Souza 2016; Nervonen et al., 2010; Puustinen et al., 2009) as well as internal settings (Hanink and White 1999; Hanink and Stutts 2002; Loomis 2004). The decision to travel is determined by attributes located inside a PA (i.e., type of landscape, facilities, services) but also for attributes located outside (i.e., distance, access, regional infrastructure) (Viveiros de Castro, Souza and Thapa, 2015). Determining the relative importance of each of these attributes is considered the most critical aspect to develop a tourist destination (Hu and Ritchie 1993).

Analyzing attractions and supporting attributes, Lee, Huang and Yeh (2010) highlight that the primary objective of visitors is always to appreciate the natural and cultural attractions. However, Puustinen et al., (2009) noted that PAs that provide better recreation services related to activities attract more visitors. Hanink and Stutts (2002) found that site location is an essential factor related to the volume of visitation. PAs with greater demand potentials are situated closer to larger population centers. Population distance is critical because the travel cost to the PA determines the lower and upper limits of potential demand. Deng, King and Bauer (2002) also identified that besides natural resources, accessibility is a critical dimension of a destination. Moreover, Lee, Huang and Yeh (2010) include the provision of catering and accommodation as decisive attributes that work together with external access.

Therefore, a new external setting of physical, social and managerial attributes was further developed to expand the analysis of recreation opportunities within the perspective of a tourist destination (Souza 2016; Viveiros de Castro, Souza and Thapa, 2015). The external setting was first proposed by Viveiros de Castro, Souza and Thapa (2015) with national parks of Brazil, where was demonstrated that tourism demand in the areas were internally correlated to reputation and recreation facilities; but also externally linked to attractions in the region and population density.

The present paper uses the ROS physical, social and managerial attributes to inventory and determine main classes of recreational use at the

system level for federal PAs of Brazil. The purpose is to develop a tourism attractive index including internal and external settings. The objective is to establish metrics to plan and monitor progress in outdoor recreation opportunities for the entire system. ROS was developed by managers for managers, and due to its simplicity, pragmatic, and replicable approach (McCool, Clark and Stankey, 2007), is especially adequate for Brazilian PA system that suffers from a historic deficit of personnel and budget.

METHODS

Sample

From the 8 million visitors in 2015, national parks and forests received 93% of total. The research collected data from 58 national parks (NP) and 36 national forests (NF) managed by the federal agency Chico Mendes Institute for Biodiversity Conservation (ICMBio). From the 94 PAs of the sample, 62 reported visitation in 2015 (Souza, 2016). PAs managers answered questionnaires sent via the survey software Qualtrics. Data collection was supplemented with secondary sources from ICMBio's internal documents (i.e., management reports), other government databases and internet (Google Search and TripAdvisor). Data collection were structured to be a cost-effective tool for monitoring visitor use. The use of social media as a source of information within the tourism academic discipline has been found to be a reliable alternative as it is more practical and less costly than primary field data (Wood et al., 2013). The variables, described below, were based on previous research from Viveiros de Castro, Souza and Thapa (2015).
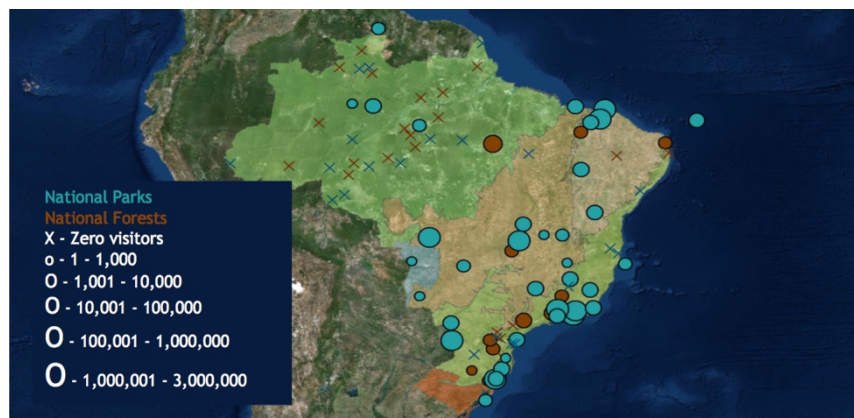

Figure 1. Visitation demand in the 62 national parks and forests of Brazil included in the sample.

Data and Variables

A resource classification system based on the ROS attributes (physical, social and managerial) was developed to group the protected areas by primary vocation. Internal and external attributes were designed to address the PAs within a tourist destination as in Viveiros de Castro, Souza and Thapa (2015). The indicators in each attribute were indexed in a 5-point scale, summed and divided by the number of variables to classify each site.

The internal physical attributes (Table 1) are comprised of natural/cultural variety (number of different landscapes, waterscapes, and cultural expressions) and scenic attractiveness. The internal social attributes encompass a variable that represents the diversity of recreation and sports activities (e.g., trekking, climbing, diving, cycling, etc.) and crowding. The internal managerial attributes include variables that focus on recreation facilities (e.g., lookouts, parking lots, visitor center), visitor services (e.g., guides, concessionaires), staff number, budget in 2015 and internal access (kilometers of trails, unpaved and paved roads), planning tools (e.g., management documents, outdoor recreation plan) and land tenure (percentage of government's ownership).

The variables within the external setting (Table 1) consider regional characteristics that can influence visitation. The physical attributes consist of attractions in the region based on the location of the PAs. Meanwhile, the social attributes evaluate public in potential. To estimate day use area, a buffer zone of 100 km around the PAs was used; on the other hand, the socio-economic context was verified through average human development index (HDI) of the gateway community. Information about the regions and population were collected from georeferenced databases of ICMBio, Brazilian Institute of Environment and Natural Resources, Ministry of Transport, and Brazilian Institute of Geography and Statistics. Additionally, access conditions were evaluated through time distance from the closest commercial airport. Data were processed in SPSS, ARCGIS and Numbers Spreadsheet (Kil and Confer, 2005). For the managerial category, information was compiled from the TripAdvisor website for the respective locations, counting accommodations and restaurants in "Things to do".

Table 1. Operationalization of variables

Attributes	Description	Data source
Internal Setting		
Physical Attributes		
Natural/ Cultural Variety	Number of different landscapes within the PA (mountain, beach, falls, etc.)	PA managers
Scenic Attractiveness	Number and origin of citations of the PA's name and most important attraction (log)	Google search engine
Social Attributes		
Diversity of Activities	Number of recreation and sports activities offered (trekking, climbing, cycling, etc.)	PA managers
Visitors Density	PA area (km^2) / (number of visitors/year) (log)	ICMBio database
Managerial Attributes		
Recreation Facilities	Number of structures offered (lookouts, parking lots, visitor center, etc.)	PA managers
Visitor Services	Number of services provided by the PA or concessionaires (transport, food, etc.)	PA managers
PA Staff	Number of PA staff	PA managers
PA Budget	One year budget spent per PA	PA managers
Planning Tools	Number of management documents that the PA already produced and updated (General Management Plan, Outdoor Recreation Plan, Interpretation Plan, etc.)	PA managers
Internal Access	Kilometers of internal roads and trails	PA managers
Land Tenure	Percentage of the PA owned by the government	PA managers
External setting		
Physical Attributes		
Regional Attractions	Number of tourist attractions in the region where the PA is inserted measured through the number of "Things to Do" of the gateway communities (log)	TripAdvisor website
Public Access	Travel time from nearest commercial airport (log)	Google maps

Social Attributes		
Socioeconomic context	Average Human Development Index - HDI of the municipalities included in the 100km buffer zone	Brazilian Institute of Geography and Statistics and Ministry of Transport
Population Density	Number of citizens living in municipalities included in a buffer zone of 100 km around the PA (log)	
Managerial Attributes		
Hospitality Establishments	Number of lodging and restaurants mentioned for the gateway communities (log)	TripAdvisor website

Data Analysis*

The indicators in each attribute were indexed in a 5-point scale. The Natural Breaks optimization method was used to divide the PAs into the 5 groups (Jenks, 1967). For logarithm transformed variables, classes were divided based on standard deviation of the mean. For each indicator, PAs received a score for between 1 and 5. For each internal and external attribute, PAs were classified summing all indicators scores and dividing by the number of indicators (e.g. physical attribute score = natural variety score + scenic attractiveness score / 2). The three internal scores (physical, social and managerial) summed and divided by three, composed the overall internal score and the same three external scores summed and divided by three, composed the overall external score. The internal and external scores summed and divided by two, formed the final score. The PAs' scores defined their internal, external and final classification (1 - primitive, 2 - semiprimitive, 3 - extensive, 4 - intensive and 5 - highly intensive).

To facilitate the understanding among Brazilian managers, the names of the classes of recreation were based on the zoning system for national parks in Brazil (IBAMA 2002).

Based on the indicators, a general internal and external profile of each class is presented in Figure 6. General descriptions provide a picture of the class of recreational use. They offer an easy way to identify the attributes expected in each class. The descriptions and indicators also support periodic evaluation of the development of recreation opportunities within the areas (Brown, Driver and McConnell, 1978; Driver and Brown 1978; Brown et al., 2009; Aukerman and Associates 2011; Cocklin, Harte and Hay, 1990; More et al., 2003).

RESULTS

Internal Setting Classification

Considering the internal physical attributes, PA managers identified 25 categories of natural attractions and 11 man-made attractions. Few PAs

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* To test the practicability of the classes systematization, a statistic test, one-way ANOVA, was conducted comparing number of visits between the different classes. Check chapter 2 of the PhD dissertation that originated this text for more information (Souza, 2016).

reported just one and Serra da Bocaina NP informed the largest number (16). On average, PAs reported six categories of attractions. The five most common attractions were: Forest (73%), Rivers (67%), Waterfalls (48%), Geological Formations (42%), and Cultural Heritage (39%). The scenic attractiveness variable demonstrated that some Brazilian PAs are only cited within their own state while others are known internationally. Overall, no PA was classified as primitive, 31 as semi primitive, 32 as extensive, 21 as intensive and ten as highly intensive.

Regarding internal social attributes, managers identified 58 different activities (e.g. hikking or swiming) that are currently happening in PAs of Brazil. Lençóis Maranhenses NP with 26 and Jericoacoara NP with 25 were the areas who informed the greatest number of activities. On average, PAs that receive visitors reported having ten different activities. The 5 most common activities were: 1 - Walk up to half day (up to 5 miles round trip), 2 - Contemplation, 3 - Photographing / Filming, 4 - Educational / school visit, 5 - Observation of fauna and flora in general. The average of internal social attributes grouped 25 PAs in primitive use category, 33 in semiprimitive, 24 in extensive, 10 in intensive and only 2 in highly intensive.

The internal managerial attributes include many aspects of PAs management. While 13 PAs reported having no facilities, on the other hand, Tijuca NP (18), Serra da Capivara NP (17), and Itatiaia NP (17) were the ones with the greatest number of structures. On average, the PAs who reported having facilities had six different infrastructures. Regarding service, the analysis found that 30% of PAs offer some kind of commercial services to the public. Guidance is the most common, followed by internal transportation, eating, and lodging. The results included 9 PAs as primitive, 36 as semiprimitive, 39 as extensive, seven as intensive and two as highly intensive.

Summing the three internal attributes, the overall classification was: 6 PAs were considered primitive, 40 semi primitive, 38 extensive, nine intensive and one highly intensive (Figure 2). For a detailed description of the settings parameters, see Souza (2016).

External Setting Classification

External physical attributes evaluate the natural/cultural attractions and physical access to the destination. Iguaçu NP, for example, was classified in a highly intensive destination. It is located within a city with an extraordinary number of other attractions and easy airport access, on the other hand, primitive class PAs are located in very remote areas where the park or forest is the only attraction and access is very difficult. The results show 15 PAs as primitive, 29 as semi-primitive, 27 as extensive, 17 as intensive and only six as highly intensive.

External social attributes measured the size and quality of potential day use visitors. The highly intensive PAs, as Serra dos Órgãos and Ipanema NF, are located in dense and well-developed regions; on the other side, the semi-primitive PAs, as Monte Roraima NP and Capivara NP, are located in undeveloped regions with low HDI and small population around. Considering the average of both attributes only one was considered as primitive, 18 as semi-primitive, 39 as extensive, 28 as intensive and eight as highly intensive use.

External managerial attributes look at how prepared the gateway communities are to receive tourists. The city of Rio de Janeiro (RJ) and the city of Brasília (DF) have the greater number of establishments of accommodations and meals, therefore Tijuca NP, Brasília NP, and Brasília NF were classified as the highly intensive class. On the other hand, the primitive class PAs such as Tapajós NF in the city of Belterra (PAs) and Sete Cidades NP in the city of Brasileira (PI), are located in municipalities with very limited structure to support tourist demand. The external managerial attributes grouped 20 PAs in primitive category, 25 in semiprimitive, 28 in extensive, 18 in intensive and only 3 in highly intensive (Figure 2).

Summing the three external attributes, the overall classification was: 6 PAs were considered primitive, 33 semiprimitive, 34 extensive, 18 intensive and three highly intensive (Figure 2). For a detailed description of the settings parameters, see Souza (2016).
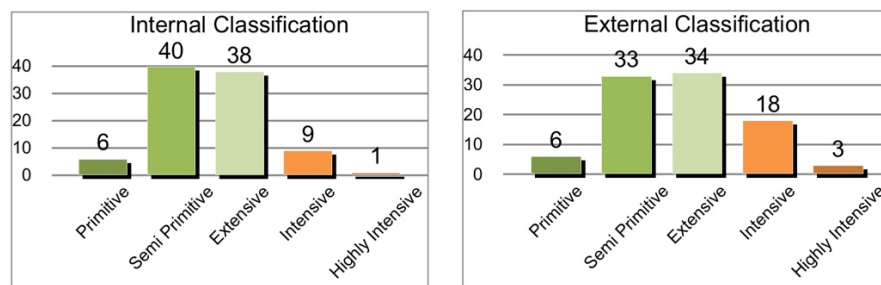
Figure 2. Overall Internal and External Inventories Compared.

Figure 2 compares the overall internal and external settings for all PAs. In both settings, semi primitive and extensive are the predominant classes in the system. Comparing the overall internal and external settings, the external one has more than double the number of intensive and highly intensive PAs than the internal setting. However, even if the class distribution offers some similarity, when you compare settings, half of the PAs present different internal and external classification.

Overall Final Classification

Final classification presents semi primitive (42%) and extensive (45%) as major categories similar with internal and external classes. The final classification has the lower number of highly intensive and intensive areas than the internal and external inventories. The reason is the unbalance between the overall internal and external classification causing the areas to have a final lower class of use. Considering the average of internal and external settings, final classification presents five primitive PAs, 39 semi-primitive, 42 extensive, seven intensive and only one highly intensive.

Figure 3 shows the final geographical inventory of recreation classes of use. Five of the eight more developed area are located in Southeast of Brazil, the region that concentrates the biggest cities and most of Brazilian population. On the other hand, the Amazon region (33 PAs) has only 4 PA classified as extensive category and none intensive or highly intensive.
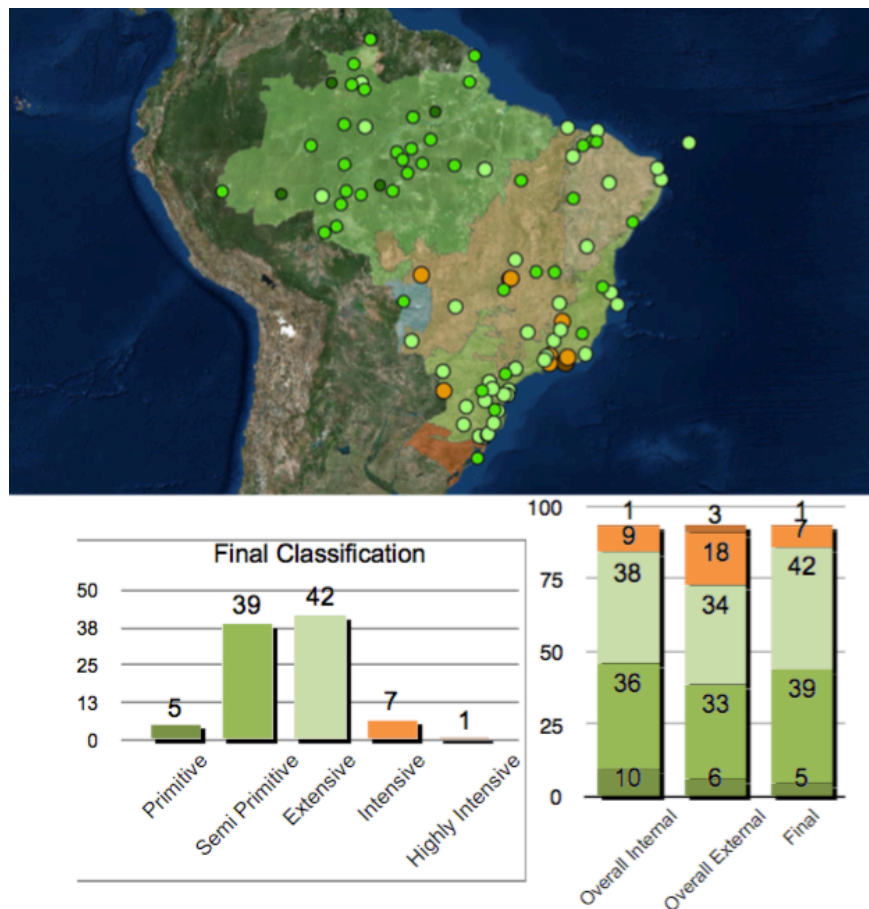

Figure 3. Overall Visitation Classifications of use for Brazilian PAs.

Figure 4 shows how much area and visitors is contained in each recreation class of the Final Overall Classification. The column Area-Mean demonstrates that the average size of PAs in the sample diminishes from primitive to highly intensive. The contrary happens with number of visitors (Visits-Mean) and visitors per hectare that increase from semi primitive to highly intensive. They also show that 39% of all visitation occurs in the highly intensive PAs or 0.01% of the total area. If we sum highly intensive and intensive, 73% of all visitors use 2% of the systems area.

Classes	PAs	Area Mean (ha)	Area Total (ha)	% Area Total	Visits Mean	Visits Sum	% Visits Total
Primitive	5	761,530	3,807,652	15%	0	0	0%
Semi Primitive	39	441,545	17,220,284	67%	5,361	209,091	3%
Extensive	42	99,869	4,194,511	16%	42,108	1,768,532	24%
Intensive	7	58,001	406,013	2%	365,685	2,559,797	34%
Highly Intensive	1	3,958	3,958	0.01%	2,945,355	2,945,355	39%

Figure 4. Variation of Area and Visitors per Final Classification

Description of the Tourism Attractiveness Index

General internal and external descriptions of each class were developed to facilitate the identification of existing and new PAs (Figure 6). The description of each class was also validated by the author's experience with a large set of the PAs. The table is useful to communicate the concepts developed in this chapter and to facilitate classification and planning of protected areas. To facilitate knowledge dissemination, a visual table was also developed (Figure 5).
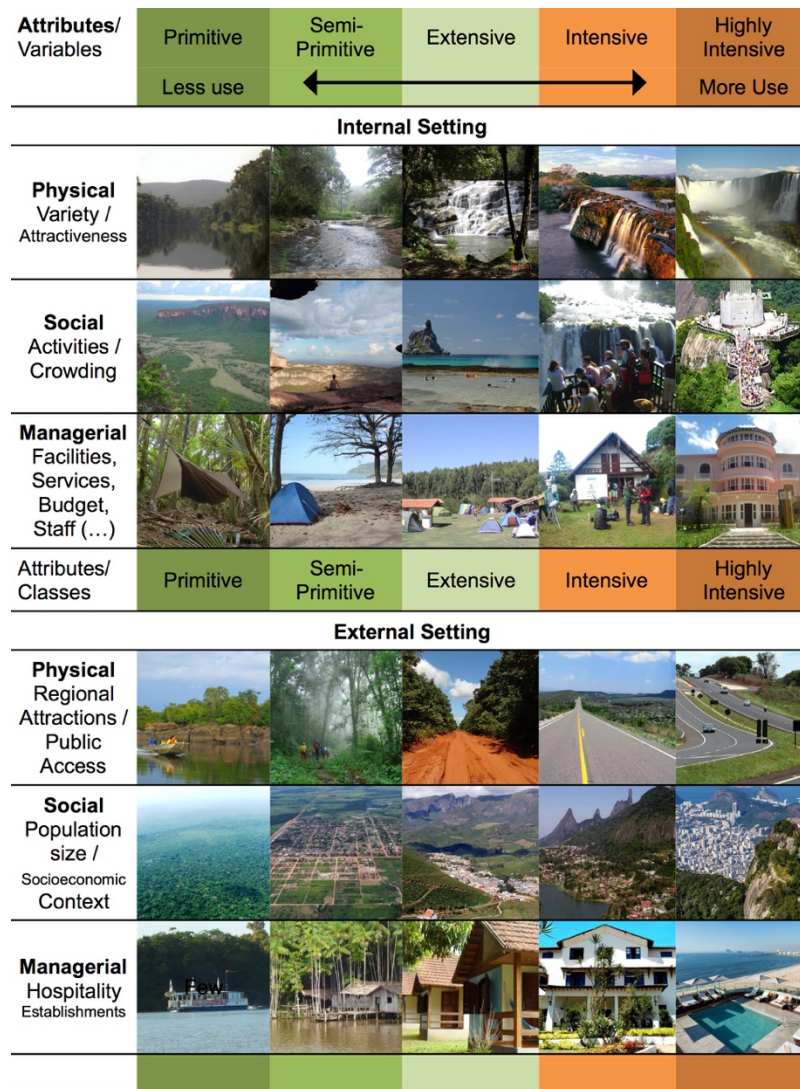
Figure 5. Visual Presentation of the Tourism Attractiveness Index

	Internal	External
Primitive Use	PAs are normally very large and remote with a high degree of naturalness and integrity of ecological processes. When local communities are present, they maintain traditional methods of livelihoods. There is no evidence of tourism and encounters with other visitors are rare. No infrastructure is offered, and users should follow "leave no trace" techniques.	The region is not a tourist destination and offers almost no infrastructure. Access normally is difficult and requires a flight and an off-road drive or boat ride for more than four hours. Visitors are limited to locals or expeditions of high skilled and educated researchers or ecotourists that require no assistance.
Semi Primitive Use	PAs are large and remote with high degree of integrity of natural processes and may have resources management by local communities, which can compose attractions for visitors. There is little evidence of tourism, and encounters with other visitors are seldom. Opportunity for solitude, autonomy, navigation, and challenge. Internal access is usually by foot or rustic unpaved roads. Besides rustic signed trails and undeveloped campsites, there is almost no infrastructure or services available. Visitation requires appropriate equipment, field skills or a guide and should follow "leave no trace" techniques.	The region is a small destination or nearby a small city. Offers very basic tourist infrastructure such as few lodging and restaurants options, small grocery stores, and few gas stations. Access normally is difficult and requires a flight and drive for more than two hours generally on unpaved roads. Visitors are ecotourists that plan ahead and come specifically for the PAs.

Extensive Use	Presence of human activity is more evident including sustainable use of resources (in NF). Landscape may contain a mixture of natural and cultural features offering attractions at regional level. PAs offer more well-marked trails or better managed unpaved roads. Although there are opportunities for privacy, meetings and interaction with other users, staff, locals and traditional communities are more frequent. Management capacity focuses on conservation but also recreation opportunities. Basic infrastructure is offered at designated sites, like rustic visitor centers, campgrounds, restrooms, etc.	Regional tourist destination or nearby a medium city. Offers some tourist infrastructure such as lodging, restaurants and snack bars, grocery stores, and gas stations. Sometimes there are tourism agencies or regional hospital. Access normally requires a flight and drive between one to two hours on paved or unpaved roads. If the PAs is a premium attraction, visitors come for a few days; otherwise, they are in the area for other interests or are local day users.
Intensive Use	Landscape contains a mixture of natural and cultural features offering excellent variety and attractiveness at national level, or even for international demand. Internal access via well managed unpaved roads but mostly on paved ones and well-designated trails. Developed visitor centers, exhibits, interpretative trails. Recreation is one important mission of the PAs, and more attention is given to the quality of the experience, safety of visitors and management of sensitive areas. There is a good variety of activities and services offered. Increases the possibility for more meetings and interaction.	National destination or nearby a large city. Destination is usually in the most developed and high-density areas of the country and offer very good tourist infrastructure such as: lodging from one to five stars, great variety of restaurants, grocery stores, gas stations, tourism agencies, hospitals, etc. Agencies sell tourism packages nationally for the destination. Access is easy and fast through airports and duplicated roads. Tourists come from all over the country, from different ages and profiles. PA can be the primary or secondary attraction in their travel, and local day users are common too.

Highly Intensive Use	PAs that are Brazilian icons known worldwide. Landscape contains a mixture of natural and cultural features offering excellent variety and attractiveness for national and international visitors. Internal access happens on paved roads and well designated trails. Infrastructure is designed and suitable for heavy intensive use and provides developed visitors centers, exhibits, and interpretative trails. Visitation is one management priority with more attention to the quality of the experience, safety of visitors and management of sensitive areas. A good variety of activities and services are offered. Meetings and interaction happen all the time and visitor may experience some crowd situations.	Region is a consolidated international destination, usually located in the most developed and high-density areas of the country. The destination offers complete tourist infrastructure such as lodging from one to five stars, great variety of restaurants, grocery stores, gas stations, tourism agencies, hospitals. Agencies sell tourism packages internationally. Access is easy and fast through international airports and duplicated roads. Tourists come from everywhere, from all ages and every profile, and local day users are common too. The PA is one of the main attractions, but the destination has a wide range of options.

Figure 6. Description of the Tourism Attractiveness Index

DISCUSSION

The research developed a Tourism Attractiveness Index for the federal PAs of Brazil. The methodology provides a picture of the actual status of the PA system while managing 8 million visitors and provide indications of how to offer a wider spectrum of recreation opportunities. It is important to note that just the increase of visitors numbers is not the objective, it is also important to provide quality experiences and promote conservation. Taking this in consideration, this extended ROS approach offers an useful framework to strategically decide what attributes need more investments or which PAs have more demand potential.

Highlighting a few situations that the tool identify, internal attributes are a case to be analysed. Regards to the physical attributes, PAs are skewed towards more demanding classes with 31 classified as intensive and highly intensive use, however, the same thing does not occur on the social and managerial attributes where PAs are more concentrated in less demanding classes. PAs as Chapada Diamantina and Emas NPs have outstanding physical attributes but do not offer enough activities, facilities or services to achieve their full spectrum of recreation opportunities. In general, few PAs have social and managerial conditions to fulfil their potential for tourism. The pattern is different for the external attributes

where there is a greater balance between physical, social and management attributes. Tourist destinations enterprises are not strictly regulated by the government as PAs, which depends of the agency capacity to develop facilities and services. The private sector is more independent to develop business and other attractions in the region.

Comparing the overall internal and external scores, the external one has more than double the number of intensive and highly intensive PAs than the internal setting. ICMBio should give special attention for PAs where the internal or external classification differs from the final class. Some of those PAs are still undeveloped but are located in strategic tourism destinations. Brasilia NF and Itajaí NP represent cases where internally the PAs lack from activities, facilities, and services but externally, the areas are located in consolidated tourist destinations such as the cities of Brasília (DF) and Blumenau (SC), respectively. These PAs basically need internal investments from ICMBio to increase visitation. Internally undeveloped sites located closer to high-density areas should receive more investments due to their high potential to increase visitation influx (Clawson and Knetsch 1963). It is an opportunity to promote outdoor recreation and conservation awareness with a relatively low effort, taking advantage of an already structured destination.

On the other hand, Serra da Capivara and Monte Roraima NP are examples of PAs that are better scored internally than externally. Monte Roraima is an outstanding and well-known natural landscape but totally isolated. This NP has a high degree of difficulty, requiring several days of heavy trekking to reach the summit and its use is targeted to very specific visitor segment. The development of the park and the region should be planned carefully not to compromise the visitor's experience and may not represent great benefit if the development of the region and access are not considered. Serra da Capivara, in turn, is also a remote destination with the worst Human Development Index (HDI) of the country but is a very important archeological site with excellent internal infrastructure. This NP is an outstanding destination *per se* and can be a vector of development for a whole region with an effective plan of marketing and easy and faster access possibilities. However, these areas should be carefully planned considering external variables such as access, infrastructure and other attractions in the region, otherwise, internal investments will be wasted due to low visitor demand. These situations need more complexes political arrangements to develop the entire region and support the tourism growth.

Regards to the description of the Tourism Attractiveness Index in Brazil, it seems to be in conformity with other ROS classifications around the world, as well as the original ROS. Primitive areas have small demand and need few infrastructure while highly intensive PAs have big visitor influx and request more facilities and services (Brown, Driver and McConnell, 1978; Driver and Brown 1978; Brown et al., 2009; Aukerman and Associates 2011; Cocklin, Harte and Hay, 1990; More et al., 2003).

The external attributes demonstrated to be statistically and practically relevant, which supported previous research (Neuvonen et al., 2010; Puustinen et al., 2009; Viveiros de Castro, Souza and Thapa, 2015). The classification of the whole PA system also demonstrated to be significant, reinforcing preceding studies and recommendations (Brown et al., 2009; McCool, Clark and Stankey, 2007; Kil and Confer 2005).

The Tourism Attractiveness Index facilitates ICMBio to manage strategically since PAs from the same groups can be similarly administered. For example, PAs in primitive and semi-primitive classes need simple intervention (e.g. trails, campsites, basic signage) that can be easily implemented by the ICMBio staff or voluntaries. On the other hand, intensive and highly intensive PAs require architecture projects and more investments to provide necessary facilities (e.g. large parking lots, buildings) for large numbers of visitors. The system of recreational classes facilitates ICMBio management since PAs from the same groups can be similarly administered. PAs in different classes should have access to different management strategies, different funds sources and amounts, and options for concessions contracts, for example.

Another benefit of the framework is that almost all indicators are sensible to variation, so PAs can move between classes and receive the most appropriate approach. For example, if a tourist destination build an airport, then the PA may receive a better score in extrenal physical attributes and an upgrade to a more demanding class. With the new situation, due to the increase in visitors' demand, the PA may access new fund options to improve its facilities and provide more services. Also, new or not evaluated PAs have, with the classification system, an opportunity to understand their real potential when developing GMPs and Visitor Management Plans.

The ROS classes used in this chapter can also be matched with the actual zoning system used in GMPs. These groups can easily correspond to primitive, extensive, and intensive zones used for national parks' GMPs; for national forests, the same relationship can be done with the zones primitive, forest management, and visitation (IBAMA, 2002; ICMBio, 2009). One classification system with equal nomenclature for overall vocation of the PAs and internal classes of use or zone may facilitate the understanding and management of the areas.

The chapter demonstrated that, despite the rare use of the ROS classes on the system level, it can be very effective and should be used for strategic planning since it can support a vision of the entire system of PAs. The development and use of the external setting is an upgrade on the ROS methodology since the merging of recreation classification indicators and tourism demand variables expand the understanding of the settings characteristics necessary to offer a diverse spectrum of recreation opportunities, optimizing the experiences and benefits (Aukerman and Associates 2011; Puustinen et al., 2009; Viveiros de Castro, Souza and

Thapa, 2015). Planning should consider the plurality of potential publics, attending a full spectrum of expectations and not just focusing on the "average visitor" (Warzecha et al., 2001).

The current chapter focused on national forests and national parks, which limits the extrapolations of results for other PA categories. It should also be noted that the survey was filled out remotely and managers' opinions may affect evaluations even though the questionnaire was developed to be as objective as possible with only quantitative questions focused on inventorying internal and external attributes. One alternative is to promote meetings where managers fill out the questionnaires together to adjust perspectives. Even considering the existence of errors in the PAs scores, the classification system demonstrated statistically significant differences between the classes, an indication that the model is reliable for visitor use management in PAs. Further research can look more specifically at the recreation opportunity classes within each ecoregion or different PA's categories. Evaluation of better management strategies for each group should also be addressed. The results also offer data to further analyze the tourism demand in PAs with the same variables used to inventory supply of recreation opportunities.

CONCLUSION

The Recreation Opportunity Spectrum (ROS) framework demonstrated to be suitable to classify outdoor recreation in the PA system of Brazil. The evaluation of the internal physical, social and managerial attributes proved to be effective and offered a panorama of visitation in the national parks and forests. Using the measurements and scores proposed, managers can understand how the settings and attributes influence visitors' activities, experiences, and benefits. The ROS settings demonstrated to be a framework that can be applied in different contexts: a cluster of PAs, an ecoregion, state level or other countries. On top of that, the use of the same attributes (physical, social and managerial) provide conditions to compare different realities (e.g. different countries), even if the indicators and measurements for each attribute are specific for each one.

The external attributes addressed the new challenges that agencies face in protected area management nowadays. The external dimension focuses on aspects such as day use population, access, and regional infrastructure which are critical to financial affairs, pricing, tourism business and economic impacts analysis, affecting multiple stakeholders and local communities. Managers can analyze the PAs within the context of a destination and understand visitors demand to a particular area. They can also perceive the external circumstances (e.g. lack of airport nearby), beyond management capacities that are affecting number of visitors and define strategies to influence them.

Overall, the Tourism Attractiveness Index offers a scientific approach to define different management procedures and investments for each class. PAs from classes of low visitation such as Primitive and Semi Primitive require less investment than PAs in Intensive and High Intensive use classes. Different classes may have distinct management policies, programs, or investment sources to support specific demands. The present analysis proposes metrics of performance for recreation opportunities in PAs to support decision makers on allocation of resources, prioritize investments, and ensure a sustainable growth of visitation influx. A well-managed visitor use program can support conservation and create sustainability though positive social and economic impacts in PAs' region.

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Appendix I – Tourism Attractiveness Index of Brazilian Protected Areas

Protected Area	Internal				External				Final Class	Visitors 2015
	P	S	M	O	P	S	M	O		
PN DA TIJUCA	4.5	5.0	4.6	4.7	5.0	5.0	5.0	5.0	4.9	2,945,355
PN DE BRASÍLIA	3.0	3.5	4.5	3.7	5.0	4.5	5.0	4.8	4.3	294,682
PN DO IGUAÇU	4.5	3.0	4.7	4.1	4.5	3.5	4.0	4.0	4.0	1,642,093
PN DA SERRA DOS ORGÃOS	4.0	3.5	3.8	3.8	3.5	4.5	4.0	4.0	3.9	217,372
PN ITATIAIA	4.0	3.5	4.3	3.9	3.5	4.0	4.0	3.8	3.9	133,801
PN DA CHAPADA DOS GUIMARÃES	4.5	4.0	3.3	3.9	4.0	3.0	4.0	3.7	3.8	174,855
FN DE BRASÍLIA	2.5	2.0	2.9	2.5	5.0	4.5	5.0	4.8	3.6	26,872
PN DA SERRA DA BOCAINA	4.5	3.5	2.8	3.6	3.0	4.0	4.0	3.7	3.6	70,122
PN DA SERRA DO CIPÓ	4.5	3.0	3.4	3.6	3.0	4.0	3.0	3.3	3.5	53,660
PN DA SERRA DO ITAJAÍ	3.5	2.5	2.3	2.8	4.0	4.5	4.0	4.2	3.5	632
PN FERNANDO DE NORONHA	3.0	4.0	4.1	3.7	3.5	3.0	3.0	3.2	3.4	85,386
PN DE JERICOACOARA	4.5	4.5	2.9	4.0	3.0	2.5	3.0	2.8	3.4	780,000
PN DO SUPERAGUI	4.5	3.5	2.2	3.4	2.5	3.5	4.0	3.3	3.4	12,711
FN DE IPANEMA	3.0	3.5	3.5	3.3	2.5	4.5	3.0	3.3	3.3	53,281
FN DE CARAJÁS	3.5	3.0	3.9	3.5	3.5	3.0	3.0	3.2	3.3	194,450
PN DA RESTINGA DE JURUBATIBA	3.5	2.0	2.4	2.6	4.5	3.5	4.0	4.0	3.3	20,000
PN DE SAINT-HILAIRE/LANGE	3.5	3.0	1.8	2.8	3.5	4.0	4.0	3.8	3.3	-
PN DOS CAMPOS GERAIS	4.0	2.5	1.6	2.7	3.0	4.5	4.0	3.8	3.3	-
PN DA SERRA DA GANDARELA	3.5	3.0	1.2	2.6	3.5	4.0	4.0	3.8	3.2	-
PN DA CHAPADA DIAMANTINA	5.0	2.5	2.6	3.4	3.5	2.5	3.0	3.0	3.2	21,435
FN DE PALMARES	2.0	3.5	2.5	2.7	4.0	3.0	4.0	3.7	3.2	2,200

Protected Area	Internal				External				Final Class	Visitors 2015
	P	S	M	O	P	S	M	O		
FN DE SÃO FRANCISCO DE PAULA	2.5	3.0	3.3	2.9	3.0	4.0	3.0	3.3	3.1	3,832
FN DE CANELA	2.5	2.5	2.7	2.6	3.5	4.5	3.0	3.7	3.1	692
PN DE APARADOS DA SERRA	3.0	3.0	3.1	3.0	2.5	3.5	3.0	3.0	3.0	106,899
PN DE ANAVILHANAS	2.5	2.0	3.0	2.5	3.5	3.0	4.0	3.5	3.0	10,684
PN DE SÃO JOAQUIM	4.5	1.5	2.8	2.9	2.5	3.5	3.0	3.0	3.0	94,412
FN DO ARARIPE-APODI	2.0	2.5	3.2	2.6	3.5	3.5	3.0	3.3	3.0	-
FN DE LORENA	2.0	3.0	2.9	2.6	2.5	4.0	3.0	3.2	2.9	13,719
FN DA RESTINGA DE CABEDELO	1.5	1.0	2.3	1.6	4.5	4.0	4.0	4.2	2.9	-
PN DA CHAPADA DOS VEADEIROS	3.5	2.5	3.3	3.1	2.5	2.5	3.0	2.7	2.9	56,629
PN DOS LENÇOIS MARANHENSES	4.0	3.0	1.9	3.0	2.5	2.5	3.0	2.7	2.8	40,000
PN MARINHO DOS ABROLHOS	3.0	2.0	3.4	2.8	3.0	2.5	3.0	2.8	2.8	5,114
FN DE RITÁPOLIS	2.0	3.0	2.8	2.6	2.5	3.5	3.0	3.0	2.8	3,459
PN DAS EMAS	4.0	2.0	3.1	3.0	1.5	3.0	3.0	2.5	2.8	1,681
PN DO MONTE PASCOAL	2.5	1.5	2.6	2.2	3.5	2.5	4.0	3.3	2.8	-
PN DAS ARAUCÁRIAS	3.0	1.0	1.7	1.9	3.0	3.5	4.0	3.5	2.7	-
FN DE PASSA QUATRO	1.5	3.5	3.2	2.7	2.5	3.5	2.0	2.7	2.7	30,461
PN MAPINGUARI	2.0	1.5	2.2	1.9	3.5	3.0	4.0	3.5	2.7	-
PN DAS SEMPRE-VIVAS	3.5	2.0	2.1	2.5	2.5	3.0	3.0	2.8	2.7	26
PN DA SERRA DA CANASTRA	4.0	1.5	2.6	2.7	1.5	3.5	3.0	2.7	2.7	52,673
FN DE TRÊS BARRAS	2.5	2.5	2.8	2.6	2.0	3.0	3.0	2.7	2.6	3,187

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Protected Area	Internal				External				Final Class	Visitors 2015
	P	S	M	O	P	S	M	O		
PN DAS ILHAS DOS CURRAIS	1.5	1.5	1.7	1.6	3.0	4.0	4.0	3.7	2.6	-
PN DA SERRA DA BODOQUENA	3.5	2.0	1.6	2.4	3.0	2.5	3.0	2.8	2.6	389
PN DA SERRA GERAL	3.0	2.5	2.1	2.5	2.5	3.5	2.0	2.7	2.6	82,440
FN DO ASSUNGUI	1.5	1.0	2.6	1.7	3.5	4.0	3.0	3.5	2.6	-
PN DO VIRUÁ	3.5	2.5	3.3	3.1	2.5	2.5	1.0	2.0	2.5	-
FN DE PIRAÍ DO SUL	2.0	1.5	2.8	2.1	2.5	3.5	3.0	3.0	2.5	-
PN DA ILHA GRANDE	3.0	2.0	2.2	2.4	2.0	3.0	3.0	2.7	2.5	36,850
FN DE NÍSIA FLORESTA	1.5	2.5	2.7	2.2	3.5	3.0	2.0	2.8	2.5	1,440
FN DE PASSO FUNDO	2.0	1.5	2.6	2.0	3.0	4.0	2.0	3.0	2.5	190
PN DO CAPARAÓ	4.0	2.0	3.3	3.1	1.0	3.5	1.0	1.8	2.5	54,548
PN DO JAÚ	3.5	2.0	2.9	2.8	2.0	2.0	2.0	2.0	2.4	920
PN DE UBAJARA	3.0	2.5	2.4	2.6	1.5	3.0	2.0	2.2	2.4	104924
PN DE SETE CIDADES	3.5	2.5	3.8	3.3	1.5	2.0	1.0	1.5	2.4	17,303
PN DA SERRA DA CAPIVARA	3.0	2.5	4.1	3.2	1.0	1.5	2.0	1.5	2.4	16,238
FN DE IRATI	1.5	2.0	2.9	2.1	2.0	3.5	2.0	2.5	2.3	2,191
PN DA AMAZÔNIA	3.0	2.0	3.3	2.8	1.0	2.5	2.0	1.8	2.3	1,112
PN DOS CAMPOS AMAZÔNICOS	3.0	2.0	2.8	2.6	2.0	2.0	2.0	2.0	2.3	-
PN CAVERNAS DO PERUAÇU	3.5	1.5	2.3	2.4	2.0	2.5	2.0	2.2	2.3	2,938
FN DE IBIRAMA	1.5	1.5	2.6	1.9	2.0	4.0	2.0	2.7	2.3	-
FN DE SILVÂNIA	1.5	2.0	2.8	2.1	2.0	4.0	1.0	2.3	2.2	1,110
FN DO AMAPÁ	3.0	2.0	2.6	2.5	2.0	2.5	1.0	1.8	2.2	-
PN DO MONTE RORAIMA	4.5	2.5	2.5	3.2	1.0	1.5	1.0	1.2	2.2	2,174

Protected Area	Internal				External				Final Class	Visitors 2015
	P	S	M	O	P	S	M	O		
PN DO CABO ORANGE	3.5	1.5	2.5	2.5	1.0	2.5	2.0	1.8	2.2	-
PN SERRA DE ITABAIANA	2.0	1.0	1.9	1.6	3.0	3.0	2.0	2.7	2.1	-
FN DE CAPÃO BONITO	1.5	1.0	2.0	1.5	1.5	3.5	3.0	2.7	2.1	-
PN DO JURUENA	3.5	1.5	1.3	2.1	1.5	2.5	2.0	2.0	2.1	-
PN DA LAGOA DO PEIXE	2.5	2.0	1.7	2.1	2.5	2.5	1.0	2.0	2.0	4,923
PN DA SERRA DO DIVISOR	3.0	1.5	2.2	2.2	1.5	2.0	2.0	1.8	2.0	-
PN SERRA DA MOCIDADE	3.0	1.0	2.2	2.1	2.5	2.5	1.0	2.0	2.0	-
FN DE SOBRAL	1.5	1.0	1.7	1.4	2.0	3.0	3.0	2.7	2.0	-
PN GRANDE SERTÃO VEREDAS	3.0	1.5	2.1	2.2	1.5	2.0	2.0	1.8	2.0	570
PN DA CHAPADA DAS MESAS	2.5	1.5	1.5	1.8	2.0	2.5	2.0	2.2	2.0	-
PN DO ALTO CARIRI	2.0	1.0	1.0	1.3	2.5	2.5	3.0	2.7	2.0	-
FN DO TAPAJÓS	2.5	1.5	2.3	2.1	2.0	2.5	1.0	1.8	2.0	-
FN DE ANAUÁ	3.0	1.0	1.7	1.9	2.0	2.0	2.0	2.0	1.9	-
FN DO JAMARI	2.0	1.0	2.6	1.9	2.0	3.0	1.0	2.0	1.9	-
PN DA SERRA DO PARDO	2.0	1.0	1.6	1.5	1.5	2.5	3.0	2.3	1.9	-
PN DO PANTANAL MATOGROSSENSE	2.5	1.5	2.1	2.0	1.0	2.0	2.0	1.7	1.8	140
PN SERRA DA CUTIA	1.5	1.0	2.0	1.5	1.5	2.5	2.0	2.0	1.8	-
PN NASCENTES DO LAGO JARI	2.5	1.0	2.3	1.9	1.5	1.0	2.0	1.5	1.7	-
FN DE RORAIMA	2.0	1.0	1.7	1.6	2.0	2.5	1.0	1.8	1.7	-
FN DO AMANA	1.5	1.0	2.2	1.6	1.0	2.5	2.0	1.8	1.7	-
FN DE TEFÉ	2.0	1.5	2.3	1.9	1.0	2.0	1.0	1.3	1.6	-
FN DE HUMAITÁ	2.5	1.0	1.6	1.7	1.5	2.0	1.0	1.5	1.6	-

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Protected Area	Internal				External				Final Class	Visitors 2015
	P	S	M	O	P	S	M	O		
PN DO JAMANXIM	2.5	1.0	1.0	1.5	1.0	2.0	2.0	1.7	1.6	-
FN DE SARACÁ-TAQUERA	1.5	1.0	2.5	1.7	1.0	2.5	1.0	1.5	1.6	-
FN DO CREPORI	2.0	1.0	1.3	1.4	1.0	2.0	2.0	1.7	1.6	-
FN DE PAU-ROSA	2.5	1.0	1.6	1.7	1.0	2.0	1.0	1.3	1.5	-
PN DE PACAÁS NOVOS	1.5	1.0	1.4	1.3	1.5	2.5	1.0	1.7	1.5	-
FN MAPIÁ - INAUINI	2.0	1.0	1.3	1.4	1.5	2.0	1.0	1.5	1.5	-
FN DE MULATA	2.0	1.0	1.7	1.6	1.0	2.0	1.0	1.3	1.4	-
FN DO AMAZONAS	3.0	1.0	1.0	1.7	1.0	1.5	1.0	1.2	1.4	-
FN DO JATUARANA	1.5	1.0	1.0	1.2	1.0	2.0	1.0	1.3	1.3	-

P - Physical, S - Social, M - Managerial, O - Overall