RECREATION CLASSIFICATION, TOURISM DEMAND AND ECONOMIC IMPACT ANALYSES OF THE FEDERAL PROTECTED AREAS OF BRAZIL

By

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To all park rangers, analysts and managers from Brazil and all over the world who dedicate their lives to conservation of protected areas.

The link between protected areas and tourism is as old as the history of protected areas. Protected areas need tourism, and tourism needs protected areas. Though the relationship is complex and sometimes adversarial, tourism is always a critical component to consider in the establishment and management of protected areas (Eagles et al., 2002, preface).

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LIST OF ABBREVIATIONS

GMP	General Management Plan
I-O	Input Output Matrix
MGM	Money Generation Model
NP	National Park
NF	National Forest
PA	Protected Area
ROS	Recreation Opportunity Spectrum

Abstract of Dissertation Presented to the Graduate School
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Understanding the determinant attributes affecting visitor demand at tourist destinations and the accompanying economic impacts are strategic for the management of protected areas (PA). This cross-sectional quantitative study examined the distribution of recreation opportunity classes, determinants of visitation demand and economic impact of tourism in the Federal System of Protected Areas of Brazil. The analyses used the Recreation Opportunity Spectrum (ROS) classification framework (Driver & Brown, 1978; Brown et al., 1978; Clark & Stankey, 1979) and a spatial demand model to evaluate demand and supply based on three attributes: physical, social and managerial. In addition, as an extension to the ROS framework, the assessment considered internal, as well as external attributes. Furthermore, a visitor spending analysis based on the Money Generation Model (MGM2) (Stynes et al., 2000) was conducted to evaluate economic impacts of the PAs on the surrounding communities. Specifically, the research examined the recreation classes of use and standards for the Brazilian PAs, the prediction of tourist demand using the recreation classification system, and the economic impacts of tourism in PAs of Brazil.

Results showed that both internal PA attributes and external characteristics are considered by visitors. The results have practical utility and can be used to improve investment efficacy among the PAs that already receive visitors and to evaluate the tourism attractiveness for new PAs. Also, findings are useful for the communities and small businesses located in the adjacent areas, since adequate prediction of visitor demand provides support for tourism activities. The economic analysis demonstrated that total contributions of around 8 million visitors in 2015 reached more than $1.2 billion dollars in total sales, $342 million in personal income, and $473 million in value added to the Gross Domestic Product (GDP) and supported 43,602 jobs. The analyses demonstrated that every dollar Brazil invested in the PA system produced $7 in economic benefits nationally. The results showed that the economic impacts of ecotourism not only directly affect PA management and the tourism industry, but also indirectly affect other types of businesses and the local communities.

CHAPTER 1
INTRODUCTION

Protected areas (PA) are globally considered as a key strategy for biodiversity conservation and provision of ecosystem services. One significant challenge to achieving these goals is the financial sustainability of the areas. Tourism is a cultural ecosystem service that can provide economic benefits and support for PAs management (Millennium Ecosystem Assessment, 2005). Protected areas offer numerous recreational opportunities that attract visitors, and the promotion of tourism assists to raise societal awareness and increase support for conservation. Also, visitor expenditures help reduce poverty and create alternative income for local communities that live inside or adjacent to the areas (Emerton et al., 2006; Ferraro & Merlin, 2014).

Tourism in PAs does result in varying degrees of positive and negative environmental, cultural, social and economic impacts (McCool et al., 2007; Spenceley et al., 2015). It is now critical for PAs to engage with multiple stakeholders and local communities since the improvement of local communities' livelihoods has been the norm (Thapa, 2013). With the evolving role of PAs to meet visitors and community needs, management has become more complex in accommodating the environmental, socio-cultural, and economic questions within and adjacent to PAs. Furthermore, financial affairs, pricing policy, tourism business, and economic significance have also become essential aspects to develop more efficient and sustainable PAs systems (Eagles, 2001). The challenge is to mitigate the negative impacts and strengthen the positives that the activity generates.

The measurement of recreation opportunities, tourism demand and expenditures are strategic for understanding impacts. Visitor use data is significant for several

aspects of PAs management. For example, natural resources protection is partly determined by the type of recreation opportunities offered. Maintenance operations require a close observation of tourism demand while concessions and services are dependent on use levels and expenditures. Furthermore, local businesses are also interested in tourism flows and associated spending in the region (Eagles et al., 2000).

As a consequence of the Aichi Biodiversity Targets from the Conservation of Biological Diversity, the majority of the world's governments are committed to integrating conservation into national policies. Policymakers, managers, and other stakeholders are demanding more knowledge of protected areas management and its social and economic benefits. PAs governmental agencies which do not provide such benefits risk being undervalued (Balmford, 2015). The importance of social and economic values is integral to illustrate public support of PAs. The International Union for Conservation of Nature (IUCN) presents a list of problems when PAs lack social and economic values (Leung et al., 2015, p. 27):

- Low revenues from entrance fees due to low visitation.
- Low revenues due to short length of stay.
- Low levels of visitation and subsequent lack of political support.
- Lack of economic benefits to local people - area is not valued by them.
- Uncompetitive destinations leading tourists to go elsewhere.
- Word of mouth – friends learn about poor experience and do not travel to the PA.
- Visitors go to PAs in countries that are perceived as peaceful and safe.

Despite the fact that PAs literature has given more attention to the negative impacts of tourism, low visitation demand has been demonstrated to be far more harmful to conservation than high demand (Mulholland & Eagles, 2002). A well-managed visitor use program can create positive social and economic impacts in PAs' region. Economic benefits of tourism are a consequence of visitation volume (Stynes,

2005) that is largely related to the spectrum of recreation opportunities offered (Castro et al., 2015; Puustinen et al., 2009). The objective of this study is to propose metrics of performance for recreation opportunities in PAs, visitation demand, and economic impacts of tourism to convince decision makers to support allocation of resources, prioritize investments, and ensure conservation and sustainability.

Statement of Rationale

In the 20th century, visitation to protected areas substantially increased in industrialized countries largely influenced by societal wealth and the possibility for extensive travel experiences. During the 1960s, with the surge in tourism demand, the necessity to offer a broad range of recreation experiences increased (Eagles, 2001). During the same decade, the progress of ecology as a science also highlighted the importance of biodiversity conservation and associated environmental impacts of tourism. The increasing demand for different recreation opportunities and the ecological consequences resulted in the development of the concept of zoning or recreation opportunity classes (Pettengill & Manning, 2011). Recreation opportunities are formed by four elements: visitors searching for recreation activities in particular settings to have experiences and subsequent benefits (Manning, 2011).

Recreation opportunity is the basic concept of the Recreation Opportunity Spectrum (ROS) (Brown et al., 1978; Clark & Stankey, 1979; Driver & Brown, 1978). The recreation opportunities are derived from activities in different settings and have three different attributes: Physical, Social, and Managerial. The combinations of these attributes create classes or zones where recreation opportunities may occur. From these combinations, visitors have different experiences which benefit individuals, communities, the environment, and economies. Understanding the relationships

between the various settings with activities is strategic for an adequate analysis of recreation opportunities. Since the development of ROS framework, academia has considerably examined the linkages between activities, settings, experiences and benefits proposed in the model (Manning, 2011; Pettengill & Manning, 2011).

The initial ROS model only considers physical, social and managerial attributes within the PAs without considering the external setting of the destinations. However, tourism demand analysis has found that number of visitors are correlated to external settings of the PAs (Neuvonen et al., 2010, Puustinen et al., 2009), as well as, internal settings (Hanink & White, 1999; Hanink & 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 et al., 2015). Also, tourism demand models can estimate or predict the number of visitors in an area based on internal and external variables.

However, tourism demand analysis and recreation opportunities studies have been examined as separate research fields (Garber-Yonts, 2005). While recreation classification studies have often been explained in inventories and geographic data, the tourism demand analyses have used other metrics such as visit days or number of visitors. Also, tourism demand research has usually been focused on large geographic areas (State or Nation) with long predictions periods, while recreation classification studies have been more local and cross-sectional (Haas, 2007).

Garber-Yonts (2005) and Haas (2007) recommend that the best way to integrate these two approaches is through spatial analysis using the variables system developed

in the ROS framework. However, ROS only uses internal variables to define the settings without consideration of the external adjacent characteristics. Therefore, to promote the integration between classification of recreation opportunities and tourism demand, a new setting of external attributes and variables needs to be included (Viveiros de Castro et al., 2015).

An integrated analysis of recreation opportunities and tourism demand, using internal and external variables, provides a model for PAs managers to build different visitation scenarios. Moreover, tourism demand analysis is one primary determinant variable of recreation economic impact studies. A cohesive effort in tourism demand assessment supports economic impact analysis increasing support for management, policy decisions, and marketing (Stynes, 2005). Integrated analyses have become more important globally where government agencies need to compete for operational budget appropriations. The social and economic significance of recreation needs to be better communicated so that policymakers and stakeholders can value this important ecosystem service and allocate the necessary financial resources for its management.

The discrepancy between tourism economic impacts and PAs investments illustrates the situation. Globally, visits to terrestrial PAs were estimated to be 8 billion per year, which generated approximately US$ 250 billion in consumer surplus and US$ 600 billion in direct in-country expenditure. These numbers are significantly higher than the US$ 10 billion estimated to safeguard the areas (Balmford et al., 2015).

The recreation opportunities classification, tourism demand analysis, and its economic contributions are linked aspects of visitation management in PAs. A method for classification of recreation opportunities capable of dialogue with tourism demand

analysis is strategic, and an effective tool to better inform managers and decision makers. Additionally, tourism demand studies based on primary data provides more reliable analysis of economic impacts and contributions of visitation. Through identification of PAs internal and external variables that correlate with tourism, it is possible to analyze the limitations and strengths of a visitation system. Furthermore, it is possible to build scenarios to improve investment efficiency. The enhancement of visitor use management increases revenues and budget that could facilitate other actions towards environmental conservation and social development to the whole PAs system. Hence, the linkages between recreation opportunities, tourism demand and consequent economic contribution are strategic elements of recreation that needs to be examined. In this study, the distribution of recreation opportunity classes, determinants of visitation demand, and economic impacts of tourism in the Federal System of Protected Areas of Brazil are examined.

Protected Areas Management in Brazil

The first national park designated in Brazil was Itatiaia in 1937 with the “objective to attend demand of tourist order” (Brazil, 1937, p. 14). In 1938, another federal decree allocated financial resources to build park facilities (Brazil, 1938). Both of these legal acts demonstrate that visitation was an initial purpose of the sites. In addition, in 1938, the Brazilian Forest Service was also established with the responsibility to maintain and protect the national parks. In the following year, two more national parks were designated: Iguaçu (Brazil, 1939) and Serra dos Órgãos (Brazil, 1939b).

The growth of new designations was evident from 1959 to 1961 as eleven national parks were established in that period. In general, these national parks followed the “Yellowstone model” where the main purpose was to protect and conserve the

extraordinary scenic beauty. This period also marked the designation of the first parks in the interior regions of the country which coincided with the move of the capital city from Rio de Janeiro to Brasilia. For example, the establishment of Brasilia National Park with its natural pools allowed for the new population to engage in leisure and outdoor recreational opportunities (Zimmermann, 2006).

The 1960s and 1970s manifested in the strengthening of the socio-environmentalist movement that was in direct opposition to the application of the "Yellowstone Model" in developing countries (Rodrigues, 2009). Basically, during the 1962 World Parks Congress, the concept of a national park evolved towards an integration for socioeconomic development of local communities (Zimmermann, 2006). Likewise, in Brazil, two separate environmental movements towards protected areas management had emerged. The preservationists advocated for no human presence nor resources exploration inside PAs, while the conservationists promoted that both factors could coexist. Hence, these two ideologies developed an antagonistic perspective towards human presence within PAs that translated to a restrictive tendency towards outdoor recreation in federal protected areas. This policy still continues to exist in Brazil (Zimmermann, 2006).

In 1967, the Brazilian Institute for Forestry Development (IBDF in Portuguese) was created and became responsible for the National Parks and other new categories such as, Biological Reserves and National Forests. The IBDF also had the responsibility to develop new criteria as importance of ecosystems services for designation of PAs. In response, criteria for ecosystem representativeness and rarity of landscapes were included along with the priority to establish PAs in less degraded areas (Zimmermann,

2006). In 1973, another federal environmental institution was created: Special Secretary of Environment (SEMA in Portuguese). SEMA was charged to develop conservation initiatives, and essentially created four other PAs categories: Ecologic Stations, Environmental Protected Areas, Biological Reserves and Relevant Ecological Interest Areas (ICMBio, 2008).

By 1989, IBDF and SEMA had dissolved, and another federal institution was created to manage all types of PAs: Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA in Portuguese). In 2007, this responsibility was eventually transferred to another new agency known as the Chico Mendes Institute for Biodiversity Conservation (ICMBio). Since then, ICMBio has been the management entity for all protected areas, while other environmental agendas have been maintained into IBAMA (Table 1-1).

Table 1-1. Timeline for institutions that have managed protected areas in Brazil

Institution	Years of Operation
Brazilian Forest Service	1938 - 1967
Brazilian Institute of Forestry Development (IBDF)	1967 - 1989
Special Secretary of Environment (SEMA)	1973 - 1989
Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA)	1989 - 2007
Chico Mendes Institute for Biodiversity Conservation (ICMBio)	2007 – current

It has been almost 80 years since the designation of the first national park. A common denominator has been the constant institutional and mandate change that has led to inconsistent polices. In addition, the implementation actions have affected all

management programs including visitation within the whole PAs system. Currently, policies still impact protected areas in Brazil, as they are generally created without budget allocations which makes it difficult to develop infrastructure and offer access to the public.

National System of Protected Areas of Brazil

PAs in Brazil are organized in the National System of Protected Areas (SNUC in Portuguese). Instituted by the Brazilian Congress, in 2000, the system is structured in different categories with specific norms for designation and management. The National System is divided into two broad categories: Full Protection and Sustainable Use. Full Protection has the primary objective to maintain the ecosystems free of changes caused by human interference, and only admits the indirect use of its natural attributes (i.e., no consumption, collection, damage or destruction of natural resources). Sustainable Use Areas allow sustainable exploration of renewable resources and ecological processes, maintaining biodiversity and other environmental attributes, in a way that is socially beneficial and economically viable (Brazil, 2000). The system is also divided into three levels of management: federal, state and, municipal. The Chico Mendes Institute for Biodiversity Conservation (ICMBio in Portuguese) is the agency under the Ministry of Environment that is responsible for the management of federal areas. Table 1-2 presents the SNUC categories and their international correspondents designated by the International Union for Conservation of Nature (IUCN) (MMA, 2007). The table also presents the number of federal sites and amount of area protected in hectares up to July 2016 (ICMBio, 2016c).

Table 1-2. Correspondence between IUCN and SNUC categories and objectives (ICMBio 2016c)

IUCN Categories	Brazilian Categories	Nº	Hectares
Ia: Strict nature reserve	Biological Reserve (Full Protection)	31	4,263,032.47
	Ecological Station (Full Protection)	32	7,476,240.21
Ib: Wilderness area	No equivalence		
II: National park	National Park (Full Protection)	72	26,255,989.89
III: Natural monument or feature	Natural Monument (Full Protection)	3	44,286.27
	Wildlife Refuge (Full Protection)	7	201,722.05
Full Protection Total		145	38,241,270.88
IV: Habitat/species management area	Relevant Ecological Interest Area (Sustainable Use)	16	44,700.03
V: Protected landscape/seascape	Environmental Protected Area (Sustainable Use)	33	10,170,390.89
VI: Protected area with sustainable use of natural resources	National Forest (Sustainable Use)	67	17,825,791.05
	Extractives Reserve (Sustainable Use)	62	12,475,798.87
	Fauna Reserve	0	0
	Sustainable Development Reserve (Sustainable Use)	2	102,619.45
Sustainable Use Total		180	40,619,300.28
Final Total		325	78,860,571.16
Correspondences based on a Ministry of Environment Report (MMA, 2007)			

Among the protected areas units, 122 are located in the Amazon Rainforest and 102 are situated in the Atlantic Forest. The system also has 47 PAs in the Cerrado ecoregion (Savannah) and 25 PAs in the Caatinga ecoregion (Semi-arid). There are 18

marine/coastal parks, four that protect the Pantanal (Wetlands), and two that protect the Pampas ecoregion (Grasslands) (ICMBio, 2015) (Figure 1-1). The PAs sizes, along with visitation numbers, vary vastly. Ilha Queimada Grande e Queimada Pequena Relevant Ecological Interest Area offers 65,17 ha to 3,865,172 ha in Tumucumaque National Park. Among the PAs, there are only a few that are prepared for tourism, while some are minimally equipped, and most do not control access or have entry fees.

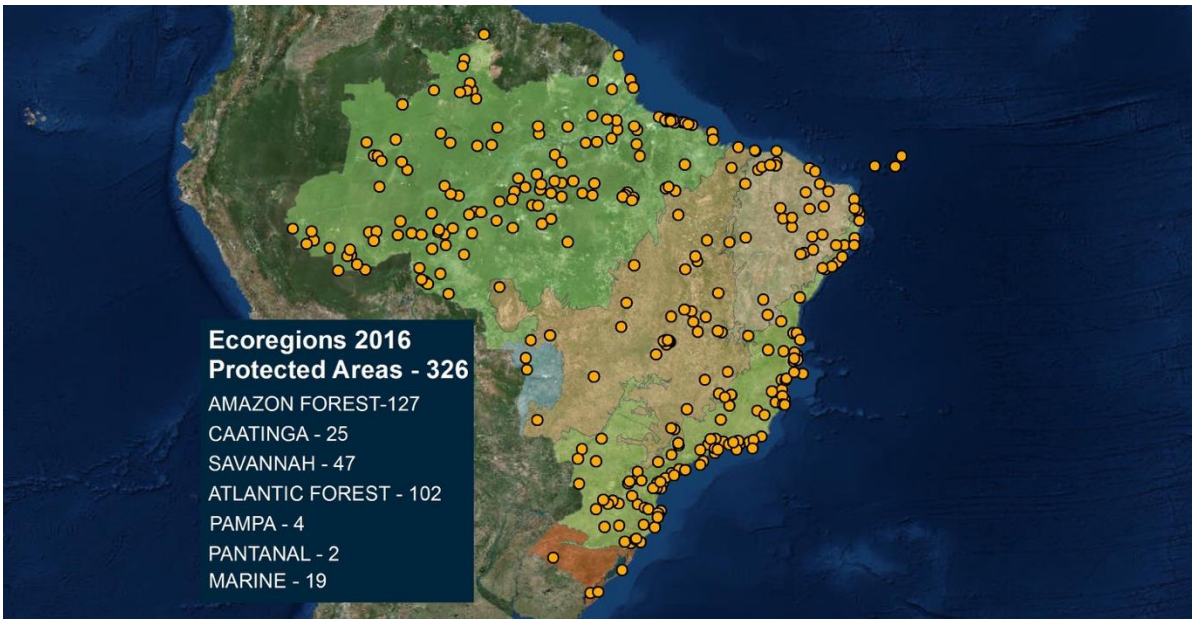


Figure 1-1. Map of Protected Areas per Ecoregions up to July, 2016 (ICMBio, 2016c)

Visitation in the National System of PAs of Brazil

In theory, public access is one of the main objectives of the PAs system in Brazil as is possible to see in the following documents that create the National System of PAs (SNUC) and ICMBio (Brazil, 2000):

Art. 4 of the SNUC has the following objectives:

XII - to provide conditions and promote environmental education and interpretation, outdoor recreation and ecotourism;

> Art. 5 The SNUC will be governed by guidelines that:(…)
>
> IV - seek the support and cooperation of non-governmental organizations, private organizations and individuals to the development of studies, scientific researchers, environmental education practices, leisure activities, ecotourism, monitoring, maintenance and other management activities in protected areas;

Visitation is one of the main purposes of the ICMBio as outlined in the Art. 1 of its Designation Act 7.515/2011 (ICMBio, 2011):

> V - to promote and implement, in coordination with other agencies and stakeholders, recreational programs, public use and ecotourism in protected areas, where these activities are allowed.

Since the establishment of the first national park, visitation was always promoted as a primary objective, but statistics do not reflect the reality. Visitation data based on number of visits is the only national basic data that has only been collected since 2000. Based on this data, visitation in Federal PAs has grown with an increase from 1.9 million in 2001 to more than 8 million in 2015 (Figure 1-2) (ICMBio, 2016). However, part of this growth is due to the fact that more PAs are monitoring visitation.

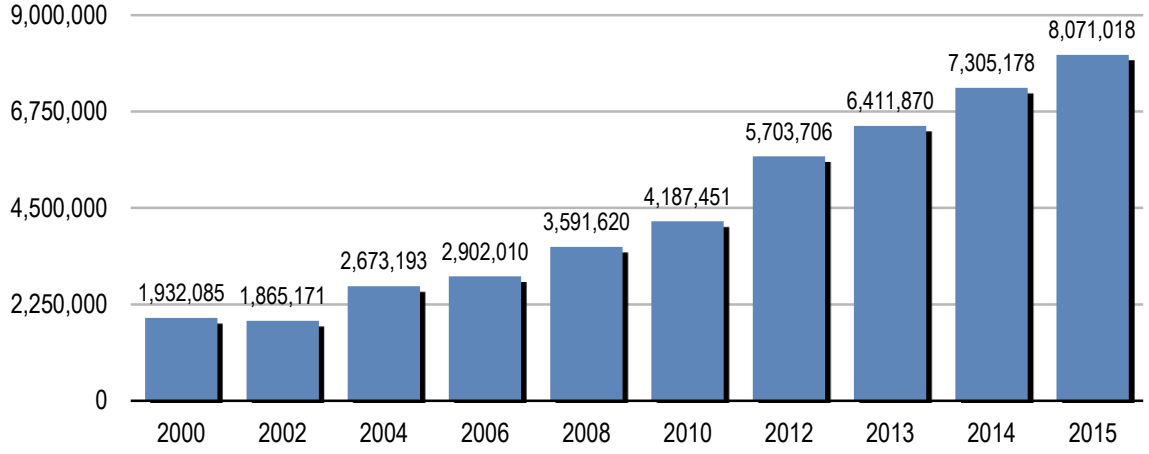


Figure 1-2. Total Visitation/Year in Protected Areas of Brazil

Visitor use is an activity that is allowed in most of the PAs categories in Brazil (all of them if environmental education is considered) (Brazil, 2000). However, from the 62 PAs that reported visitation in 2015, 38 are national parks and 17 are national forests (90%) (Table 1-3).

Table 1-3. Areas that reported visitation per year

Brazilian Category	IUCN	06	07	08	09	10	11	12	13	14	15
National Park	Category II	19	21	21	22	24	27	31	36	33	38
National Forest	Category VI					12	11	12	12	17	17
Environmental Protected Areas	Category V								1	2	3
Biological Reserve	Category Ia									1	1
Extractive Reserve	Category VI									1	1
Relevant Ecological Interest Area	Category IV										1
Ecological Station	Category Ia										1
Total		19	21	21	22	36	38	43	48	54	62

The categories National Parks (IUCN category II) and National Forests (IUCN category VI) have different overall management purposes. However, visitation is allowed in both categories and is managed similarly by ICMBio. IUCN guidelines also demonstrate the similarity in visitor use management between both categories (Leung et al., 2015) (Table 1-4).

Table 1-4. Visitation Purposes for National Parks and Forests by SNUC and IUCN

Categories	SNUC (Brazil, 2000)	IUCN (Leung et al., 2015, p. 24)
Category II: National Park	Permitted Environmental Education and Interpretation, Outdoor Recreation and Ecologic Tourism	• Visitor use and experience is often a management objective • A range of recreation opportunities are typically provided through zoning, facility development and visitor services
Category VI: Protected area with sustainable use of natural resources	Permitted and needs to be subordinated to the GMP rules	• Recreation visitation and commercial tourism can be a key objective • A range of recreation opportunities is provided with associated facilities and services • Commercial tourism common

Overall, based on the units and scale, Brazil receives a comparatively small volume of visitors. The lack of visitor influx may be the result of various issues. For example, the lack of opportunities and infrastructure development has been evident. One possible cause is the ICMBio's outdated viewpoint towards tourism despite the fact that visitation is a key mission of the institution. For the past 30 years, tourism has been perceived as a negative agent of change, such as, threat of exotic plants or fires caused by humans, which has supported restrictive policies for outdoor recreation in the PAs (Zimmermann, 2006). Furthermore, the combination of lack of societal support and budgetary constraints has also created a vicious cycle which has hindered the growth of visitation and support for protected areas.

Hence, the objective of this study is to enhance understanding based on factors that influence visitor flows to the PAs in Brazil and their economic relevance for the populations that live nearby. Further, to assist decision-makers and PAs managers on resources allocation, investment priorities, and sustainability of protected areas,

Purpose of Study

This cross-sectional quantitative study examined the distribution of recreation opportunity classes, determinants of visitation demand and economic impact of tourism in the Federal System of Protected Areas of Brazil. The analyses used the ROS classification framework (Driver & Brown, 1978; Brown et al., 1978; Clark & Stankey, 1979) and a spatial demand model to evaluate demand and supply based on three attributes: physical, social and managerial. In addition, the assessment considered internal, as well as, external settings which offered an extension for the ROS framework. Furthermore, a visitor spending analysis, based on Money Generation Model (MGM2) (Stynes et al., 2000) was conducted to evaluate economic impacts of the PAs.

Specifically, the following major research questions were addressed:

1. What are the recreation classes of use and standards for the Brazilian Protected Areas?
2. How to predict tourist demand using the recreation classification system?
3. What is the economic impact of tourism in Protected Areas of Brazil?

Project Significance

The mission of ICMBio is "to protect the natural heritage and promote environmental development" (ICMBio, 2011, p. 69). While these goals can be sometimes antagonistic, it requires the institution to implement actions to support accrual of benefits and minimize resource impacts. Brazil is in a unique position as a natural tourism destination given that the PAs are the “crown jewels” and needs to be conserved. In addition, it is in the national interest to invest in PAs due to the ability to generate employment options and revenues that have local and national multiplier

impacts. This study attempts to provide a detailed panorama for new policy formulations. The recreational opportunities, tourism demand, and economic contributions are linked aspects in PAs management. An enhanced management of visitor use increases revenues and budget appropriations, facilitates other actions towards conservation and environmental development to the whole PAs system.

Moreover, a standardized analysis of ROS classes for an entire PAs system is key to assist in the replication of tourism demand analyses. Reliable demand predictions provide trustworthy economic analysis of impacts and contributions of PAs. Furthermore, comparative analysis of recreation supply and demand provides an efficient way for managers to understand visitation dynamics. Both can assist to evaluate if a PA is under or over-used and subsequently identify mechanisms to address these issues. Additionally, PAs managers can also define different strategies for visitor use management. For example, if the analysis demonstrates that a PAs can support more visitation, managers can increase the supply of recreation opportunities to accommodate additional use, or disperse it evenly. Conversely, in the event of overuse, then demand can be limited. In the case of treating supply and demand as fixed variables, then two other strategies become possible: focus on reducing use impacts by modifications in visitor behavior, or increasing the durability of resources and/or experiences (Manning & Anderson, 2012) (Figure 1-3).

Such analyses can be conducted for single sites, regions or the whole PAs system. In a system-wide analysis, the central office is able to holistically determine where visitation should be increased or decreased. Also, management actions to build new structures, close or open trails, improve access or invest in marketing will also

provide the basis for a new demand analysis with a forecast of predicted changes in visitation volume. The economic analysis of impacts and contributions of the new management strategy will provide arguments for increase in budget allocations.

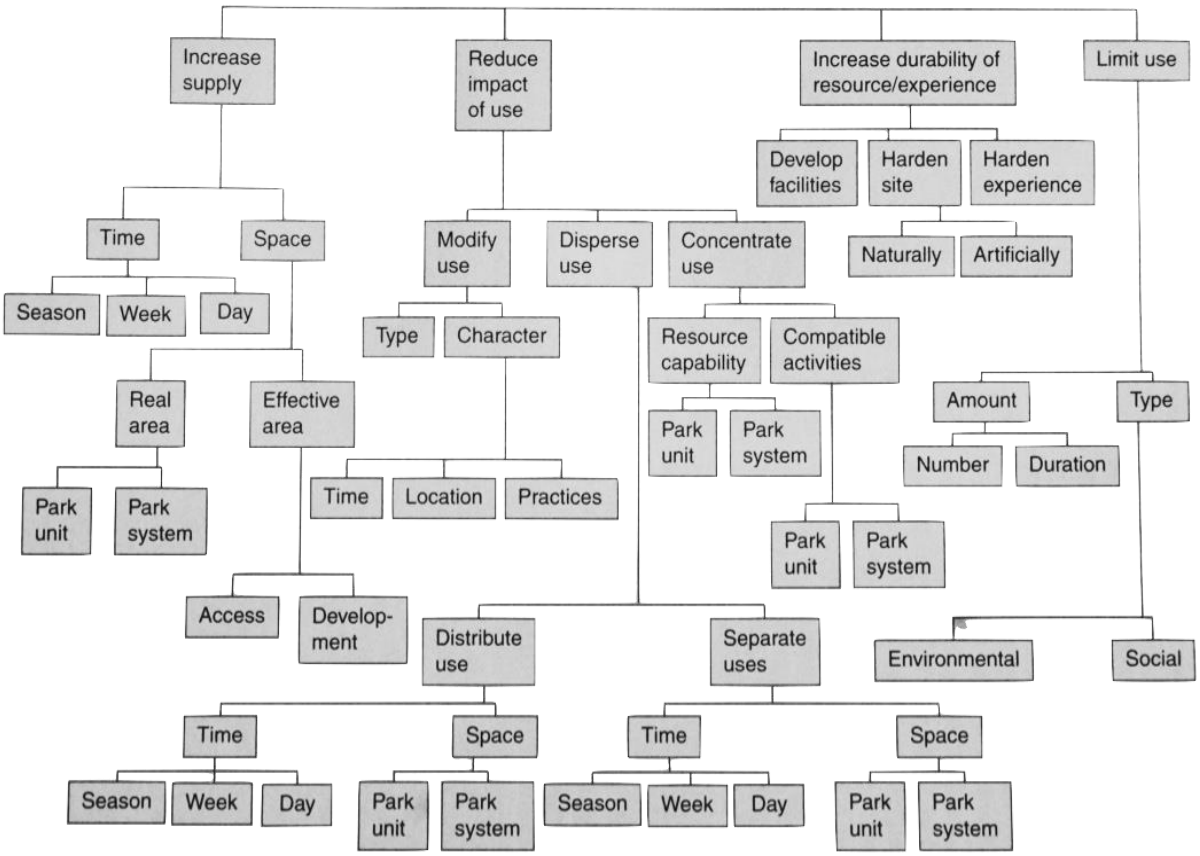


Figure 1-3. Strategies for managing recreation demand and supply (Manning & Anderson, 2012)

Finally, this research offers a framework for ICMBio to improve visitation planning and management at the system level. Accordingly, public policies at the federal level can be traced more strategically to increase visitation in the whole system. In the era of budget constraints, this study provides tools to define investment allocations, predict visitation growth, and evaluate economic significance of PAs.

Dissertation Format

The dissertation is divided into five chapters via three distinct areas based on each research question. The three research questions are sequential and test the visitation dynamics along with the economic significance (Table 1-5).

Table 1-5. Dissertation Phases

Chapter	Statistical Analysis	Outcomes
Chapter 2	Descriptive Statistics, One-way ANOVA	Recreation Opportunity Classes for PAs System
Chapter 3	Pearson's Correlation Stepwise Regression	Predictions of visitation demand for different scenarios
Chapter 4	Economic Impact Model of Visitor Spending, Input-Output Matrix	Economic Impacts of Tourism in PAs

Chapter 2 examines the spectrum of recreation opportunity classes for the whole System of Federal Protected Areas of Brazil. The identified variables were categorized based on ROS framework – physical, social, and managerial attributes. Results determined if the PAs could be grouped in different classes based on their classification in the different settings. As the result, PAs were represented by their settings and classes. One-way ANOVA tested if the classes are significantly different from each other.

Chapter 3 examined the determinants of tourism demand in PAs. Pearson's correlation was used to identify dependent variables that were correlated with volume of visitation. A multiple regression analysis was used to determine the most efficient model to predict visitation potential for the whole system. Subsequently, the model was applied individually for each National Park and National Forest to determine their attractiveness

potential. Results presented the predicted ranges of visitation for each recreation class defined in Chapter 2. The regression model was utilized to create an improved scenario of visitation.

Chapter 4 addresses the economic impacts of tourism. The economic impacts analysis model utilizes the visitor numbers, visitor spending, and economic multipliers to estimate the economic effects at national level (Stynes et al., 2000). Results were presented as Sales Captured, Jobs, Personal Income and Value Added for direct effects and total effects.

Chapter 5 provided an overall summary of how the research questions were analyzed in the earlier chapters to form a macro scenario about visitation management in the PAs system of Brazil. Chapter 5 presents an evaluation if and how recreation opportunities and tourism demand could be integrated with economic significance. Also, a model to plan recreation demand and monitor economic contributions on an annual basis is proposed for the National Parks and National Forests of Brazil.

CHAPTER 2
ECOTOURISM IN BRAZILIAN PROTECTED AREAS: IDENTIFYING CLASSES OF RECREATIONAL USE

Brazil is a continental nation containing numerous ecosystems and mega biodiversity. The natural beauty is so inherent that the country was considered the most competitive tourism destination in the category of natural resources in 2015 (Crotti & Misrashi, 2015). For the purpose of nature conservation, places of scenic landscape and ecological significance are designated as protected areas (PA). These natural places offer numerous recreational opportunities that can attract tourists. Tourism in PAs does result in varying degrees of positive and negative impacts (environmental, cultural, social and economic). The challenge is to mitigate the negative impacts and strengthen the positives ones (McCool et al., 2007; Spenceley et al., 2015).

Brazil faces a challenge in managing 79 million hectares within a system of 325 federal protected areas. It is a territory bigger than Spain and the United Kingdom together. Visitation influx has been growing every year since 2002 and achieved 8 million visitors in 2015; however, based on the scale and units, the system receives a comparatively small volume of tourists. In order to maintain visitation growth, Brazil needs to better comprehend the dynamics of the ecotourism industry within the context of PAs. For example, why do some areas receive high volumes of visitors while others remain unknown? What are the activities preferred by different visitor segments? Do the settings for these activities influence their choices?

Understanding the PAs aspects that influence tourist decision is strategic to ensure a sustainable growth, offering the right spectrum of recreation opportunities and services. The purpose of this study is to develop a recreation classification system for

the protected areas of Brazil that can further support demand and economic impact analyses. More specifically, three objectives have been formulated to:

- Inventory the federal protected areas in regard to their recreation opportunities.
- Define standards and actual recreation classes of use for the PAs
- Prepare an optimal scenario where PAs are classified in the appropriate recreation class of use.

To fulfill these objectives, the study provides a descriptive analysis adapting the framework Recreation Opportunity Spectrum (ROS) (Brown et al., 1978; Clark and Stankey, 1979; Driver and Brown, 1978) to inventory the Brazilian PAs based on their internal and external settings. The objective is to establish metrics to plan and monitor progress in outdoor recreation opportunities for the entire system. After the inventory, a statistical analysis using one-way ANOVA will test the practicability of the classification system. The idea is that a reliable recreation classification system offers assistance for decision makers and managers to allocate resources, prioritize investments, build partnerships and ultimately ensure biodiversity conservation.

Literature Review

Recreation Resources Classification

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 recreation opportunities or zones originated from a framework called Recreation Opportunity Spectrum (ROS) (Brown et al., 1978; Clark and Stankey, 1979; Driver and Brown, 1978). The ROS concepts were developed in the 1970s and, over the years, were incorporated into most important visitor’s management systems as Limit of

Acceptable Change (LAC) (Stankey et al., 1985), Visitor Impact Management (VIM) (Graefe et al.,1990), and Visitor Experience and Resource Protection (VERP) (NPS, 1997). Nowadays, ROS is considered “the most widely recognized recreation management concept around the world and probably the most single influential concept in recreation management and planning for public lands and protected areas” (McCool et al., 2007, p. 46). For a comprehensive review of studies related to ROS see Manning (2011) and Pettengill & Manning (2011).

Recreation Opportunity Spectrum (ROS)

ROS states that visitors not only search for recreation activities, they also select particular settings to have experiences and subsequent benefits (Manning, 2011). The public good of a PA is the recreation opportunity and is formed by these four elements - activities, settings, experiences and benefits:

> The opportunity for a person to participate in a particular recreation activity in a specific setting in order to enjoy a particular recreation experience and the benefits this affords (Aukerman et al., 2011, p.. viii).

The recreation opportunities are derived from activities in different settings. These settings have three different attributes: physical, social, and managerial. Combinations of these attributes create classes or zones where recreation opportunities may occur. From these combinations, visitors have different experiences, which turn into benefits for individuals, communities, environments, and economies (Figure 2-1). Understanding the relationships between the various settings with different activities is strategic for an adequate analysis of recreation opportunities.

The attributes are defined by indicators. Based on the indicators parameters, PAs managers can identify the classes of recreation opportunities or zones for a determined area. Classes of recreation opportunities range from total primitive areas

with no facilities and few visitor encounters to classes described as modern or high developed where landscape have been altered, and facilities serve various groups of tourists. Each class offers a different experience and benefits (Figure 2-2).

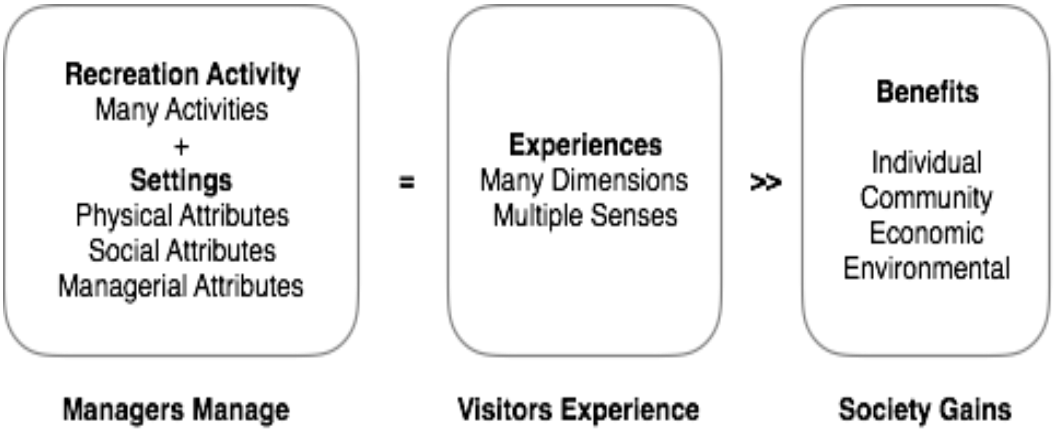


Figure 2-1. Components of a Recreation Opportunity (Aukerman et al., 2011)

Opportunity Class	Primitive	Rural
Activitiy	Hiking in wilderness area	Family Picnic
Attributes and Indicators		
Physical Social Managerial	Natural terrain Few visitors Undeveloped trails	Grass field Visitors groups Picnic tables
Experience	Solitude Challenge Take risks	Union with family Escape from daily life Rest
Personal, Social, Economic and Environmental Benefits	Increase in self-esteem and health Increase in productivity Increase in conservation commitment	Increase in mental health Familiar solidarity Increase in productivity Increase in natural appreciation

Figure 2-2. Examples of Recreation Opportunity Settings, Experiences, and Benefits (Brown et al., 2009)

Based on a recreation plan, the territory of a PA is divided in different classes or zones considering the internal attributes and the possible experiences. Different guidelines based on ROS have been developing different names and numbers of classes; however, as highlighted by Clark and Stankey (1979), more important than the name and number of classes, is the range of different settings that they cover (Figure 2-3).

Framework	Primitive ←				→ Developed	
Clark and Stankey, 1979	Primitive	Semi primitive		Semimodern	Modern	
Brown and Driver, 1979	Primitive	Semi primitive non-motorized	Semi primitive motorized	Rural	Concentrated	Modern-urbanized
Forest Service, 1982	Primitive	Semi Primitive Non-motorized	Semi Primitive Motorized	Roaded Natural	Rural	Urban
More et al., 2003	Primitive	Semi Primitive Non-motorized	Semi Primitive Motorized	Semi Developed Natural	Developed Natural	Highly Developed
Wallace, 2009	Prístina (Pristine)	Primitiva (Primitive)	Rústica (Rustic)/Natural	Rural	Urbana (Urban)	

Figure 2-3. Different ROS Classification

System Approaches for ROS and Tourism Demand

Despite the number of classes or zones that a PA might have, a full spectrum of recreation opportunities cannot be provided by a single recreation area, regardless of size. Managing each recreation area in isolation leads to development of opportunities focused on the "average" visitor without considering the plurality of potential publics (Warzecha et al., 2001). More than that: "Each recreation area, individual site, zone, park, etc., should be evaluated as part of a larger system of areas, each contributing as

it can to serve the diverse needs of the public" (Pettengill & Manning, 2011, p. 2). In order to address that, Kil & Confer (2005) were able to apply ROS and produced a recreational classification for PAs in the state of Florida. Each area received an overall classification from primitive to urban based in their physical, social and managerial attributes that facilitates planners to geographically identify what experiences different regions of the state have to offer.

Using a different approach, Clawson and Knetsch (1963) proposed a recreation classification system whereby different PAs are divided into three classes: user-oriented, intermediate areas and resource-based. User-oriented PAs are small and closer to population centers, and the visits are for short time periods. The main purpose is for daily activities such as jogging or picnicking. Resource-based PAs are usually larger and distant from cities or markets. Trips demand more time and may include overnight stays. The Table 2-1 shows a matrix between the three Clawson and Knetsch classes and the ROS attributes.

Table 2-1. Clawson and Knetsch Recreation Classification System (1963) adapted to ROS settings

Attributes	User-Oriented	Intermediate	Resource-based
Physical	- Small Areas - Scenic beauty important but not in high demand - Absences of severe hazard	- Medium size - Most attractive site in 2-hour distance.	- Larger areas - Outstanding scenic or other recreational quality
Social	- Day use by local population after school, after work, by mothers with small children	- More towards day use - 1 to 2 hours of distance	- Distant from large population centers - Used for overnight and long periods
Managerial	- Highly developed - Minimal cost, often zero	- Medium developed - Low travel cost	- Minimally developed (mostly) - High travel cost

The Clawson and Knetsch model spatially adds tourist demand variables to the analysis, something that has been not yet been considered in managing recreation in PAs using ROS. ROS does not look to external variables such as distance, external access or surrounding population when considering the possible classes of a PA.

Recreation Opportunity Spectrum in Destination Context

The initial ROS model only considers physical, social and managerial attributes within the PAs without considering the external setting of the destinations. However, studies have found that number of visitors is correlated to external settings of the PAs (Neuvonen et al., 2010, Puustinen et al., 2009), as well as internal settings (Hanink & White, 1999; Hanink & 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 et al., 2015). Determining the relative importance of each of these settings is considered the most critical aspect to develop a tourist destination (Hu & Ritchie, 1993).

Analyzing destination attractiveness, Ferrario (1979) divided attractions into two groups: natural and man-made. Examples of natural resources are falls, beaches and mountains, while man-made attractions are historical sites and cultural events. To support attractions, there are other man-made attributes that Puustinen et al. (2009) divided into two types: inside and outside the PA. Inside a site, there are recreation facilities and services; outside, tourists find services provided by local communities, private sector and public agencies.

Analyzing attractions and supporting attributes, Lee et al. (2010) highlights 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. Tourism services are important to reinforce destination attractiveness although they are not necessary for all groups. Iatu & Bulai (2011) pointed out that natural attractions may not need tourism structures since their significance relies on relative isolation or wilderness.

Hanink & 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. They recognize that natural attributes influence the decision to travel and may enlarge potential demand. For example, a national park with an iconic attraction has the potential to attract international visitors while others areas may only attract locals or regional public. Deng et al. (2002) also identified that besides natural resources, accessibility is a critical dimension of a destination. Moreover, Lee et al. (2010) includes provision of catering and accommodation as decisive attributes that work together with external access.

The initial ROS model considered only internal attributes; 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 tourism destination (Viveiros de Castro et al., 2015). The analysis conducted by them with national parks of Brazil, demonstrated that tourism attractiveness in the areas were correlated to reputation, recreation facilities, attractions in the region, and population density. Results showed that both internal attributes and external characteristics are relevant. The present paper uses the ROS to inventory and determine the actual and potential classes of recreational use of the federal system of PAs of Brazil. An important

reason to use ROS as the framework for the study is its simplicity, pragmatic and replicable approach designed by managers for managers (McCool et al., 2007).

Federal System of Protected Areas of Brazil

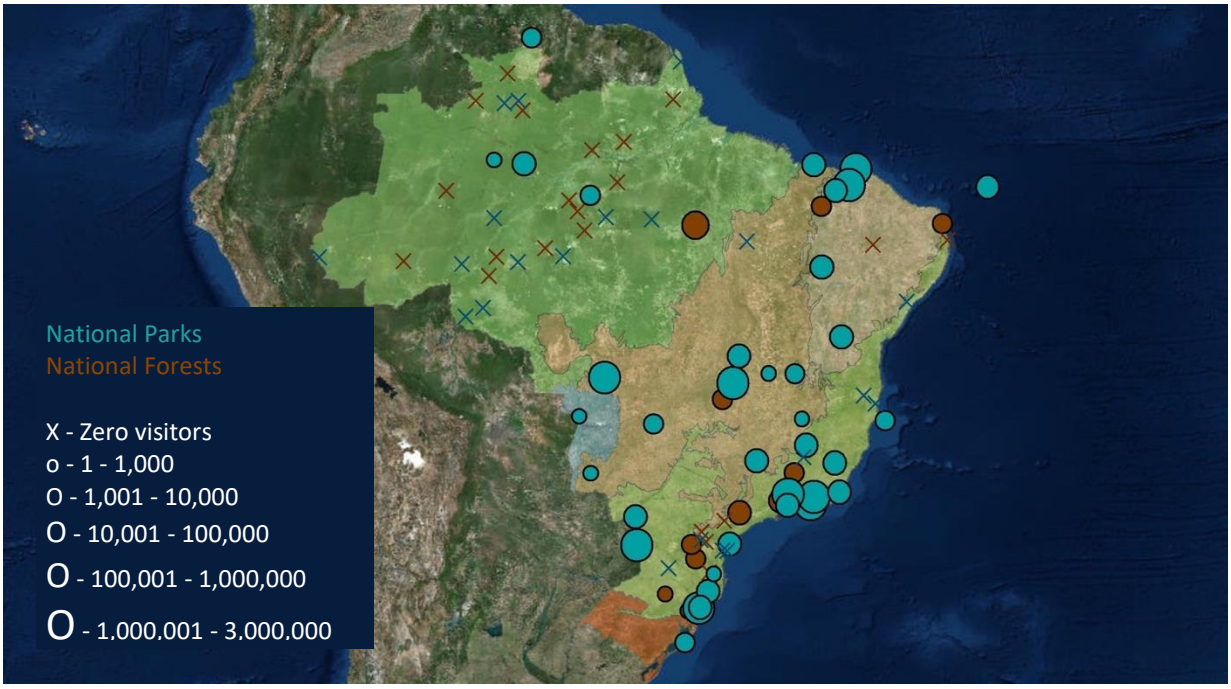


Figure 2-4. National Parks and Forests of Brazil

Brazil has been managing visitation since the first PA in 1937, Itatiaia National Park, designated "as a center of attraction for travelers, domestics and foreigners" (Brazil, 1937). The Chico Mendes Institute for Biodiversity Conservation (ICMBio) is the federal agency responsible for the management of the Brazilian federal protected areas. The categories that have more areas prepared for visitation are National Parks (IUCN category II) and National Forests (IUCN category VI) (MMA, 2007) (Figure 2-4). National Parks allow only tourism and research whereas national forests also permit other uses such as timber, mining, and traditional utilization by local communities.

Due to recent efforts in capacity building, the number of reported visitors of PAs has been growing gradually to achieve more than 8 million visitors in 2015. Visitation is an activity that is allowed in most of the PAs categories in Brazil (all of them if environmental education is considered) (Brazil, 2000). However, from 320 only 62 PAs reported visitation in 2015, where 38 are national parks and 17 are national forests (90%) (ICMBio, 2016). Due to the number of cases, for the purpose of this study, the population analyzed included only national parks and national forests.

Table 2-2. Annual Recreation Visitation by SNUC Categories 2015 (ICMBio, 2016)

SNUC Categories	N^0 of PAs	N^0 of Visitors
National Parks	38	7,149,112
National Forests	17	371,339
Environmental Protected Area	3	394,744
Extractive Reserves	1	150,000
Relevant Ecological Interest Area	1	3,294
Biological Reserves	1	2,375
Ecological Station	1	154
Total	62	8,071,018

Despite the large number of federal areas in Brazil, ICMBio never specifically applied ROS on a system level, though they had been using the concepts of zoning for more than 40 years. Kenton Miller is responsible for spreading the idea of General Management Plans (GMP) for PAs in Latin America and Brazil. He adapted the concept of Recreation Opportunities Classes to consider other management issues (e.g.

protection and research) and named it Management Zones. His guidelines for General Management Plans (GMP) have been used in Brazil since the 1970's (Moseley et al., 1976; Miller, 1978) and are the reference for the zoning systems proposed in the Brazilian Guidelines for GMP (IBAMA, 2002; ICMBio, 2009). Different categories such as national parks and national forests have specific GMP guidelines and different names for the zones. However, the zoning systems are similar and can be matched with ROS classes. The Figure 2-5 compares the zoning classification system for national parks and forests of Brazil and the ROS recreation classes. All of them range from more restricted to areas of more intensive use, demonstrating the same spectrum of possible experiences. As highlighted by Clark and Stankey (1979), more important than the name and number of classes is the range of different settings that they cover.

Categories	Zoning Classification System			
ROS (Clark and Stankey, 1979)	Primitive	Semiprimitive	Semimodern	Modern
National Parks	Primitive	Extensive Use		Intensive Use
National Forests	Primitive	Forest Management		Visitation

* Only Brazilian PA zones that are related to visitor use are presented

Figure 2-5. Correspondence between ROS classes and PAs zones

Visitor use data is significant for various aspects of PAs management. For example, natural resources protection is partly determined by the type of recreation opportunities offered. Maintenance operations require a close observation of tourism

demand while concessions and services are dependent on use levels and expenditures. Furthermore, local businesses are also interested in tourism flows and associated spending in the region (Eagles et al., 2000). Therefore, the classification of recreation opportunities is strategic for understanding tourism's social and economic impacts.

Methods

Data Collection

This research looked at Brazilian Federal Protected Areas. Different sources were used to collect information. Primary data were collected on-line among managers of 71 National Parks and 67 National Forests (n = 138) during January and February of 2016. Questionnaires were developed via the survey software Qualtrics. ICMBio endorsed the survey with a circular memo sent to the PAs. Four more reminders (1 per week) were sent by the researcher. A total of 101 questionnaires were completed (74% response rate), and 94 were usable. From the 94, 36 are national forests (NF), and 58 are national parks (NP), which represents 69% of the population of 138 parks and forests. Data was supplemented with secondary sources from ICMBio's internal documents (i.e., management reports) and mediums such as government databases and the internet. The data collection was 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 were drawn from previous research from Viveiros de Castro et al. (2015).

Operationalization of Variables

Internal settings

The variables within this setting reflect the internal attributes of the sites. The physical attributes are comprised of natural/cultural variety (number of different landscapes, waterscapes, and cultural expressions) and scenic attractiveness. Essentially, each PA's name, as well as its most famous attraction, was queried in Google Citations during February of 2016. The social attributes encompass a variable that represents the diversity of recreation and sports activities (e.g., trekking, climbing, diving, cycling, etc.) and crowding. The 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).

External settings

The variables within the external setting consider regional characteristics that can influence visitation. The physical attributes consist of attractions in the region based on the location of the PAs. Specific information was compiled from the TripAdvisor website for the respective locations. For each site, the web link “Things to do” was searched for information regarding o the gateway communities. Similarly, TripAdvisor was employed to compile information about tourism infrastructure such as accommodations and restaurants, which are noted as hospitality establishments under the managerial category. Meanwhile, the social attributes evaluate public in potential. To estimate day use area, a buffer zone of 100 km around the PAs was used; 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 Analysis

A resource classification system based on the ROS attributes (physical, social and managerial) was developed to group the protected areas by primary vocation. Two settings of attributes were developed to address the PAs within a tourist destination (Viveiros de Castro et al., 2015). The indicators in each attribute were indexed in a 5-point scale, summed and divided by the number of variables to classify the sites. The same procedure was used to develop the internal, external and final classification. To facilitate the understanding among Brazilian managers, the names of the class of recreation use were based on the actual zoning system used for national parks in Brazil: primitive use, semi primitive use, extensive use, intensive use and highly intensive use (IBAMA, 2002) (Figure 2-5). Data were processed in SPSS, ARCGIS and Number Spreadsheet (Kil & Confer, 2005). To divide the classes, the Natural Breaks optimization method was used. This method minimizes average deviation from the mean in each class while maximizing deviation from the other classes mean (Jenks, 1967). For logarithm transformed variables, classes were divided based on standard deviation of the mean.

Dependent Variable	Number of visitors 2015 (Log)
Independent Variables	**Internal Setting**
Physical Attribute	
Natural/Cultural Variety	Number of different landscapes in the same PA (mountain, beach, falls, etc.)
Scenic Attractiveness	Number of citations in a Google research of the PA's name and most important attraction
Social Attribute	
Diversity of Activities	Number of recreation and sports activities offered (trekking, climbing, diving, cycling etc.)
Crowding	PA area (km^2) / (number of visitors/year)
Managerial Attribute	
Recreation Facilities	Number of structures offered (lookouts, parking lots, visitor center, etc.)
Visitor Services	Number of services provided by the PA or concessionaires (transport, souvenirs, food etc.)
PA Staff	Number of PA staff
PA Budget	One year budget spent per PA
Planning Tools	Number of management documents that the PA already produced and updated (General Management Plan, Outdoor Recreation Plan, Interpretation Plan etc.)
Internal Access	Kilometers of internal roads and trails
Land Tenure	Percentage of the PA owned by the government
Independent Variables	**External attributes**
Physical Attribute	
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 in the website TripAdvisor
Public Access	Travel time from nearest commercial airport
Social Attribute	
Socioeconomic context	Average Human Development Index - HDI of the municipalities included in the 100km buffer zone
Population Density	Number of citizens living in municipalities included in a buffer zone of 100 km around the PA
Managerial Attribute	
Hospitality Establishments	Number of lodging and restaurants mentioned on Trip Advisor for the gateway communities

Figure 2-6. Operationalization of variables

Descriptive Analysis

The PAs received a score for each attribute between 1 and 5. The three internal attributes (physical, social and managerial) composed the overall internal score and the same three external attributes composed the overall external score. The internal and external scores formed the final score. The PAs' scores defined their class. For example, the overall internal classification for Chapada dos Guimaraes NP was intensive (3.9), and the overall external was intensive (3.7). They were summed, divided by two and the final score was 3.8, classifying the PA as intensive. Other cases such as Monte Roraima NP, showed the overall internal class was extensive (3.2) but the overall external class was primitive (1.2) which resulted in the PA being classified in the middle as semi primitive (2.2). Appendix A presents all PAs' classification.

Protected Area	Internal				External				Final Class
	P	S	M	O	P	S	M	O	
Tijuca NP	4.5	5.0	4.6	4.7	5.0	5.0	5.0	5.0	Highly Intensive (4.9)
Chapada dos Guimarães NP	4.5	4.0	3.3	3.9	4.0	3.0	4.0	3.7	Intensive (3.8)
São Franscisco de Paula NF	2.5	3.0	3.3	2.9	3.0	4.0	3.0	3.3	Extensive (3.1)
Monte Roraima NP	4.5	2.5	2.5	3.2	1.0	1.5	1.0	1.2	Semi Primitive (2.2)
Jatuarana NF	1.5	1.0	1.0	1.2	1.0	2.0	1.0	1.3	Primitive (1.3)

* Example of 5 sites / P - Physical, S - Social, M - Managerial, O - Overall

Figure 2-7. Overall Visitation Classifications of use for Brazilian PAs*

Statistical Analysis

From the 94 respondents in the sample, 51 reported number of visitors in 2015 to ICMBio. A one-way ANOVA was conducted to compare number of visits between the different classes (primitive to highly intensive) (Puustinen et al. 2009). Analysis of Variance (ANOVA) assessed the statistical significance between 2 or more independent groups, in this case recreation classes (Hair, 2010). The dependent variable was the reported number of visitors in 2015. The independent variables were the internal, external and final scores. One-way ANOVA needs two or more observations in each group to run the analysis. Due to only one site being classified as highly intensive (Tijuca NP), the highly intensive class and intensive class were grouped together. Pristine was also merged into the semi primitive class due to the lack of primitive PA that reported visitors for the overall internal and final scores. Data was normally distributed for each group, as assessed by Shapiro-Wilk tests ($p > 0.05$); and there were homogeneity of variances, as evaluated by Levene's tests of homogeneity of variances (minimum $p > 0.531$).

Results - Descriptive Analysis

Internal Setting Classification

Internal physical attributes

During the survey, PA managers identified 25 categories of natural attractions and 11 man-made attractions. Some PAs reported only one and Serra da Bocaina NP was the one who informed the largest number - 16. On average, PAs reported 6 classes of attractions. The five more common attractions were: Forest (73%), Rivers (67%), Waterfalls (48%), Geological Formations (42%), and Cultural Heritage (39%) (Appendix C).

Indicator	Primitive Use	Semi Primitive Use	Extensive Use	Intensive Use	Highly Intensive Use
Natural/Cultural Variety (n)	Poor	Good	Very Good	Excellent	Outstanding
mean	-	3	5	9	13
range	-	(1 - 8)	(1 - 8)	(6 - 13)	(9 - 16)
Scenic Attractiveness (google citation)	Local	State	Region	National	International
mean	-	5,650	53,867	118,517	1,328,020
range		(234 - 30,908)	(1,090 - 313,000)	(3,890 - 420,000)	(84,600 - 9,172,000)
Class Description	PAs are only known locally and have no special features.	PAs are known within the state and offer few natural / cultural attractions.	PAs are known in the states around and offer some natural/cultural attractions.	PAs are well known nationally and offer a great variety of natural / cultural attractions	PAs are Brazilian icons known internationally and offer a great variety of natural/cultural attractions.
Number of Protected Areas	0	31	32	21	10

Figure 2-8. Internal Physical Attributes

Internal social attributes

Managers identified 58 different activities that are currently happening in PAs of Brazil. Lençóis Maranhenses NP with 26 and Jericoacoara NP with 25 were the areas who informed the greater spectrum of activities. On average, PAs that receive visitors, reported to have 10 different activities. The 10 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, 6) Birdwatching, 7) River / waterfall bathing, 8) Biking, 9) Camping, 10) Walk one day (with 5 or more miles round trip) (Appendix C).

Indicator	Primitive Use	Semi Primitive Use	Extensive Use	Intensive Use	Highly Intensive Use
Diversity of Activities (n)	Poor or None	Good	Very Good	Excellent	Extensive
mean	0.6	7	13	17	22
range	(0 - 3)	(5 - 11)	(6 - 26)	(13 - 17)	(19 - 25)
Crowding [km^2/(visitor/day)]	None	Very Small	Moderate	Large	Crowded
mean	*	183,456	3248	186	2
range	*	(126 - 1,742,957)	(7 - 19601)	(4 - 972)	(0.5 - 4)
Class Description	PAs offer few primitive forms of outdoor recreation. Opportunity for solitude.	PAs offer few low impact activities. Encounters are seldom. Opportunity for solitude.	PAs offer several activities. Encounters are occasional. Opportunity for solitude.	PAs offer a great variety of activities. Encounters with other visitors are frequent.	PAs offer a great variety of activities. Encounters with other visitors are frequent. Visitor can experience crowd.
Number of Protected Areas	25	33	24	10	2

* Primitive PAs reported no visitors

Figure 2-9. Internal Social Attributes

Internal managerial attributes

Infrastructure level varies within the system. 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 most structured. On average, the PAs who reported having facilities had 6 different infrastructures. Among the 32 reported facilities, the most common were: 1 - Administrative Office inside the PA, 2 - Indicative / informative signage, 3 - Parking, 4 - Toilets for visitors, and 5 - Ordinary gateway. The study found that 30% of PAs offer some kind of commercial services for the public. Guidance is the most offered service,

followed by internal transportation, eating, and lodging. Related to staff members, PAs in Brazil have a mean of 5 employees per area (Appendix C).

Indicator	Primitive Use	Semi Primitive Use	Extensive Use	Intensive Use	Highly Intensive Use
Planning Tools	None Does not have a general management plan yet	Emergency Outdated general management plan	Outdated General management plan in preparation / or updated	Updated Management Plan updated and one or more tools	Complementary Management Plan updated and one or more tools
Recreation Facilities (n)	Rare	Seldom	Infrequent	Common	Dominant
mean	2	2	6	13	16
range	(1 - 3)	(1 - 5)	(1 - 13)	(4 - 17)	(15 - 18)
Visitor Services (n)	Rare	Seldom	Infrequent	Common	Dominant
mean	0	1	1	5	7
range	(0 - 1)	(0 - 3)	(0 - 5)	(2 - 8)	(6 - 7)
PAs Staff (n)	None	Very Small	Small	Moderate	Large
mean	3	7	13	25	101
range	(0 - 11)	(1 - 25)	(4 - 33)	(6 - 76)	(76 - 142)
Land Tenure (%)	None	Small	Moderate	Large	Dominant
mean	10%	50%	80%	80%	90%
range	(0% - 40%)	(0% - 100%)	(10 - 100%)	(20% - 100%)	(80% - 100%)
Class Description	PAs have capacity to manage very light demand, with primitive forms of recreation.	PAs have capacity to manage light demand, preferably minimum impact activities.	PAs have capacity to manage moderate demand, preferably minimum impact activities.	PAs have capacity to manage high demand with controlled impact throughout the year.	PAs have full capacity to manage heavy visitation with controlled impact throughout the year.
Number of PAs	9	36	39	7	3

Figure 2-10. Internal Managerial Attributes

Overall internal setting

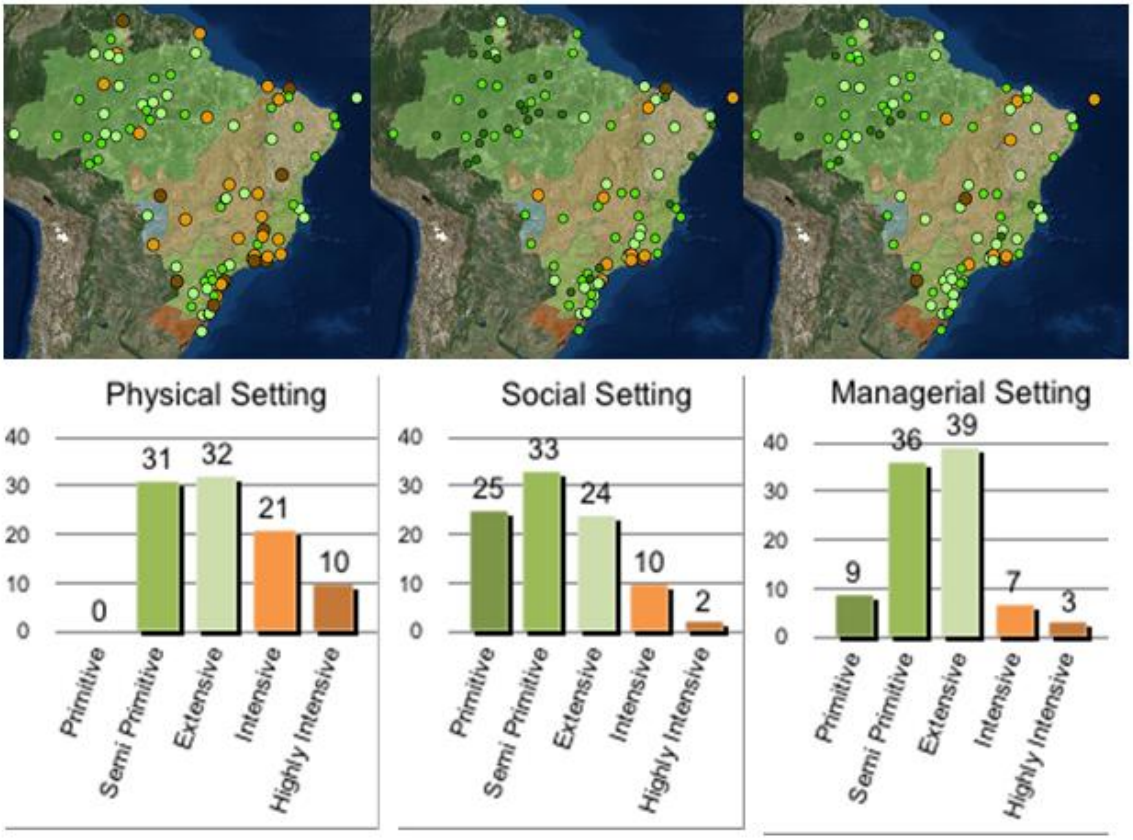


Figure 2-11. Internal Physical, Social and Managerial Inventories

When the three attributes are compared, it is possible to observe some differences between them. The physical attributes have the major concentration of PAs (31) in the most developed classes: intensive and highly intensive. That is more than double the social attributes (12) and triple the managerial (10). Several PAs are not managed to provide the full spectrum of recreation opportunities that the physical attributes have. Corroborating that, the social attributes have the highest number of primitive classes that provide no or very few activities. The managerial attributes present a concentration of PAs in the semi primitive and extensive classes with very few PAs with capacity to manage intensive and highly intensive recreation classes.

Primitive Use - These PAs are normally very large and remote. They have a high degree of naturalness and integrity of ecological processes, as well as occurrences of important fauna and endemic species in a significant natural state. However, there is very few or no presence of attractive landscape. When local communities are present, they preserve traditional methods of livelihoods. There is no evidence of tourism and encounters with other visitors are rare. Due to the very low management capacity, visitation should be limited to locals, researchers or high skilled and educated ecotourists that do not require assistance. No infrastructure is offered and users should follow “leave no trace” techniques.
Semi Primitive Use - PAs can be large and remote, offering high degree of naturalness and integrity of ecological and natural processes. Areas may have also resources management or use by local communities. The landscape and traditional uses compose some attractions for visitors. There is little evidence of tourism, and encounters with other visitors are seldom. Users have opportunity for solitude, autonomy, navigation and challenge, for example. There are areas without trails or marked routes. In those areas, visitation requires appropriate equipment, field skills or a guide. Besides trails, rustic signs and camping sites, there is almost no infrastructure or services available. Internal access is usually by foot or animals on trails, or rustic unpaved roads. Management capacity is low and is very focused in conservation. Visitation should follow “leave no trace” techniques.
Extensive Use - Presence of human activity is more evident including the sustainable use of resources where it is permitted. The landscape may contain a mixture of natural and cultural features offering attractions of regional level. PAs offer more well-marked trails. Internal access continues to be by trails, or better managed unpaved roads and even a few paved ones. 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. Visitors may find rustic visitor centers, some information, developed camping areas, potable water, restrooms, etc.
Intensive Use - The landscape contains a mixture of natural and cultural features offering excellent variety and attractiveness at the national level, with possibilities of some international demand. Internal access normally occurs via well managed unpaved roads but mostly on paved ones and well designated trails. The infrastructure is designed and suitable for more intensive use. Developed visitors centers, exhibits, interpretative trails are expected. 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 near the attractions. There is a good variety of activities and services offered. Increases the possibility for more meetings and interaction.
Highly Intensive Use - Protected Areas here are Brazilian icons known worldwide. The 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. The infrastructure is designed and suitable for heavy intensive use and provides developed visitors centers, exhibits, and interpretative trails, for example. Visitation is one management priority with more attention to the quality of the experience, safety of visitors and management of sensitive areas near the attractions. There is a good variety of activities and services offered. Meetings and interaction happen all the time and visitor may experience some crowd situations.

Figure 2-12. Description of the Recreation Opportunity Classes - Internal Setting

Based on the internal settings, a general description to identify the characteristics and management actions for each class is presented in Figure 2-12. General descriptions provide a picture of the recreational use of class. Based on the indicators,

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 (Aukerman, Haas, and Associates, 2011, Brown et al., 1978; Cocklin et al., 1990; Driver and Brown, 1978; Brown et al., 2009, More et al., 2003).

External Setting Classification

External physical attributes

Indicator	Primitive Use	Semi Primitive Use	Extensive Use	Intensive Use	Highly Intensive Use
Regional Attractions (n)	None	Very Small	Small	Moderate	Large
mean	2	3	31	52	315
range	(1 - 2)	(1 - 10)	(2 - 314)	(3 - 191)	(42 - 1142)
Public Access (mim)	Very difficult	Difficult	Moderate	Easy	Very Easy
mean	383	193	137	78	22
range	(302 - 555)	(89 - 457)	(26 - 264)	(26 - 167)	(16 - 32)
Class Description	PAs are isolated attractions and faces serious accessibility issues, sometimes with boat access only.	PAs are located in regions with some other tourist attractions, but faces some accessibility issues.	PAs are located in regional destinations that has an airport not too far.	PAs are located in consolidated national destinations that has a airport within or closer.	PAs are one attraction of a consolidated international destination that has a international airport.
Number of PAs	15	29	27	17	6

Figure 2-13. External Physical Indicators

External physical attribute evaluates the natural/cultural characteristics and physical access of the destination. The spectrum of classes from primitive to highly intensive estimates the attractions and accessibility of the region. Brasília National

Forest is one of the highly intensive destinations. It is located within the boundaries of Brazil's capital, Brasília, a city with an extraordinary number of attractions and served by an international airport. The intensive class has 17 PAs that have easy access and are clustered with a good sort of other natural/cultural attractions; on the other hand, the extensive class PAs, as São Joaquim NP, are in a region with some other attractions but are more than two hours from an airport. In general, in the semi primitive class, PAs are located in regions with very few other attractions and difficult access. The primitive class PAs are located in very remote areas where the park or forest is the only attraction.

External social attributes

Indicator	Primitive Use	Semi Primitive Use	Extensive Use	Intensive Use	Highly Intensive Use
Socioeconomic context	Very Poor	Poor	Good	Very Good	Excellent
mean	0.498	0.638	0.705	0.760	0.823
range	-	(0.542 - 0.690)	(0.552 - 0.862)	(0.659 - 0.826)	(0.786 - 0.845)
Population Density	None	Very Small	Small	Moderate	Large
mean	65,962	142,727	623,357	2,723,716	8,632,993
range	-	(0 - 264,793)	(3,012 - 2,257,715)	(1,035,637 - 6,781,815)	(3,358,017 - 20,833,304)
Class Description	PAs are isolated in a very poor region.	PAs are surrounded by small-size poor population .	PAs are surrounded by medium-size population in a medium developed area.	PAs are located in the high density and most developed areas.	PAs are located in the high density and most developed areas.
Number of Protected Areas	1	18	39	28	8

Figure 2-14. External Social Indicators

External social attributes measured the size and quality of possible day use visitors demand. 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. The map (Figure 2-16) shows that most of the highly intensive and intensive PAs are located in the Atlantic Forest ecoregion, the most developed and populated region of the country.

External managerial attributes

Indicator	Primitive Use	Semi Primitive Use	Extensive Use	Intensive Use	Highly Intensive Use
Hospitality Establishments	None	Very Small	Small	Moderate	Large
mean	26	79	224	1,273	11,457
range	(5 - 40)	(43 - 125)	(147 - 388)	(566 - 2,415)	(10,723 - 12,860)
Class Description	PAs are not in a tourist destination.	PAs are located in a local destination.	PAs are located in a regional destination.	PAs are located in a consolidated national destination.	PAs are located in a consolidated international destination.
Number of PAs	20	25	28	18	3

Figure 2-15. External Managerial Indicators

External managerial attributes look at how prepared the gateway community is to receive tourists. The city of Rio de Janeiro (RJ) and the city of Brasília (DF) have the greater number of accommodations and meals establishments classifying Tijuca NP, Brasília NP and Brasília NF as the highly intensive class. Other state capitals such as Cuiabá (MT) of Chapada dos Guimarães and Manaus (AM) of Anavilhanas NP are considered as 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.

Overall external setting

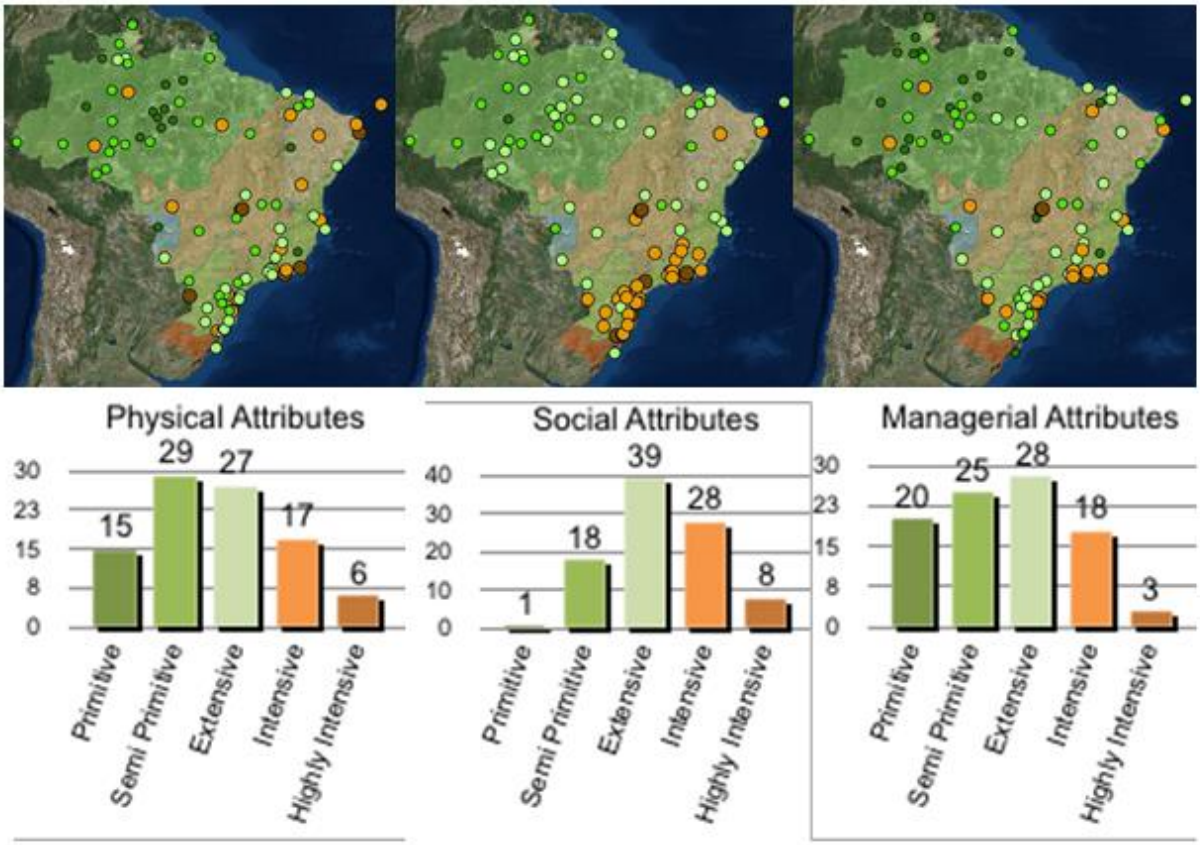


Figure 2-16. External Physical, Social and Managerial Inventories

Comparing the external attributes, more homogeneity between the classes division is observed. The destinations are not strictly controlled by the government, which allows the private sector to develop business with the regional attractions. Geographically, it is possible to observe a concentration on the developed classes in the southeast of Brazil, which has the highest density area of the country. Based on the external settings, a general description to identify the destination characteristics for each class is presented in Figure 2-17.

Primitive Use - The region is not a tourist destination and offers almost no infrastructure. Access normally is difficult and requires a flight and a off-road drive or boat ride for more than four hours. Visits are expeditions of high skilled and educated researchers or ecotourists that require no assistance.
Semi Primitive Use - The region is a small destination sometimes not developed yet or nearby a small city. The destination 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 - The region is a regional tourist destination or nearby a medium city. Region has medium development and population is medium-size. The destination offers some tourist infrastructure such as: lodging, restaurants and snack bars, grocery stores, and gas stations. Some destinations may have tourism agencies or a 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 - The region is a consolidated national destination or is nearby a large city or state capital. 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 and snack bars, wide net of 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. Sometimes the PA is the primary attraction, sometimes the PA is secondary in their travel, and local day users are common too.
Highly Intensive Use - The region is a consolidated international destination. The location is usually 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 and snack bars, wide net of 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 2-17. Description of the Recreation Opportunity Classes - External Setting

Overall Internal and External Classification

Figure 2-18 geographically compares the overall internal and external settings for all PAs. In the internal setting, semi primitive (40%) and extensive (43%) 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. Some of those PAs are still undeveloped but are located in strategic tourism destinations. Figure 2-19 shows some cases where PAs received different internal and external classes. Brasilia NF and Itajaí NP represent

cases where internally the PAs lack activities, facilities and services but externally, the areas are located in consolidated tourist destinations such as the cities of Brasília and Blumenau. Serra da Capivara and Monte Roraima NP represent PAs that are better scored internally than externally. Monte Roraima is a outstanding and well-known natural landscape but totally isolated. Serra da Capivara, an important archeological site, is also an isolated destination however with excellent infrastructure.

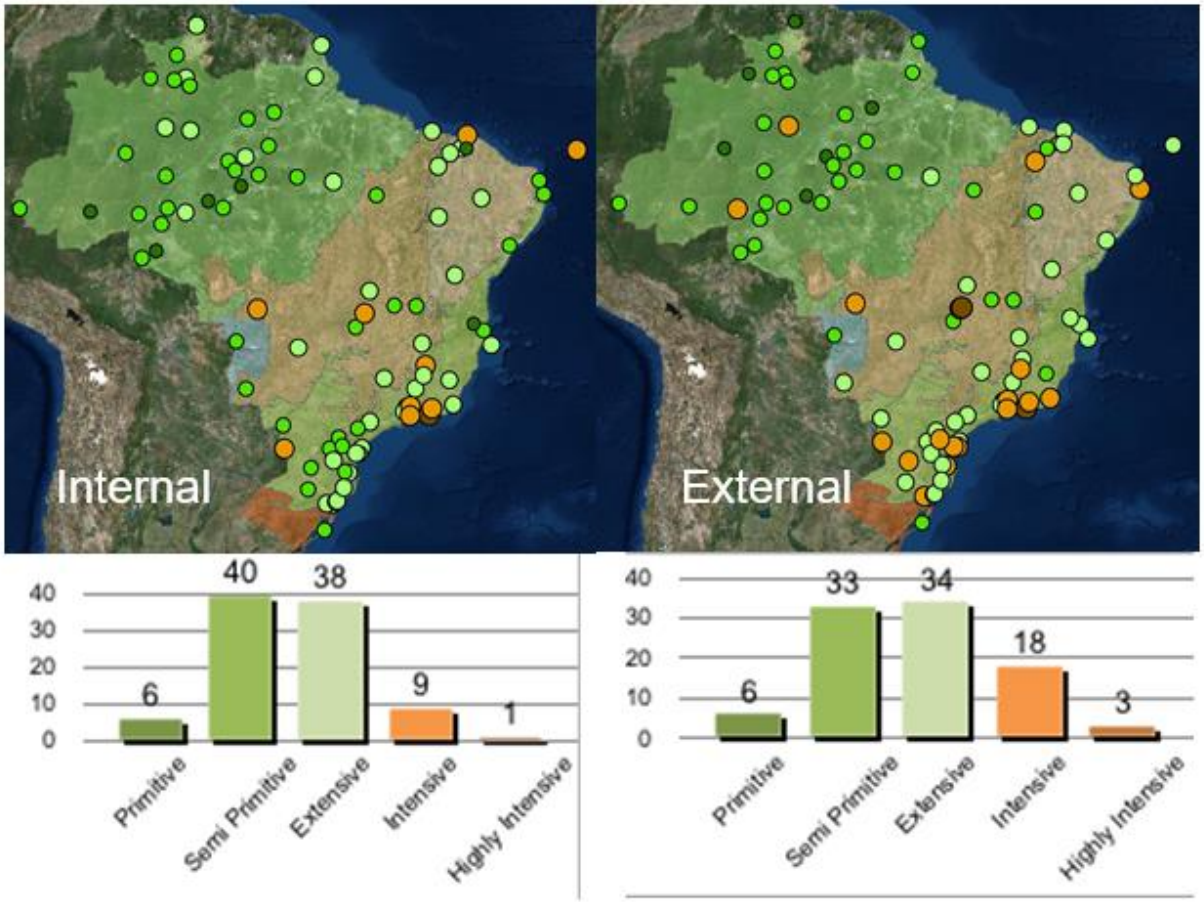


Figure 2-18. Overall Internal and External Inventories Compared

Protected Area	Internal				External				Final Class
	P	S	M	O	P	S	M	O	
Brasília NF	2.5	2.0	2.9	2.5	5.0	4.5	5.0	4.8	Intensive (3.6)
Itajaí NP	3.5	2.5	2.3	2.8	4.0	4.5	4.0	4.2	Extensive (3.4)
Serra da Capivara NP	3.0	2.5	4.1	3.2	1.0	1.5	2.0	1.5	Semi Primitive (2.4)
Monte Roraima NP	4.5	2.5	2.5	3.2	1.0	1.5	1.0	1.2	Semi Primitive (2.2)

* Example of 4 sites / P - Physical, S - Social, M - Managerial, O - Overall

Figure 2-19. Visitation Classifications of Brazilian Pas

The matrix (Figure 2-20) below presents all the interactions of the different recreational settings. The horizontal axis presents the external classes and the vertical axis the internal classes. From the 94 PAs evaluated, 46 have classes where the internal settings match the external ones, demonstrating a balance between PAs development and destination characteristics (Figure 2-21). The matrix also shows 48 unbalanced PAs with a first group of 18 that have higher internal than external classification and a second group of 30 that have lower internal than external classification. The PAs of the first group present higher scores in internal attributes than the surrounding destination while the bigger cluster of the second group has PAs that can increase supply of recreation opportunities because the destinations are better structured than the other PAs. These are PAs that only need internal investments from ICMBio to increase visitation while the first group needs political arrangements to develop the whole region.

		External Classes				
	Class	Primitive	Semi Primitive	Extensive	Intensive	Highly Intensive
Internal Classes	Primitive	1	3	2	-	-
	Semi Primitive	4	20	10	5	1
	Extensive	1	10	19	8	-
	Intensive	-	-	3	5	1
	Highly Intensive	-	-	-	-	1
		First Group		Second Group		

Figure 2-20. Matrix of overall internal and external settings and number of Pas

PAs evaluated	Same internal and external class	First group: Higher internal than external class	Second group: Lower internal than external class
94	46	18	30

Figure 2-21. Number of PAs in different internal and external classifications

Overall Final Classification

The map (Figure 2-22) displays the final geographical inventory of recreation classes of use. Final classification presents semi primitive (42%) and extensive (45%) as major categories similar with the overall internal 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. The matrix (figure 2-

20) shows that there are two distinct groups of PAs where internal and external classes do not match.

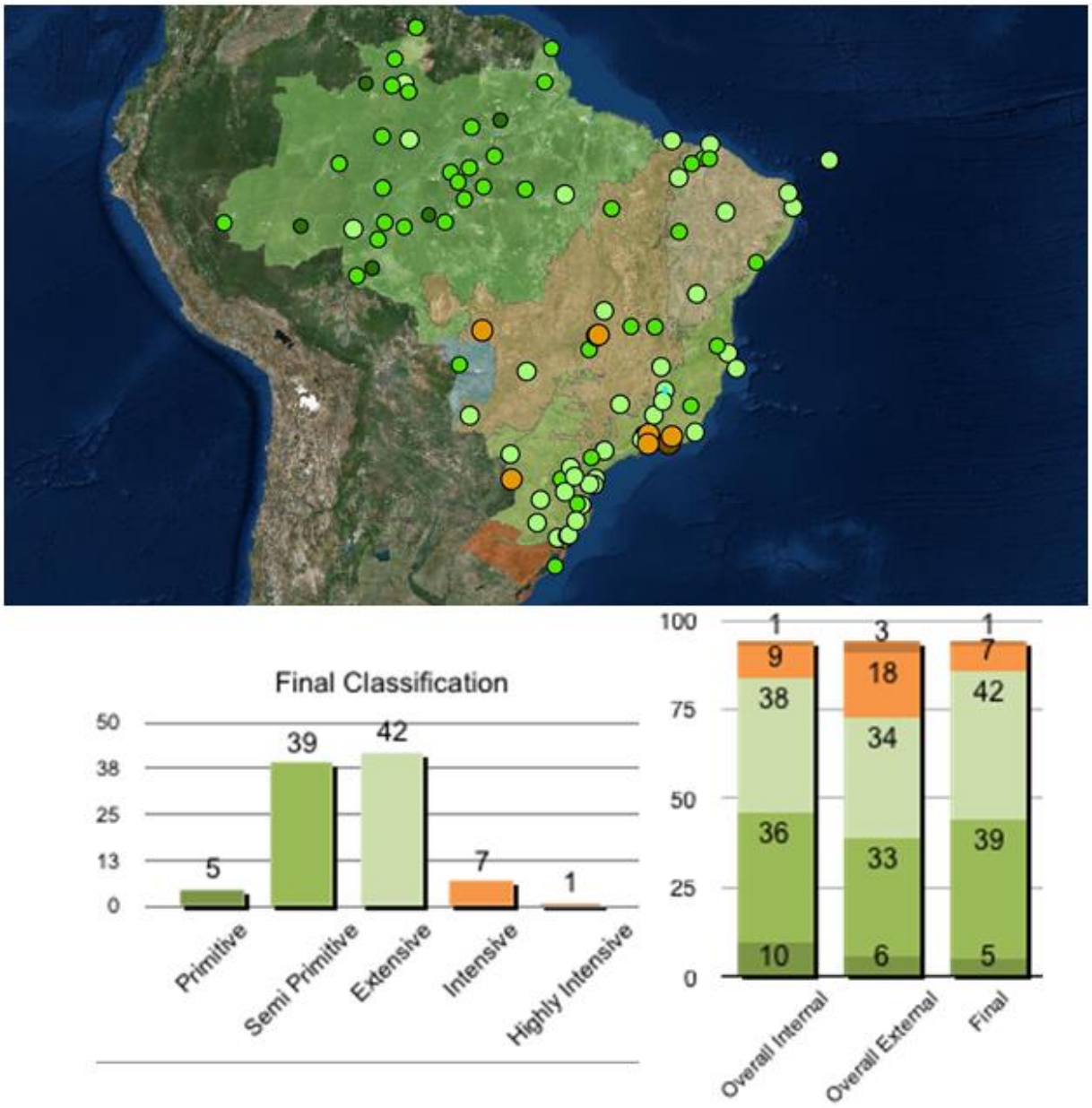


Figure 2-22. Overall final inventory

Figure 2-23 shows how much area and visitors is contained in each recreation class. 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 and visitors per hectare that increase from semi primitive to highly intensive. Total area and visitation per class is graphically compared in Figure 2-24. They show also 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	Number of PAs	Area Mean (ha)	Area Total (ha)	% Area Total	Visits Sum	Visitor/ Hectare	% Visits Total
Primitive	5	761,530	3,807,652	15%	0	0.00	0%
Semi Primitive	39	441,545	17,220,284	67%	209,091	0.01	3%
Extensive	42	99,869	4,194,511	16%	1,768,532	0.42	24%
Intensive	7	58,001	406,013	2%	2,559,797	6.30	34%
Highly Intensive	1	3,958	3,958	0.01%	2,945,355	744.15	39%

Figure 2-23. Variation of Area and Visitors per Final Classification

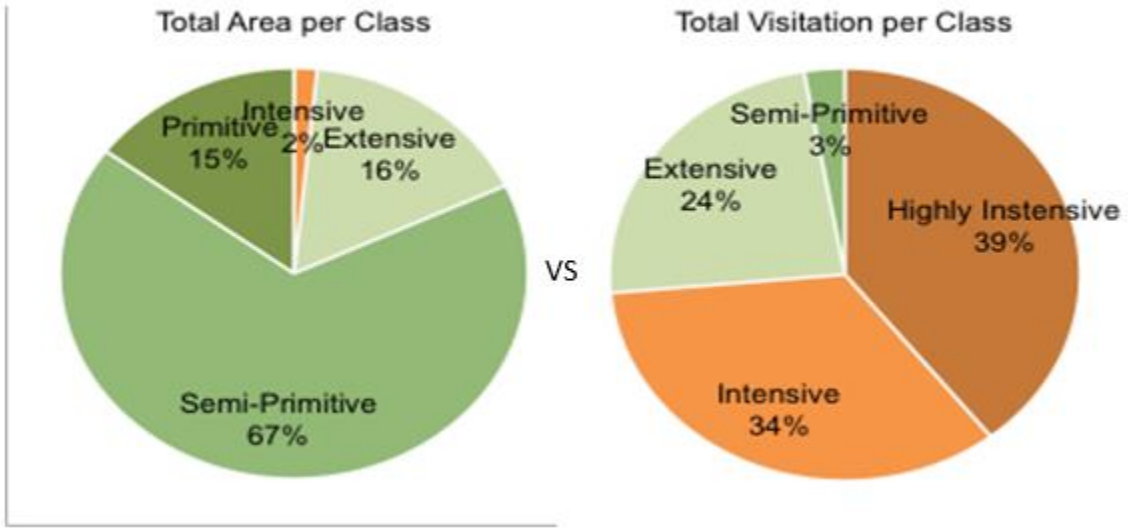


Figure 2-24. Area per Class versus Visitation per Class

Results - Statistical Analysis

Classification	Internal	External	Final
Classes	Visits Sum	Visits Sum	Visits Sum
Primitive	0	2,174	0
Semi Primitive	77,613	204,726	209,091
Extensive	1,007,836	1,736,515	1,768,532
Intensive	3,451,971	2,272,451	2,559,797
Highly Intensive	2,945,355	3,266,909	2,945,355
F-statistic for visits	19.950	3.559	10.503
p-value	0.000	0.036	0.000
Tukey's comparison between groups tests, p-values			
highly intensive+intensive vs. semi primitive+primitive	0.000	0.028	0.000
highly intensive+intensive vs. extensive	0.000	0.261	0.001
extensive vs. semi primitive+primitive	0.026	0.293	0.268

Figure 2-25. Sum of visitation for different recreation classes and ANOVA analysis

The one-way ANOVA analyzed the differences among the recreational classes of use in each result: overall internal, overall external and final classification. The ANOVA showed that visitation significantly differed between the internal recreation classes at the *p*-level of 0.000. The pair-wise analysis revealed that all classes (highly intensive+intensive vs. extensive vs. semi primitive+primitive) significantly differ from each other (*p*-levels < 0.05) demonstrating that visitation demand is affected by the different internal attributes. The analysis of variance of the external recreation classes also revealed to be statistically significant at the *p*-level of 0.036, indicating that the destination where the PA is located also influences number of visitors. In particular,

highly intensive+intensive PAs significantly attracted more visitation compared with semi primitive+primitive (*p*-level of 0.028). The final classification of the PAs showed that visitation significantly differed at the *p*-level of 0.001 between the recreation classes, demonstrating that the interaction of the settings are relevant for visitor use management. Particularly highly intensive+intensive classes revealed significant difference from the other two groups tested: extensive and semi primitive+primitive (*p*-levels < 0.005). The one-way ANOVA revealed that the different internal settings proposed in ROS play a role in visitor preferences. The analysis demonstrated also that the external settings is also relevant to manage recreation opportunities (Figure 2-25).

Discussion

The research developed a recreation classification system for the federal PAs of Brazil. The various internal and external PA atributes illustrated the different characteristics of the sites. Based in the indicators, the classes definitions are in conformity with other ROS classifications around the world, as well as the original ROS (Aukerman, Haas, and Associates, 2011; Brown et al., 1978; Cocklin et al., 1990; Driver and Brown, 1978; Brown et al., 2009; More et al., 2003). The external attributes demonstrated to be statistically and practically relevant, which supported previous research (Viveiros de Castro et al., 2015; Neuvonen et al., 2010; Puustinen et al., 2009). The classification of the whole PA system also demonstrated to be effective, reinforcing previous studies and recommendations (Brown et at., 2009; Kil & Confer, 2005).

The analysis indicated that the different recreation classes are associated with numbers of visits. Both internal and external classification revealed to be correlated to tourism demand. The study demonstrated that the PAs with outstanding natural/cultural

internal physical attributes and various activities supported by diverse facilities, services, trails and internal roads receive more visitors, supporting previous studies (Deng et al., 2002; Lee et al., 2010; Puustinen et al., 2009). Although classes such as highly intensive and intensive concentrate most of the demand, the existence of other classes as extensive and semi primitive that offer different experiences is important to form the spectrum of recreation opportunities. Some visitors prefer less social interaction and provision of services and facilities (Iatu & Bulai, 2011). The external attributes demonstrated that location and access are essential to visitation influx (Clawson & Knetsch, 1963; Hanink & Stutts, 2002).

The research designed a framework to address outdoor recreation in Brazil. PAs can regularly be inventoried to monitor the evolution of recreation opportunities. The ROS classes used in this study can also be matched with the actual zoning system used in GMPs. Like the zones, the one-way ANOVA analysis showed that there are three significant groups since primitive and semi primitive, and highly intensive and intensive, were grouped together. These three 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 (Figure 2-26).

Categories	Zoning Classification System		
ROS	primitive	semi primitive / semi-modern	modern
National Parks	primitive	extensive	intensive
National Forests	primitive	Forest management	visitation

Figure 2-26. Correspondence between ROS classes and PAs zones in Brazil

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.

Whit the development of the system in Brazil, the framework has space to expand and accommodate more classes. However, for now, three outdoor recreation classes offer a simple and effective tool for management purposes. For example, PAs in primitive and semi primitive classes need simple intervention that can be easily implemented by the ICMBio staff. On the other hand, intensive and highly intensive PAs require more investments to provide necessary facilities for large numbers of visitors. The system of recreational classes of use facilitates ICMBio management since PAs from the same groups can be similarly administered. Different classes can have access to different funds and budget, different management approaches, investments in facilities and options for concessions contracts. Since almost all indicators are sensible to management variation, PAs can shift between classes and receive the most appropriate support. Also, new or not evaluated PAs have with the classification system, an opportunity to understand their real potential to develop realistic GMPs and Visitor Management Plans.

The analysis showed also that the system as a whole presented the same characteristics of a single PA in regard to total area and number of visitors per class. Generally, in one PA, zones as highly intensive and intensive have a small percentage of the total area and concentrate most of the visitation, while extensive and semi primitive classes are much larger with low use rates. The same pattern appeared at the country level where semi primitive and extensive have most of the area and highly

intensive and intensive most of visitation. This indicates that an overall classification for the PAs maybe be useful for the GMP and Visitor Management Plans of each PA (Pettengill & Manning, 2011). The study 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 PA. 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 necessary to offer a varied spectrum of recreation opportunities, optimizing the experiences and benefits (Aukerman et al., 2011; Viveiros de Castro et al., 2015; Neuvonen et al., 2010; Puustinnen et al., 2009).

ICMBio should give special attention for PAs where the internal or external classes differ from the final ones. Internally undeveloped sites located closer to high density areas such as Itajaí NP or Brasília NF should receive more investments due to their high potential to increase visitation influx (Clawson and Knetsch, 1963). Public use is one of the main ICMBio objectives and those areas should serve the population, promoting leisure for visitors and development for surrounding communities. On the other hand, Serra da Capivara and Monte Roraima NP are outstanding destinations *per se* and can be vectors of development for a whole region with an effective plan for accessibility and attractiveness. 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.

The current study focused on national forests and national parks, which limits the extrapolations of results for other PA categories. It should also be noted that

questionnaires were 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.

Concluding Remarks

The Recreation Opportunity Spectrum (ROS) framework demonstrated to be suitable to classify outdoor recreation in the PA system of Brazil (McCool et al., 2007). 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 (Manning, 2011).

The external attributes addressed the new challenges that agencies face in protected area management nowadays. The external setting focuses on aspects such as day use population, access, and infrastructure which are critical to financial affairs, pricing, tourism business and economic impacts affecting multiple stakeholders and local communities (Eagles, 2001; Thapa, 2013). Managers can analyze the PAs within the context of a destination and understand users' decision to visit a particular area. The same can be done for a cluster, for an ecoregion or the whole system (Viveiros de Castro et al., 2015; Puustinnen et al., 2009). Managers can perceive the external circumstances, beyond their management capacities, that are affecting number of visitors and define strategies to influence them.

Further research can look more specifically to the recreation opportunity classes within each ecoregion or different PA's categories. Evaluation of better management strategies for each group should also be addressed, as well as more effective indicators and measurements. The results also offer data to further analyze the tourism demand with the same variables used to inventory the supply of recreation opportunities in PAs.

CHAPTER 3
RECREATION DEMAND ANALYSIS OF FEDERAL PROTECTED AREAS OF BRAZIL

Brazil is considered the most biologically diverse country in the world, managing six terrestrial ecosystems and three large marine biomes (Brazil, 2010). The natural beauty is so exuberant that the country was considered the most competitive tourism destination in the category of natural resources in 2015 (Crotti & Misrashi, 2015). The most important scenic landscapes and mega biodiversity spots are located within protected areas (PA). In 2015, Brazil managed around 8 million visitors within a total of 325 PAs that correspond to an area of 79 million hectares (ICMBio, 2016). While visitation influx has been growing every year since 2002, based on the size and the number of PAs, Brazil receives a comparatively small volume of visitors. This small demand may be the result of various issues. One possible cause is the protected areas agency's longstanding viewpoint towards tourism. For the past 30 years, tourism has been perceived as an agent of negative impact, such as exotic plants or fire, which has justified the lack of priority on visitor use management (Zimmerman, 2006). The lack of access and infrastructure development has been evident. Areas designated national parks more than 50 years ago are still closed for tourism hindering the growth potential of the system. Only a few PAs provide services, such as concessions, which limits the access of the average tourist (Rodrigues, 2009).

Despite the fact that literature on PAs has given more attention to the negative impacts of tourism, low visitation demand has been surprisingly demonstrated to be far more harmful to conservation than high demand (Mulholland & Eagles, 2002). The International Union for Conservation of Nature (IUCN) list a series of problems that occur when a country has low number of visitors in PAs, such as lack of political

support, lack of social and economic benefits to local people, low revenues and budget allocation (Leung et al., 2015).

Brazil PAs agency has been facing historical constraints in budget allocation, making visitor fees and concession contracts main sources of revenues. To continue increasing visitation influx and consequently turnover for the PAs system, Brazil needs to understand what factors influence tourism demand. For example, why do some PAs receive more visitors than others? What are the internal and external characteristics of those areas that attract more tourists? Which PAs will respond better to investments?

Understanding the PAs' aspects that affect tourist decision is important to offer the right spectrum of recreation opportunities guaranteeing efficiency and a sustainable growth of visitation. The purpose of Chapter 3 is to calculate the visitation potential of the Federal System of PAs of Brazil based on the recreation classes developed in Chapter 2. More specifically, three objectives have been formulated to:

- Define which attributes (physical, social and managerial) are correlated to number of visitors
- Develop a model to predict tourism demand in PAs
- Predict the potential number of visitors in an improved scenario where all PAs are in appropriate classes of recreation use.

To accomplish that, the study uses Pearson' Correlation and Stepwise Regression to analyze how the indicators from the physical, social and managerial attributes are related to the number of visitors. The idea is that a more efficient visitor use management system increases revenues and optimizes investments providing resources to improve environmental conservation and social development throughout the entire system.

Literature Review

Recreation Opportunity Spectrum (ROS)

Among the various types of protected areas, the most popular for tourism are the national parks (IUCN category II) and national forests (IUCN category VI). Both have included in their main objectives to provide opportunities for recreation. Recreation opportunities are formed by four elements: visitors searching for recreation activities, in particular settings to have experiences and following benefits (Manning, 2011). These settings have three different attributes: physical, social, and managerial. Combinations of these attributes create different classes of use or zones within a PA where recreation opportunities may occur. Recreation opportunities go from trekking solo in a total primitive zone with no facilities and few visitor encounters, to more developed classes where visitors enjoy picnics in areas with altered landscape and several facilities that serve various groups of tourists. Each class offers different experiences, which turn into benefits for individuals, communities, environments, and economies. These are the basic concepts of the Recreation Opportunity Spectrum (ROS) framework (Brown et al., 1978; Clark & Stankey 1979; Driver & Brown, 1978). Understanding the relationships between the various settings with different activities is strategic for efficient visitor use management (Aukerman et al., 2011).

ROS has been widely used in visitor use management on site (Manning, 2011; Pettengill & Manning, 2011) However, a full spectrum of recreation opportunities cannot be provided by a single recreation area, regardless of size. Managing each recreation area in isolation will lead to development of opportunities focused on the "average" visitor without considering the plurality of potential publics (Warzecha et al., 2001). More than that: "Each recreation area, individual site, zone, park, etc., should be evaluated as

part of a larger system of areas, each contributing as it can to serve the diverse needs of the public" (Pettengill & Manning, 2011, p. 2). Brown et al. (2009) states that ROS can also be used at regional or national levels for planning and managing in a system-oriented approach to satisfy these societal demands. Using ROS, Kil & Confer (2005) were able to produce a recreational classification for some PAs in the state of Florida. Each area received an overall classification from primitive to urban based on their physical, social and managerial attributes that facilitates planners to geographically identify what experiences different regions of the state have to offer. Using the same approach, Chapter 2 applied adapted the ROS physical, social and managerial attributes to classify the Brazilian PAs in different classes of recreational use. The present Chapter 3 further examines how number of visitors correlates to these attributes from each class.

Recreation Opportunity Spectrum in Context of Tourism Demand Analysis

The initial ROS model only considers physical, social and managerial attributes within the PAs without considering the external factors. However, to contemplate certain social and economic aspects of tourism demand, how people decide to visit a particular PA shall be a studied within a larger context of a tourist destination (Puustinen et al., 2009). Studies have found that number of visitors is correlated not only with internal settings (Hanink & White, 1999; Hanink & Stutts, 2002; Loomis, 2004) but also to external settings of the PAs (Neuvonen et al., 2010; Viveiros de Castro et al., 2015). The decision to travel is generally thought to be determined by attributes located inside a PA (i.e. type of landscape, facilities, services). However, attributes outside the location (i.e. distance, access, regional infrastructure) also influence the decision (Viveiros de Castro et al., 2015). Determining the relative importance of each of these settings may

be considered the most critical aspect to develop a tourist destination (Hu & Ritchie, 1993).

Analyzing tourism attractiveness, Ferrario (1979) divided attractions into two groups: natural and man-made. Examples of natural resources are falls, beaches and mountains, while man-made attractions can be historical sites, and cultural events. To support the attractions there are others man-made attributes that Puustinen et al. (2009) divided in two types: inside the PAs and outside the PAs. Inside a site, there are recreation services and facilities; outside, tourist services provided by local communities, private sector and public agencies.

Attractions are also divided in a different perspective: potential and real attractions. Potential attractions have not been adequately visited while real tourism attractions have been constantly used. A recently designated PA is still a potential attraction, in comparison with an older site that is already structured and have been receiving visitors for several years. Understand which factors influence the visited PAs are important to plan potential ones.

Puustinen et al. (2009) found that what defines the level of visits in a park is the combination of natural attractions with the man-made factors. However, Iatu & Bulai (2011) addressed that natural attractions sometimes do not need tourism structures as their significance relies on relative isolation or wilderness. However, Neuvonen et al. (2010) pointed out that parks that provide more recreation services related to activities attract more visitors.

In respect to man-made factors, Lee, Huang & Yeh (2010) found that, besides natural resources, the most important factors affecting visitation are external access and

provision of catering and accommodation. Deng, King, & Bauer (2002) likewise found that services and accessibility are the most important dimensions of a destination. For both, accessibility plays a significant role in attraction development. Transportation is a critical linkage from generating regions and destinations. Barbosa (2010) confirmed this, stating that airports and flight connections are important to national and international access.

Due to the importance of tourism demand analysis to understand visitors' choices and the necessity to plan at a national level, several research studies using internal and external variables have emerged (Deng et al., 2002; Lee et al., 2010; Neuvonen et al., 2010; Puustinen et al., 2009; Viveiros de Castro et al., 2015). An analysis by Puustinen et al. (2009) of 35 national parks in Finland acknowledged that higher volume of visitation was associated with natural characteristics, as well as the availability of recreational facilities inside and tourism services outside the parks. Furthermore, based on the same sample, Neuvonen et al. (2010) demonstrated that number of visitors can be predicted by recreation activities, number of biotopes, length of trail and park's age and location. Using a similar approach but systematizing the internal and external variables through the ROS framework, Viveiros de Castro et al. (2015) found that tourism attractiveness in the national parks of Brazil can be predicted through reputation (internal physical attribute), recreation facilities (internal managerial attribute), attractions in the region (external physical attribute) and population density (external social attribute). These studies demonstrated that different variables of recreation supply affect tourism demand, with each country presenting different groups of predicted variables based on available data. However, when the data is classified using

ROS attributes, countries can be compared even with different variables, because the settings are the same. The present study further analyzes the prediction power for the different physical, social and managerial attributes from each class to develop an optimized scenario of visitation in Brazil.

The linkages between recreation opportunities and tourism demand are strategic elements of PAs management. The present study proposes a model to estimate tourism demand trends in different classes of recreational use. The research correlated internal and external PAs variables with visitor numbers to develop a panorama of the weaknesses and strengths of the system. The regression model offers predictions that the Brazilian PA agency can use to inform the positive impacts and latent potential of recreation to policymakers and stakeholders in order to make the PAs more socially and economically valued by the society.

Federal System of Protected Areas of Brazil

The Chico Mendes Institute for Biodiversity Conservation (ICMBio) is the federal agency responsible for the management of the Brazilian Federal Protected Areas. Among the PAs, there are only a few that are fully structured for tourism, while some are minimally equipped, and most do not control access or have entry fees. The categories that have more areas prepared for visitation are National Parks (IUCN category II) and National Forests (IUCN category VI) (Figure 3-1). National parks allow only tourism and research whereas national forests also permit other direct uses such as timber, mining, and traditional utilization by local communities. The categories National Parks (NP) and National Forests (NF) have different overall management purposes, even though visitation is allowed in both, and are managed in a very similar way by ICMBio.

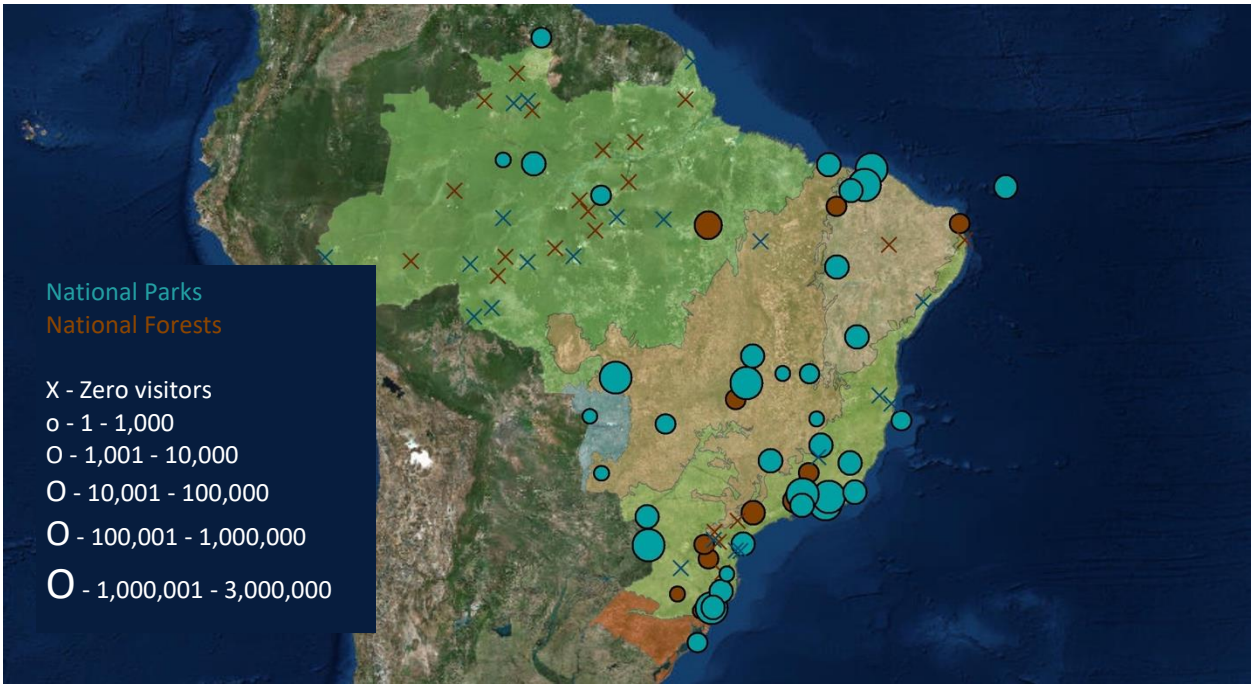


Figure 3-1. Visitation in National Parks and Forests of Brazil

In Chapter 2, PAs were classified by their recreation opportunity classes. The PAs received a score for each setting between 1 and 5. The three internal attributes (physical, social and managerial) compose the overall internal score and the same three external attributes compose the overall external score. The internal and external scores form the final score. The scores define the class of recreational use of the PAs: primitive, semi primitive, extensive, intensive and highly intensive. For example, the internal classification for Chapada dos Guimaraes NP was intensive (3.9), the external was intensive (3.7) resulting in a final score of 3.8, classifying the PA as intensive. In other cases, such as Monte Roraima NP, the internal class was extensive (3.2) but the external class was primitive (1.2) which classified the PA being in the middle as semi primitive (2.2). Appendix A presents all PAs' classifications.

Protected Area	Internal				External				Final Class
	P	S	M	O	P	S	M	O	
Tijuca NP	4.5	5.0	4.6	4.7	5.0	5.0	5.0	5.0	Highly Intensive (4.9)
Chapada dos Guimarães NP	4.5	4.0	3.3	3.9	4.0	3.0	4.0	3.7	Intensive (3.8)
São Franscisco de Paula NF	2.5	3.0	3.3	2.9	3.0	4.0	3.0	3.3	Extensive (3.1)
Monte Roraima NP	4.5	2.5	2.5	3.2	1.0	1.5	1.0	1.2	Semi Primitive (2.2)
Jatuarana NF	1.5	1.0	1.0	1.2	1.0	2.0	1.0	1.3	Primitive (1.3)

* Example of 5 sites / P - Physical, S - Social, M - Managerial, O - Overall

Figure 3-2. Overall Visitation Classifications of Brazilian PAs*

The Brazilian classes vary from primitive use where PAs internally offer few or no recreation options, no facilities or services. The primitive PAs are also generally located in remote areas with difficult access. On the other hand, highly intensive PAs offer a great variety of attractions, facilities, and services. They tend to be located close to state capitals or big cities with high population density and easy access. The other classes are inside this spectrum. Most of PAs in Brazil are classified as semi primitive or extensive but most of the recreation is concentrated in a few intensive and highly intensive areas. Today only about 2% of the PAs are classified as intensive and highly intensive but they are responsible for 73% of visitation in Brazil (Figure 3-3).

Classes	Number of PAs	Area Total (ha)	% Area Total	Visits Sum	% Visits Total
Primitive	5	3,807,652	15%	0	0%
Semi Primitive	39	17,220,284	67%	209,091	3%
Extensive	42	4,194,511	16%	1,768,532	24%
Intensive	7	406,013	2%	2,559,797	34%
Highly Intensive	1	3,958	0.01%	2,945,355	39%

Figure 3-3. Variation of Area and Visitors per Final Classification

Number of visits started to be nationally stored in 2000 and visitation has grown from 1.9 million in 2000 to more than 8 million in 2015 (Figure 3-4) (ICMBio 2016). However, part of this growth is due to the inclusion of data from new PAs instead of real increase in the participating PAs. Even now, only 62 collected data about outdoor recreation in 2015, from the total number of 325 (ICMBio, 2016). The federal system still has space to expand the visitation program.

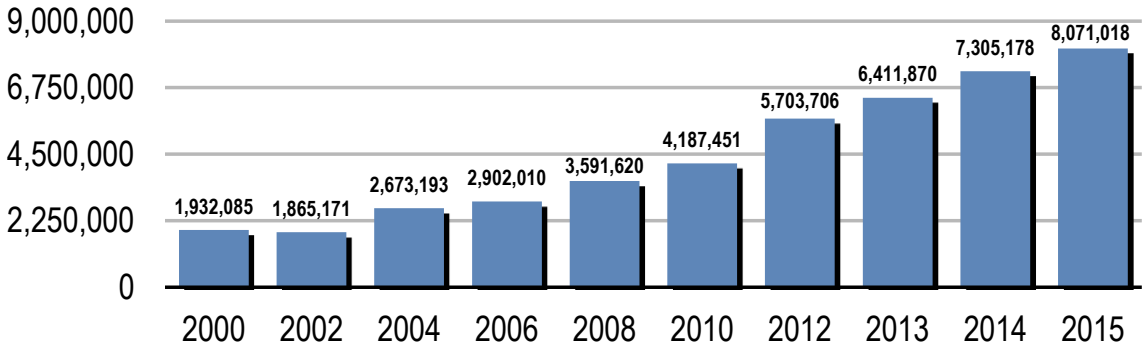


Figure 3-4. Total Visitation/Year in Protected Areas of Brazil

Visitor Use is an activity that is allowed in most of the PAs' categories in Brazil (all of them if we consider environmental education) (Brazil, 2000). However, from 61

PAs that reported visitation in 2015, 37 are national parks and 17 are national forests (90%) (Table 3-1). Due to the number of cases, for the purpose of this study, initially, the population analyzed included only national parks and national forests (7,520,451 visitors).

Table 3-1. Number of areas that reported visitation per year

Brazilian Category	IUCN Class	06	07	08	09	10	11	12	13	14	15	Total visitation 2015
National Park	II	19	21	21	22	24	27	31	36	33	37	7,149,112
National Forest	VI					12	11	12	12	17	17	371,339
Environmental Protected Areas	V								1	2	3	394,744
Extractive Reserve	VI									1	1	150,000
Biological Reserve	Ia									1	1	2,375
Relevant Ecological Interest Area	IV										1	3,294
Ecological Station	Ia										1	154
Total		19	21	21	22	36	38	43	48	54	61	8,071,018

Methods

Data Collection

Federal protected areas of Brazil are the object of this research. Information was collected from different sources for the inventories. First, primary data were collected via a visitation assessment conducted on-line among managers of all the 71 National Parks and 67 National Forests (n = 138) during January and February of 2016. A circular

memo was sent by ICMBio requesting managers' support. It was followed by four more reminders (1 per week) sent by the researcher. A total of 101 questionnaires were completed (74% response rate), and 94 were usable.

The variables were based on previous research from Viveiros de Castro et al. (2015). Data was supplemented with secondary sources from ICMBio's internal documents (i.e., management reports) and mediums such as government databases and the internet. The objective was to build a cost-effective tool for monitoring visitor use that can be easily replicated and periodically reapplied. The use of the Web 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).

Operationalization of Variables

The recreation classification system proposed in Chapter 2 was used to operationalize the variables. The system consists of two settings: internal and external. Each setting had three attributes: physical, social and managerial. Attributes were constructed by series of 16 indicators (Figure 3-5). Each indicator aimed to measure objective responses (i. e. number of facilities). The results in each attribute were indexed in a 5-point scale, summed and divided by the number of variables to classify the sites. The same procedure was used to develop the internal, external and final classification. This classification system defined the recreation class of each PA: primitive, semi primitive, extensive, intensive and highly intensive.

Dependent Variable	Number of visitors 2015 (Log)
Independent Variables	**Internal Setting**
Physical Attributes	
Natural/Cultural Variety	Number of different landscapes in the same PA (mountain, beach, falls, etc.) (Log)
Scenic Attractiveness	Number of citations in a Google research of the PA's name and most important attraction
Social Attribute	
Diversity of Activities	Number of recreation and sports activities offered in each park (trekking, climbing, diving, cycling etc.)
Crowding	PA area (km^2) / (number of visitors/year) (Log)
Managerial Attribute	
Recreation Facilities	Number of structures offered (lookouts, parking lots, visitor center, etc.)
Visitor Services	Number of services provided by the park or concessionaires (transport, souvenirs, food etc.)
PA Staff	Number of PA staff
PA Budget	One year budget spent per PA (Log)
Planning Tools	Number of management documents that the park already produced and updated (General Management Plan, Outdoor Recreation Plan, Interpretation Plan etc.)
Internal Access	Kilometers of internal roads and trails
Land Tenure	Percentage of the park owned by the government
Independent Variables	**External attributes**
Physical Attributes	
Regional Attractions	Number of tourism attractions in the region where the PA is inserted measured through the number of "Things to Do" of the gateway communities in the website TripAdvisor (Log)
Public Access	Travel time from nearest commercial airport (Log)
Social Attribute	
Socioeconomic context	Average Human Development Index - HDI of the municipalities included in the 100km buffer zone
Population Density	Number of citizens living in municipalities included in a buffer zone of 100 km around the PA (Log)
Managerial Attribute	
Hospitality Establishments	Number of lodging rooms and restaurants mentioned on Trip Advisor for the gateway communities (Log)

Figure 3-5. Operationalization of Variables

Internal setting

The variables within this setting reflect the internal attributes of the sites. The physical attributes are comprised of natural/cultural variety (number of different landscapes, waterscapes, and cultural expressions) and scenic attractiveness. The perception of beauty or importance is subjective and poses measurement challenges (Puustinen et al., 2009; Neuvonen et al., 2010). Hence, the option to use attractiveness as a proxy can be objectively measured based on Google citations. Studies have increasingly utilized the Google search engine as a research tool in various disciplines including tourism (Mazanec, 2010; Murphy & Law, 2008). Essentially, each PA's name, as well as its most famous attraction, was queried in Portuguese during February of 2016.

The social attributes encompass indicators that represent the diversity of recreation and sports activities (e.g., trekking, climbing, diving, cycling, etc.) and crowding (PAs area divided by the result of number of visitors divided by one year). The managerial attributes include indicators 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 ownership).

External setting

The variables within the external setting consider regional characteristics that can influence visitation. The physical attributes consist of attractions in the region based on the location of the PAs. Specific information was compiled from the TripAdvisor website for the respective locations. User-generated content websites such as TripAdvisor are

gaining more credibility from the traveling public and academia (Ayeh et al., 2013). For each PA, the web link “Things to do” was searched for determine the number of attractions in the gateway communities. Similarly, TripAdvisor was employed to compile number of tourism infrastructure such as accommodations and restaurants, which are noted as hospitality establishments under the managerial category. Meanwhile, the social attributes evaluate potential public. To estimate day use area, a buffer zone of 100 km around the PAs was used (Neuvonen et al., 2010); socio-economic context was verified through average human development index–HDI of the gateway community. Other information about the regions and population data were collected from georeferenced databases of ICMBio, the Brazilian Institute of Environment and Natural Resources, the Ministry of Transport, and the Brazilian Institute of Geography and Statistics. Additionally, access conditions were evaluated through time distance from the closest commercial airport.

Data Analysis

First, the 16 independent indicators were grouped in the six variables (internal setting: physical, social and managerial; and external setting: physical, social and managerial). Since the dependent variable did not have a normal distribution, a log transformation was used during the correlation analysis. In addition, the following indicators were also log transformed: scenic attractiveness, crowding, regional attractions, hospitality establishments, and population density. To divide the classes, the Natural Breaks optimization method was used. The method minimizes average deviation from the mean in each class while maximizing deviation from the other classes mean (Jenks, 1967). For logarithm transformed variables, classes were divided based on standard deviation. The six variables plus overall internal, external and final

scores were analyzed via Pearson's correlation. The assumptions of linearity, independence of errors, homoscedasticity, unusual points, and normality of residuals were all met (Hair, 2010). The indicators from each attribute were grouped for the correlation analysis with the objective to test the importance of each of the six PAs attribute for the tourism demand. Following, a multiple regression with all attributes was employed (Cooper & Schindler, 2011). Data were processed in SPSS, ARCGIS and Numbers Spreadsheet.

Results

Inventory of Protected Areas Respondents

From the 94 respondents, 36 are national forests (NF), and 58 are national parks (NP). The sample represents 69% of the population of the 136 national parks and national forests of Brazil. From the same 94 respondents, 51 PAs have reported visitors (94%), from the 54 PAs that reported visitors in 2015. This means that from the 7,520,451 tourists that visited NP and NF, the sample captured 7,482,775 (99.5%).

Table 3-2. Sample characteristics in relation to the population

	Population	Visitors	Sample Size	Visitors
National Forest	65	371,339	36	337,084
National Parks	73	7,149,112	58	7,145,691
Total	138	7,520,451	94	7,482,775
PA (NF+NP) that reported visitors in 2015	54		51	
PA (NF+NP) that did not report visitors in 2015	84		43	
Total	138		94	

Correlation Analysis

The 51 respondents from the sample that reported visitors were used in the correlation analysis. The analysis revealed that all attributes are statistically significant (*p*-level < 0.05). Essentially, the results demonstrated that all attributes in both settings are correlated with number of visitors and that the indicators could measure the variation in visitation demand.

Table 3-3. The variables, indicators and Pearson's Correlation

Variables	Indicators	Pearson's correlation coefficient	p-value
Internal Setting			
Internal Physical attributes	Natural/Cultural Variety, Scenic Attractiveness	0.544**	0.000
Internal Social attributes	Diversity of Activities, Crowding	0.668**	0.000
Internal Managerial attributes	Recreation Facilities, Services, Staff, Budget, Planning Tools, Internal Access and Land Ownership	0.643**	0.000
Internal Overall	**(physical+social+managerial)/3**	**0.838****	**0.000**
External Setting			
External Physical attributes	Regional Attractions, Public Access	0.485**	0.001
External Social attributes	Population Density, Socioeconomic context	0.369**	0.012
External Managerial attributes	Hospitality Establishments	0.500**	0.000
External Overall	**(physical+social+managerial)/3**	**0.508****	**0.000**
Final Classification	**(internal+external)/2**	**0.642****	**0.000**

** Correlation is significant at the 0.01 level (2-tailed).

The internal attributes received higher scores than the external ones indicating that PAs characteristics are the most relevant indicators of tourism attractiveness; however, all

external attributes also were statistically significant indicating that PAs location and surroundings are also important. Correlations increased when the attributes of the overall internal, external settings and final classifications were summed. That demonstrated that the attributes and settings are an effective classification system to measure visitation demand.

Between the internal setting, social attributes were the high correlated what evidences that the spectrum of activities is paramount to create recreation opportunities followed closely by managerial attributes, indicating that facilities and services need to be provided for visitation increase. The physical attributes also play an important role since greater natural variety and beauty expand tourism demand. The external attributes correlation indicates that PAs located in established destinations, densely populated regions or with easier access receive also higher visitation (Table 3-3).

Regression Analysis

The same 51 respondents from the sample that reported visitors were used in the regression analysis. The independent variables for the regression analysis were the six single attributes (physical, social and managerial) plus overall internal, external and final scores. Based on the results of the multiple regression, the internal and external settings offered the best fit model to predict visitation. These variables had the best significant contributions and explained 72 percent of the variance in visitation numbers - $F(2, 43)=59.811$, $p<0.05$, Adj. $R^2 = 0.723$ (Table 3-4). Among the variables, internal setting was the strongest predictor with an increase of internal class resulting in a surge of 122 percent in visitation. Similarly, an increase in one external class relates to an increase of 24 percent in visits.

Table 3-4. Summary of Multiple Regression Analysis

Variable	Unstandardized Coefficients		Standardized Coefficients	p-value
	B	Standard Error	Beta	
Intercept	-0.184	0.405		
Internal setting	1.220	0.143	0.748	0.000
External setting	0.236	0.102	0.203	0.026
F(2, 43)=59.811, p<000.5				
Adj. R^2 = 0.723				

p-value = Level of Significance

Based on the model, predictions intervals of the means at 95 percent confidence were built for final classes. Figure 3-6 shows that, basically, visitation varies in one order of magnitude for each class: primitive class in order of hundreds (100/y), semi primitive class in order of thousands (1,000/y), extensive class in order of tens of thousands (10,000/y), intensive class in order of one hundred of thousands (100,000/y) and highly intensive class in order of millions of visitors (1,000,000/y).

Final Index	Predicted Cases	Lower Bound	Estimate	Upper Bound
Primitive	5	31	85	234
Semi Primitive	39	933	1,984	4,309
Extensive	42	12,614	22,101	39,487
Intensive	7	121,429	248,826	514,274
Highly Intensive	1	1,653,560	5,375,762	17,476,723

Figure 3-6. Number of reported cases, visitation mean and prediction for Final (Internal+External) Estimation

Predictions

Based on the regression model, a series of predictions were made to calculate the recreational potential latent in the system. First, estimations were made for the 51 PAs from the sample that reported visitation in 2015. Second, estimations were made for the 43 PAs from the sample that did not report visitation in 2015. Then, estimations were made for the 231 PAs out of the sample in order to formulate a scenario for the entire system.

Prediction for PAs from the Sample that Reported Visitation in 2015

To verify the practical validity of the predictions, a matrix was built with internal and external classes for the 51 PAs in the sample that registered visitors in 2015. The matrix (Figure 3-7) shows the interaction of the two recreational settings (internal and external). The horizontal axis presents the external classification of the PAs and the vertical axis the internal classes. Based on the internal and external overall class, the PAs are placed in different cells. The cells show the visitation mean and the number of PAs in the same case. It is possible to see in the matrix that the PAs that fall in the diagonal, where the internal class matches with the external, present average number of visitors in the same order of magnitude predicted in the model: thousands for semi primitive, tens of thousands for extensive, hundreds of thousands for intensive and millions for highly intensive. Outside the diagonal, the internal and external classes do not match, demonstrating that the PAs have internal settings that are not consistent with the external destination. The first group (in red), below the diagonal, has PAs that offer more recreation opportunities than the capacity of the destination to attract tourists (internal class higher than the external), and the second group (in blue), above the

diagonal has PAs that are underdeveloped compared with the surrounding destination (external class higher than the internal).

		External Classes				
	Class	Primitive	Semi Primitive	Extensive	Intensive	Highly Intensive
Internal Classes	Primitive	(0)	(0)	(0)	(0)	(0)
	Semi Primitive	(0)	1,936 (5)	8,212 (5)	(0)	26,872 (1)
	Extensive	2,174 (1)	32,508 (6)	43,134 (18)	6,842 (5)	(0)
	Intensive	(0)	(0)	306,349 (3)	447,649 (5)	294,682 (1)
	Highly Intensive	(0)	(0)	(0)	(0)	2,945,355 (1)

Visitation mean (number of PAs)

First Group	Second Group

Figure 3-7. Matrix of visitation mean and number of PAs per class

The regression model was used to evaluate the growth potential of the system in different ways. First, using the regression model, where the increase in one internal class would result in an increase of 122 percent in visitation, a scenario was built with the 12 PAs of the second group that reported visitation. In the improved scenario, they would have their internal class improved to match the external. These sites from the second group only need internal investments from ICMBio to increase visitation. In this scenario, the number of visitors in these 12 PAs would increase 706,428 visitors from 396,824 to 1,103,252 per year.

Prediction for PAs from the Sample that did not Report Visitation in 2015

When the 43 PAs that did not report visitors are considered, 17 sites have classes where the internal settings match the external ones and 26 that do not (Figure 3-8). From the 26 unbalanced, 8 fall in the first group where PAs have higher standards than the destination, and 18 sites, a bigger cluster, correspond to the second group, where the PAs can increase supply of recreation opportunities because the destination has demand for that. Those are the PAs with highest investment potential.

PAs evaluated	Same internal and external class	First group: Higher internal than external class	Second group: Lower internal than external class
43	17	8	18

Figure 3-8. Number of PAs in different internal and external classifications

The regression model was used again to predict number of visitors for the 43 PAs that were evaluated but did not report visitors in 2015. In the actual conditions, if all these PAs were receiving visitors or monitoring them, around 68,000 more users in the system would be expected with a given confidence interval (95% CIs for the PAs: 35,000 –133,000s/y). However, in a improved scenario where the internal classes from the second group are improved to match the external ones, the number of visitors would be about 368,000 (95% CIs of 159,000 - 968,000s/y).

Prediction for the 94 PAs of the Sample

Considering the potential increase in only the 94 PAs analyzed (not the 325 total federal PAs in Brazil), the study predicted that visitation could have been 9.145 million in 2015, instead of the reported 8.071 million. This prediction considered that all areas

were monitoring visitor entrance and having adequate facilities and services in their respective class to attend the tourism demand of the destination where they are located.

Table 3-5. Visitation prediction in 2015 in an improved scenario (94 PAs)

Actual visitation in 2015 (total system)	8,071,018 visitors
Predicted visitation for 43 PAs no reported visitors	368,000 visitors
Predicted increase in visitation for 12 PAs of second group	706,428 visitors
Total visitation in 2015 considering improvement in 94 PAs	9,145,446 visitors

The distribution between the classes is presented below:

Final Index	Actual Classes	Visitation Mean	Total	Improved Classes	Prediction Mean	Prediction Total
Primitive	5	0	0	1	271	271
Semi Primitive	39	5,361	209,091	28	1,185	33,180
Extensive	42	42,108	1,768,532	40	22,872	914,880
Intensive	7	365,685	2,559,797	22	168,878	3,715,316
Highly Intensive	1	2,945,355	2,945,355	3	1,297,852	3,893,556
Total	94		7,482,775	94		8,557,203

* Visitation for the 94 PAs in the study

Figure 3-9. Comparison between visitation in the actual and improved scenario *

Scenario for the 231 others PAs outside the Sample

The other 231 PAs that do not have visitation, do not report it, or did not participate in the survey were considered in this scenario. Considering that the most attractive protected areas are the national parks that participated in the survey, a

conservative evaluation of the other 231 PAs should use the prediction means of national forests, which are much lower.

Final Index	National Forests			National Parks		
	Number of PAs	Visitation Mean	Visitation Total	Number of PAs	Visitation Mean	Visitation Total
Primitive	1	271	271	0	.	.
Semi Primitive	14	761	10,655	14	1,611	22,548
Extensive	15	11,190	167,843	25	29,882	747,038
Intensive	5	61,043	305,213	17	200,595	3,410,121
Highly Intensive	1	294,008	294,008	2	1,799,775	3,599,549
Total	36		777,990	58		7,779,256

Figure 3-10. Comparison of visitation between national parks and forests in the improved scenario

Considering the possibility that the other sites are proportionally distributed between the classes as the national forests are and offering the facilities and services expected for each class, around 4.8 million visitors per years in the other 231 PAs would be expected. Actual information from other PAs categories not included in the study indicated that the projection has correct order of magnitude since in 2015, seven PAs from those 231 were responsible for more than 550,000 visitors (Table 3-1).

Total Visitation in Improved Scenario

Considering the potential of all 325 federal PAs, Brazil could be receiving around 13.4 million visitors in 2015. This number is just considering internal improvements like facilities and services.

Table 3-6. Visitation prediction in 2015 in an improved scenario (325 PAs)

Actual visitation in 2015 for 94 NP and NF in the sample	7,482,775 visitors
Predicted visitation for 43 PAs no reported visitors	368,000 visitors
Predicted increase in visitation for 30 PAs of second group	706,428 visitors
Predicted increase in visitation for 231 PAs out of the sample	4,872,916 visitors
Total predicted visitation in 2015 considering 325 PAs	13,430,119 visitors

The distribution between the classes is presented in the figure below:

Final Index	Number of PAs	Visitation Mean	Visitation Total
Primitive	7	271	1,899
Semi Primitive	118	862	101,677
Extensive	137	14,600	2,000,263
Intensive	54	104,975	5,668,676
Highly Intensive	9	628,623	5,657,604
Total	325	12,672,336	13,430,119

Figure 3-11. Conservative visitation scenario for the 325 Federal Brazilian PAs

Examples of Potential Growth in Visitation for Some PAs

Figure 3-12 presents the capacity of some protected areas to increase number of visitors with adequate facilities and services. Brasília NF is a case were a PA internal setting is three classes below the external setting. The visitation in an improved scenario could increase from 26,000 to 294,000 (95% CIs for the PAs: 58,000 – 1,200,000/y). The Figure 3-14 exemplifies growth predictions in some PAs. All 94 PAs are presented in Appendix B.

Protected Area	Actual Internal Class	Actual Visitation	Improved Scenario Class	Possible Visitation	Lower and upper bound
Brasília NF	Semi Primitive	26,872	Highly Intensive	294,000	(58,000 - 1,200,000)
Serra do Itajaí NP	Extensive	632	Intensive	84,000	(28,000 - 246,000)
Restinga do Cabedelo NF	Semi Primitive	0	Intensive	84,000	(28,000 - 246,000)
Restinga de Jurubatiba NP	Extensive	20,000	Intensive	56,000	(21,000 - 145,000)
Canela NF	Extensive	692	Intensive	31,000	(14,000 - 67,000)

Figure 3-12. Examples of potential growth in visitation for some PAs

Discussion

The research was able to develop a model that predicts visitation in PAs of Brazil. To accomplish that, it measured the relative importance of various internal and external attributes and overall settings in relation to the number of visitors. The best fit model selected the overall scores of internal and external ROS settings as better explanatory variables. Using the best fit model, the study built visitation improved scenarios for different groups of federal protected areas.

The matrix analyzed PAs in different situations regarding their internal versus external classification. The first group (higher internal than external) has higher visitation in average than the prediction model and they share one particularity; most are an outstanding natural/cultural attraction but are isolated from big population centers or other attractions. However, they have sufficient attractiveness power to stand above the expected local tourism demand (e.g.: Fernando de Noronha NP, Jericocoara NP or Serra da Capivara NP). These are cases where investments need to be made outside

the PAs, in the destination (i.e.: better access or regional infrastructure). On the other hand, the sites of the second group (blue), where internal class is lower than external, present a different situation. They may not be the most important attraction in the region but they are located in consolidated destinations (e.g.: Brasília NF in the city of Brasília, Itajaí NP in the city of Blumenau, Canela NF between the cities of Gramado and Canela, and Anavilhanas NP close to Manaus). These are cases where just internal investments by ICMBio can positively impact visitation. These are examples where the Institute is failing to open the areas for recreation, environmental education and consequently, raise revenues.

Related to the model, results suggested that internal setting is a major variable that influences choice for PAs visitation since areas well scored in the internal physical, social and managerial attributes tend to have higher demands. For example, the 10 PAs classified as urban in the physical attributes are responsible for 5.7 million visitors, 72% of the total in 2015. This finding is in accordance with other studies where natural attractions are the primary elements of destination appeal (Crouch & Ritchie, 1999; Lee et al., 2010). Brazilian PAs also show a significant positive correlation between social attributes and the number of visits. PAs that offer a wider spectrum of activities tend to receive more visitors and, as a consequence, are more crowded. The findings are also comparable with PAs in other countries such as Finland in respect to the positive correlation of visits and diversity of activities (Neuvonen et al., 2010). A relevant example in Brazil is Jericocoara National Park (State of Ceará), the third most visited park, which offers a wider spectrum of recreation opportunities for different visitor profiles and interests. The great natural and cultural variability corroborates that.

Related to the managerial attributes, the availability of recreational facilities and services is also a strong factor that influences visitation. For example, more visitors tend to prefer structured PAs with visitor centers, boardwalks, paved internal roads and trails. This result supports findings in other countries (Puustinen et al., 2009). In Brazil, most of the national parks that have consistent tourism concessionaires are among the most visited (Tijuca, Iguaçu and Serra dos Órgãos).

The results also reinforce findings that PAs need to be a studied within a larger context of a tourism destination (Neuvonen et al., 2010; Puustinen et al., 2009). PAs with easy access and which are closer to other attractions tend to have more visitation which corresponds to Hanink & Stutts' (2002) findings where site location was a important factor to explain demand. Contributing to that, the relationship between visitation rates in PAs and the existence of other close attractions demonstrates that the average tourist often visits more than one destination during a given trip (Deng et al.; 2002). For example, Tijuca NP (State of Rio de Janeiro) and Brasília NP (Federal District) are destinations with easy access, large population nearby and great number of other attractions demonstrating potential to attract international visitors. On the other hand, Monte Roraima NP (State of Acre) faces a contrast; it has outstanding internal physical attributes but it is a single attraction in a far and hard to access destiation.

Results also show a positive correlation between visitation and the physical, social and managerial attributes of the external setting (Clawson & Knetsch, 1963). PAs situated closer to larger population centers have more visitation. Population distance is critical because the travel cost to the PAs determines the lower and upper limits of potential demand. Serra dos Órgãos NP and Chapada dos Guimarães NP are good

examples of parks that are closer to state capitals and can be accessed in one day. They are between the most visited PAs in Brazil. Other PAs such as Restinga de Jurubatiba NP and Restinga do Cabedelo NF, identified with potential to increase visitation due to location closer to state capitals, but have low demand due to lack of necessary investments.

The research confirms the results of the previous Brazilian study made in 2015 with 28 national parks in which the areas were accessed using ROS indicators as variables (Viveiros de Castro et al., 2015). However, the use of settings and attributes as independent variables enhanced the methodology towards PAs' analysis. ROS settings can be applied to compare different system levels or countries independent of the variables and data available. The distribution of PAs in recreation opportunity classes also facilitates the demand trend analysis enhancing visitor use management.

This study promoted an evaluation in national scale of outdoor recreation opportunities, which supports the findings of Warzecha et al. (2001) and (Pettergill & Manning (2011) that PAs should be appraised as part of a system. The Brazil analysis demonstrated to be effective to classify recreational use, reinforcing previous studies and recommendations in other countries (Brown et al., 2009; Kil & Confer, 2005; McCool & Cole, 2001). When the classification of recreational use is displayed on the Brazilian map, it is possible to realize a concentration of developed classes in the southeast of the country where most of the developed cities are. Using the maps, ICMBio can analyze trends and diversify uses among different parts of Brazil.

The system analysis is also a useful tool for strategic planning since managers need to invest limited resources effectively. The classes of recreational use facilitate to

identify which PAs have greater possibility to increase visitation, with the ranges of potential demand. Based on that, agencies can calculate necessary investments and the return rates in number of visitors and revenues. Based on the analysis, agencies like ICMBio have more technical data to negotiate with donors, stakeholders, policy makers and concessionaires.

The current study focused on national forests and national parks, so estimates for other PAs categories should be carefully examined. However, even considering the existence of errors in the PAs estimations, the model can be considered reliable since the predictions followed the same order of magnitude of the actual visitation numbers.

Concluding Remarks

The study indicated that tourism demand in the protected areas of Brazil is correlated to the physical, social and managerial attributes proposed in ROS. Results show that both internal and external settings are considered by visitors. While inner characteristics and management are important, external factors independent of PAs governance also play an important role, since outdoor recreation needs to be planned within a larger context of a tourism destination. In this sense, outreach initiatives by managers at the local and regional scales are recommended, as joint actions with other government agencies and the tourism trade are critical to increase visitor flow to the areas and adjacent communities.

The study also demonstrated the growth potential of visitation in Brazil. The model revealed that the system has been underused and has potential to enlarge visitation numbers. Using a conservative approach, the analysis indicated that the entire federal system could be receiving 13.4 million visitors, 4.5 more than the reported 8.1 million that visited the PAs in 2015. That is an increase of 60% in recreation

opportunities for the society, revenues for the PAs agency and business and employment for the local communities.

Tourism demand analysis is one primary determinant variable of economic significance studies in recreation. The results can support analysis of economic contributions of tourism in protected areas and potential increase in economic benefits in different investment scenarios. The results presented similar findings with previous studies that used different methodologies and variables. Moving forward, the author proposes that the ROS settings can be used as a framework to standardize the proceedings while indicators can be adapted to specific realities. Further research can develop trend analysis of predictions or comparative evaluation among countries or states, different ecoregions, or PAs categories that can serve to contrast data.

CHAPTER 4
ECONOMIC IMPACT OF RECREATION IN PROTECTED AREAS OF BRAZIL

The creation of protected areas (PA) is an effective strategy for biodiversity conservation and provision of ecosystem services. Tourism is recognized as a cultural ecosystem service provided by PAs with high potential to financially support their management (Millennium Ecosystem Assessment, 2005). PAs offer a spectrum of outdoor recreation opportunities that attract visitors as well as assist to raise societal awareness and support for conservation (Leung et al., 2015). Globally, visits to terrestrial PAs is estimated to be 8 billion per year that generates approximately US$600 billion in direct in-country expenditures. Such economic impacts are considerably positive, even more considering that only $10 billion per year is applied to safeguard the PAs (Balmford et al., 2015).

The role of tourism is increasingly realized as an opportunity to generate revenues to support management functions as PAs are consistently faced with budgetary constraints (Eagles & McCool, 2002). In addition, since tourism is interdependent with other businesses, services, governments and local communities; visitor expenditures stimulate job creation and entrepreneurial activities (e.g., tour operations, hospitality business, etc.). Moreover, visitor expenditures help reduce poverty and create alternative income for local communities that live inside or adjacent to the areas (Emerton et al., 2006; Ferraro & Merlin, 2014; Thapa, 2013). The understanding of its positive and negative impacts is decisive to develop sustainable tourism regions and objective evaluations can properly support communities' decisions to create equitable tourist destinations.

Policy-makers, decision-makers and financiers are increasingly asking for economic contributions for PAs to endorse investments decisions (Balmford et al., 2015). In order to raise public support, more countries are developing visitor expenditure analyses at site and system level, such as the USA (Cullinane et al., 2014), Canada (The Outspan Group, 2011), Australia (Driml, 2010), Finland (Huhtala et al., 2010), Namibia (Turpie et al., 2010), South Africa (Saayman et al., 2010) and Brazil (Medeiros, 2011). Some countries, like the USA, have been producing annual economic reports that became an important instrument during budget negotiations. On the other hand, Brazil for example, despite the enormous size of the PAs system, its biodiversity importance and small budget allocation, have done only one approximation based on secondary data. It is still uncertain how much sales and value added the tourism industry in Brazilian PAs is promoting for the country. Questions like how many jobs and how much income is supported by the system of PAs, should be answered.

Therefore, the purpose of this research was to estimate the economic impacts of tourism in the federal system of PAs of Brazil. More specifically, the following objectives were formulated and examined:

- Assess local expenditures of visitors in in different PA's classes of recreational use (based on Chapter 2).
- Examine the income, value added, and jobs generated by each PA .
- Analyze the average income, value added, and jobs generated by each PA class based on classification of recreational use (based on Chapter 2).
- Analyze the income, value added, and jobs generated by the entire PA system that report visitation and forecasted scenario of 2015 (based on Chapter 3).

To accomplish the objectives, this study adapted a methodology based on the MGM2 framework (Stynes et al., 2000) to address contextual issues for Brazil.

Economic impact analyses generate quantifiable estimates of the tourism interdependencies which provide a tangible aspect of the industry effects, and ultimately the importance of the services provided by the PAs to the region and country (Stynes et al., 2000). The results of this research can assist in decision making for managers and policymakers, inform conservation and commercial stakeholders, and local communities, as well as the general public about PA's value in serving not just conservation purposes, but as engines for relatively low-impact, high added-value economic growth.

Literature Review

Economic Impacts Worldwide of PAs

Some of the most important PA agencies around the world have been working with economic analysis to increase public opinion and support. For example, since 1969, the U.S. National Park Service (NPS) has formally estimated the economic contributions of outdoor recreation - 140 million visits generated $6.4 billion in spending and $4.7 billion in personal income (Stynes, 2001). The visitation continued its increase with 292 million visits in 2014 along with $15.7 billion in spending. Based on the data, the estimated contribution to the national economy was $29.7 billion in output and $10.3 billion in labor income, and created 277,000 jobs (Cullinane & Koontz, 2015). Such periodically formulated estimations have been instrumental for NPS to advocate for fiscal need and negotiate budget allocations through the years. Other agencies such as Parks Canada has also documented 20 million recreation visits in 2008-09, and reported the economic significance at $2.24 billion, with income employment at 41,720, and full time jobs and tax revenue at $163 million (The Outspan Group, 2011). Furthermore, even developing countries such as Namíbia has also evaluated the

economic importance of their PA system. Results estimated that 180,000 recreation park visits were recorded with an overall expenditure of $176 million. The direct contribution to the GDP was $80 million along with a total contribution of $147 million[1] (Turpie et al., 2010).

Table 4-1. Comparative analysis between Brazil, USA and Canada

Country	Brazil	USA	Canada
N^0 of PAs considered	310	360	129
Visitors Numbers	17.5 mi*	307 mi	20 mi
Budget	U$ 81 mi (2011)	U$ 2.6 bi	U$ 545 mi (2015)
Visitors Revenues	U$ 7.8 mi (2011)	U$ 430 mi	U$ 90 mi
Revenues/ % of the budget	(8.7%)	(17%)	(16%) (2015)
Economic Significance	U$ 630 mi	U$ 32 bi	U$ 2.5 bi
Visitor Spending	-	U$ 16.9 bi	U$ 2.0 bi
Added Value	-	U$ 18.4 bi	-
Labor income	-	U$ 11.1 bi	U$ 1.44 bi
Jobs	-	295,000	41,720
Source	Medeiros & Young, 2011	Cullinane & Koontz, 2016	The Outspan Group, 2011
Year	2010	2015	2008/2009

* Estimation for 2016

In the context of Brazil, the first attempt to evaluate the economic impacts of tourism in PAs was conducted in 2010 with the Money Generation Model (MGM)

[1] 1.00 US Dollar equals to 13.90 Namibian Dollars (09/09/16)

(Medeiros & Young, 2011). Based on an estimated scenario of 17.5 million visitors for 2016, the economic impact was forecasted to be approximately $630 million in tourist spending (Table 4-1)[2]. Such estimates reflect the importance to the economy since the PAs organizational entity's (i.e., ICMBio) budget spent for the management of the whole system was only $173 million in 2015 (ICMBio, 2016b). In addition, Semeia (2014) used an indirect approach based on demographic census analysis to evaluate the economic potential. Results identified that investments in infrastructure and services in the PAs would result in an increase of 558,000 jobs and $5.3 billion in total sales related to tourism at the gateway communities. These estimates offer advantages to the local and national economy and can be further realized with $700 million in investments to consolidate infrastructure in all federal PAs (Muanis et al., 2009).

Economic Impact Analysis

Economic impact is part of a group of economic analyses that can be used to evaluate tourism in PAs (other analyses are: fiscal impact analysis, financial analysis, demand analysis, benefit cost analysis, feasibility study and environmental impact assessment) (Stynes, 1997). Since each type of analysis is somewhat specific, the problems to be addressed may require more than one method. For example, an economic impact evaluation may request a prior demand analysis to forecast potential increase in volume of tourism activity, as was accomplished in Chapter 3.

Economic impact analysis describes the interrelationships between economic sectors, and creates estimates of the possible changes in a certain economy due to actual or future scenarios. It can be used for (Stynes, 1997):

[2] 1.00 US Dollar = 3.17 Brazilian Real (08/15/16) Conversion used for the entire chapter

Estimation of the economic impacts due to possible changes in the supply of recreation opportunities or tourism infrastructure. Changes can be related to quantity, such as new attractions or facilities or in quality such as improvement in infrastructure or services.

- Estimation of the economic impacts due to possible changes in tourism demand. Population growth, destination competitiveness, among other things, can alter demand and spending characteristics affecting associated economic activities.
- Evaluation of the effects of new public policies that can potentially affect the tourism industry or harm the PAs. Scenarios and related economic effects can be created as a consequence of government decisions to support as an argument in political debates.
- Evaluation of impacts of new investments, or new local tax allocation, or new zoning plans. Tourism impacts analysis may help convince decision-makers to invest more in policies that encourage tourism but also consider the necessities of the PA.
- Understand economic interdependence helping to identify potential partner industries that indirectly benefit from tourism. These partnerships can also help to handle tourism issues as seasonality.
- Compare economic impacts of different resource allocation scenarios or policies. The analysis can be used to compare outdoor recreation economic benefits to other direct use of resources such as cattle growth, mining or timber harvesting.

Overview of Tourism Economic Effects in PA

Tourists spend money in PAs and gateway communities, and their expenditures create and support local economic activity. Economies are interconnected systems where producers and consumers interact (Guilhoto, 2011). Raw material processed by producers and manufacturers is combined with inputs from other economic sectors to generate output. This in turn is the input for yet other economic sectors which adds value to the intermediate goods and generates their own output until eventually the goods and services reach the final consumer. Consequently, if demand for a product changes, a ripple effect will be experienced at multiple levels and sectors of an

economy (Cullinane et al., 2014). This impact is described in terms of direct effects, indirect effects, and induced effects of the initial consumer spending, discussed below.

Direct effects: The changes, caused by visitor spending, in the businesses that sell directly to tourists (i.e., lodges, campgrounds, restaurants, grocery stores, etc.). However, for the trade-sector businesses (grocery and sporting goods stores, fuel stations, etc.), the direct output effects need to include the capture rate, that is the percentage of spending that stays in the region by first round sellers (retailers), and by local wholesalers and manufacturers/producers as well (Stynes, 2001). Though only the margins (selling price less the cost of goods sold) of retailers and local wholesalers, and only the portion of sales accruing to local manufacturers/producers should be counted.

Indirect effects: The changes generated when lodges and other directly affected businesses buy goods and services from other businesses within the local region (Crompton, 2010). For service-sector businesses, the indirect output effect includes all items purchased and fixed operating expenses associated with operating a business (e.g., office supplies, electricity, maintenance, etc.). For trade-sector businesses, indirect output includes only the fixed operating expenses and not the cost of items purchased for resale.

Induced effects: The changes generated through household spending of personal income received directly or indirectly from tourist spending. For example, spending by employees of tourist lodges on meals, gas, etc. supports additional jobs in non-tourism businesses, and therefore allows additional rounds of local spending across a broad range of economic sectors (Cullinane et al., 2014).

The secondary effect is the sum of the indirect plus the induced effects. The sum of direct, indirect, and induced effects are termed the total effects of visitor spending (Crompton, 2010). These interactions between consumers and producers are described by economic input-output models that capture the effects of visitor spending by regional economic multipliers.

Regional Economic Models

To measure economic effects, it is necessary to obtain multipliers and ratios from Input-Output models (I-O). I-Os are matrices that describe the interdependencies and flows of money between different sectors within a certain economy (Camargo et al., 2008). I-O captures how much each industry demands from all the others. It also presents the proportion of sales that is used to pay salaries income, benefits, proprietors income and taxes, as well as the amount of employees of each sector. The basic calculations for the I-O matrix, coefficients, effects and multipliers are noted below (Guilhoto, 2011).

Direct and indirect effects matrix

In matrix terms, the intersectorial flux in a certain economy can be described as:

$$AX + Y = X \tag{4-1}$$

Where,

A is the matrix of direct input technical coefficients with a dimension (n x n)

X and Y are vector columns (n x 1), in which values represent total input and final output for each sector.

Considering the final output as exogenous to the system, it is possible to obtain:

$$X = BY \tag{4-2}$$

$$B = (I - A)^{-1} \quad (4\text{-}3)$$

Where,

B is the matrix of direct and indirect coefficients or Leontief Inverse Matrix with dimension (n x n), where the element b_{ij} should be understood as the total input of sector i necessary to produce one unit of final output for the sector j (Camargo et al., 2008).

Induced effects matrix

In order to calculate the induced effects, it is necessary to include households, making it endogenous to the system. So, instead of using the Matrix A described above, the following one should be used:

$$\bar{A} = \begin{bmatrix} A \\ H_e \\ H_i \end{bmatrix} \quad (4\text{-}4)$$

Where $\bar{A}$ is the new technical coefficient matrix ((n + 1) x (n + 1)) with household income (H_i) and expenditures (H_e) (Guilhoto & Sesso Filho, 2005).

In the same way, the new vector of total input is X ((n + 1) x 1) and final output Y ((n + 1) x 1), where the new components, household income and expenditures, are endogenous to the matrix:

$$X = BY \quad (4\text{-}5)$$

$$B = (I - A)^{-1} \quad (4\text{-}6)$$

Technical coefficients

For a vector W (n x 1) where the elements w_j are the coefficients of input, job, import, income and value added, that are obtained dividing these variables for each sector for the total output of the sector, as (Camargo et al., 2008):

$$w_j = e_j / x_j \tag{4-7}$$

Where,

w_j is the job coefficient for sector j

e_j is the total people occupied in sector j

Economic effects

Using the formula above it is possible to calculate the job effects and all the other economic effects:

$$\mathrm{E_j} = \sum_{\mathrm{i=1}}^{\mathrm{n}} \mathrm{b_{ij} w_i} \tag{4-8}$$

Where,

E_j is job effect that estimates the direct, indirect and induced effects of job creation for each monetary unit produced for the final output of the j-sector (Guilhoto & Sesso Filho, 2005).

Economic multipliers

In the same way, the job multipliers can be obtained by dividing the job effect by the job coefficient correspondent. It indicates how much in direct, indirect and induced is generated for job, import, taxes per each unit directly produced (Guilhoto, 2011). The multiplier for the j-sector would be:

$$\mathrm{ME_j} = \sum_{\mathrm{i=1}}^{\mathrm{n}} \mathrm{E_j}/W_j \tag{4-9}$$

Measurements of Tourism Economic Impacts

The multiplication of visitor expenditures by regional multipliers is used to calculate the economic effects of tourist spending to regional economies. There are two

possible metrics to present economic effects of tourism in PAs: economic impacts and economic contributions (Cullinane et al., 2014):

Economic Contribution analysis captures the gross economic activity generated in the regional economy by the total amount of visitors in the protected area. Economic contributions studies include expenditures by local visitors (the ones who live in the gateway community) and non-local visitors (the ones who come from outside).

Economic Impact analysis reports the economic net changes in the regional economy generated by the new money brought to the local economy from outside visitors. Economic impacts exclude spending by local visitors based on the assumption that if they decide not to visit the park, they would spend the money in another recreation activity within the local community.

Furthermore, economic significance analysis is more geared to measure the relative importance and magnitude of the total contribution of tourism in PAs to regional economies. However, economic impact analysis is more indicated to measure the inflow of visitors and spending in a local community generated by non-local visitors (Crompton, 2010).

Methodologies of Tourism Economic Analysis

Economic Impacts are estimated by the following equation (Stynes et al., 2000):

Economic Effects = Number of Visitors * Average spending per visitor * Economic multipliers

The variables of the equation require the following information:

- Collect or estimate the number of tourists that visit the PA and surrounding area.
- Estimate average spending per visitor in the region.

- Apply economic multipliers to measure the ripple effects of the expenditures of new money within the region.

The three main inputs on the right side of the equation can be derived in a number of ways depending on resources available for the study and degree of accuracy desired. Basically, four levels of rigor are possible:

- Subjective estimates of the inputs can be made by expert judgment.
- Secondary aggregated data adapted to a specific region.
- Secondary disaggregate data allowing better adjustment to a specific situation.
- Primary data from visitor surveys and regional input-output economic models.

The decision box below illustrates how the four levels of rigor apply to each of the three input variables.

Table 4-2. Decision box with different levels of information (adapted from Stynes et al., 2000)

	Number of Visitor	Visitor Spending	Economic Multiplier
Level 1	Estimation based in expert judgment	Estimation based on judgment	Estimation of multipliers based on expert judgment
Level 2	Existing visitor counts or estimates from similar PAs	Secondary data from similar area or market (total or segmented)	Use of aggregate multipliers from similar area
Level 3	Total visitor counts by segments or also estimates by segment	Secondary data from similar area or market disaggregated per segment and spending categories	Use of multipliers specific for each spending sector from published sources
Level 4	Survey to estimate visitors per segments or a demand model	Visitor survey with spending by segment and category	Multipliers generated from an I-O matrix of the local economy

Applications of Economic Impact Analysis on Tourism

Different approaches were designed over the years to produce economic impact analyses for tourism (Stynes, 1997). The NPS in the US developed a model called "Money Generation Model" (MGM) as the first attempt to estimate the impacts of visitation in the PAs. This first approach was basic but and presented only the aggregated data (USDI-NPS, 1990). Following MGM, two other applications were available for tourism economic research: Regional Input-Output Modeling System (RIMS II) from the US Bureau of Economic Analysis (USDC BEA, 1992), and Micro-Implan Recreation Economic Impact Estimation System (MI-REC/IMPLAM) developed by Stynes and Propst (1992; 1996). Both systems provided improvements with the option to desegregate spending per sector and visitors segment in application that could be manipulated; however, both require the purchase of multipliers. Stynes et al. (2000) developed the second generation of the MGM called MGM2 to be applied for the NPS, that also offered desegregated spending sectors and option for visitors' segments. MGM2 was released as a open version (non-proprietory) for state and local agencies with the option to use with generic multipliers (Chang, 2001). This required no acquisition of specific local multipliers, hence facilitating and reducing cost of the analysis, and probably made MGM2 the preferred approach in economic analysis in other countries (Buultjens & Luckie, 2005; Huhtala et al., 2010; Medeiros & Young, 2011). Two other systems should also be noted: Travel Economic Impact Model (TEIM) developed by the US Travel Data Center (US Travel Data Center, 1997), and the Tourism Satellite Account (TSA) by the World Travel and Tourism Council (WTTC, 1996) that are focused more to estimate national impact levels.

Federal System of Protected Areas of Brazil

The Chico Mendes Institute for Biodiversity Conservation (ICMBio) is the federal agency responsible for the management of the Brazilian Federal Protected Areas. ICMBio manages a system of 325 federal protected areas in a total of 79 million hectares. The categories that have more areas prepared for visitation are National Parks (IUCN category II) and National Forests (IUCN category VI). National parks allow only tourism and research whereas national forests also permit other uses such as timber, mining, and traditional utilization by local communities.

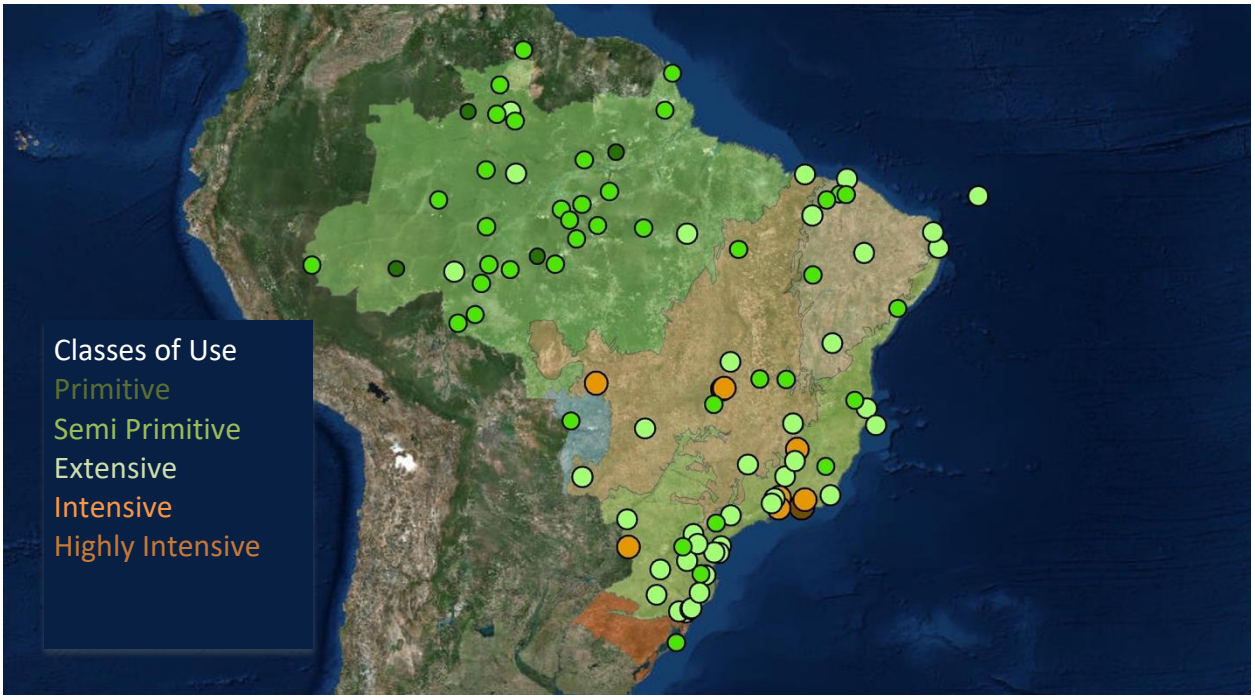


Figure 4-1. Recreation opportunity classes of use for national parks and forests of Brazil

Chapter 2 classified the sampled 94 PAs by their classes of recreational use based on their physical, social and managerial attributes. The Brazilian classes vary from Primitive where PAs internally offer few or no recreation options, no facilities or

services. The Primitive PAs are generally also located in remote locations with difficult access and low use rate. On the other side of the spectrum, Highly Intensive PAs offer a great variety of attractions, facilities, and services. They are located close to state capitals or big cities with high population density, easy access and high use rates. In between, the system has use classes named Semi Primitive, Extensive and Intensive. Today 97% of visitation (7,273,684) is located in PAs of Extensive, Intensive and Highly Intensive Use (Figure 4-2).

Classes	Number of PA	Area Total (ha)	% Area Total	Visits Sum	% Visits Total
Primitive	5	3,807,652	15%	0	0%
Semi Primitive	39	17,220,284	67%	209,091	3%
Extensive	42	4,194,511	16%	1,768,532	24%
Intensive	7	406,013	2%	2,559,797	34%
Highly Intensive	1	3,958	0.01%	2,945,355	39%

Figure 4-2. Variation of area and visitors per final classification

Chapter 3 calculated the visitation potential of the PA system based on the recreation classes developed in Chapter 2. To accomplish that, the indicators from the physical, social and managerial attributes were correlated to the number of visitors of the PAs. The correlation allowed the development of a regression model capable of predicting visitation variance of different investment scenarios and also potential visitation for PA out of the sample.The results were used to perform an estimation for the entire system of 325. (Table 4-3 and Figure 4-3).

Final Index	Number of PA	Visitation Mean	Visitation Total
Primitive	7	271	1,899
Semi Primitive	118	862	101,677
Extensive	137	14,600	2,000,263
Intensive	54	104,975	5,668,676
Highly Intensive	9	628,623	5,657,604
Total	325		13,430,119

Figure 4-3. Improved visitation scenario for the 325 federal Brazilian PAS

Table 4-3. Actual and predicted visitation in 2015 for the 325 PA

Actual visitation in 2015	8,071,018 visitors
Total predicted visitation in 2015	13,430,119 visitors

Methods

Federal protected areas of Brazil are the object of the research and the MGM2 methodology (Stynes et al., 2000) was chosen to calculate their economic contributions for the local, state and national economy. The MGM2 model requires three different inputs (number of visitors, visitor expenditures and multipliers). The study collected information from different sources for each variable.

Number of Visitors

PAs in Brazil report visitor arrival statistics annually to the central office of ICMBio. Since 2000, visitation has grown from 1.9 million to more than 8 million in 2015 (Figure 4-4) (ICMBio 2016).

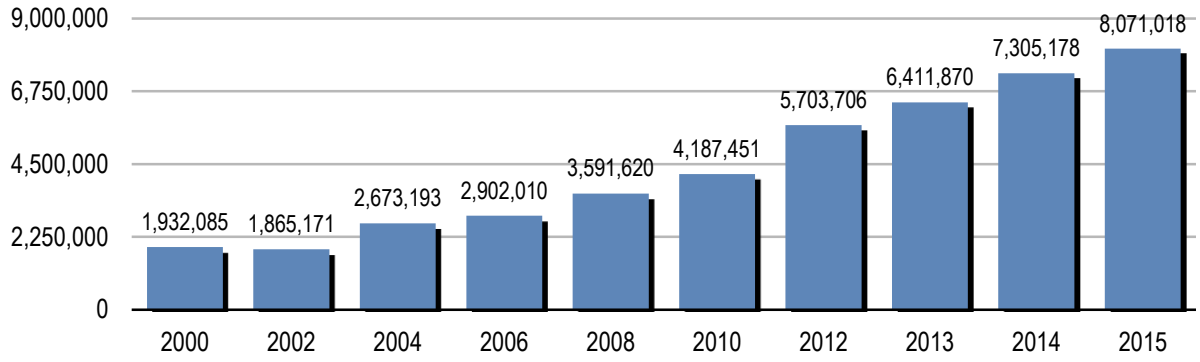


Figure 4-4. Total visitation/year in protected areas of Brazil

Visitation is allowed in most types of PAs (all of them if environmental education is considered) however, only 62 out of 325 PAs reported visitation in 2015 (Table 4-4) (Brazil, 2000). The study considered two scenarios: 1 - the actual reported visitation of 2015 and, 2 – An improved scenario of 13.4 million visitors developed with a demand analysis (Chapter 3).

Table 4-4. Number of areas that reported visitation per year

Brazilian Category	IUCN Class	N^0 of PA	Total visitation 2015
National Park	II	38	7,149,112
National Forest	VI	17	371,339
Environmental Protected Areas	V	3	394,744
Extractive Reserve	VI	1	150,000
Biological Reserve	Ia	1	2,375
Relevant Ecological Interest Area	IV	1	3,294
Ecological Station	Ia	1	154
Total		62	8,071,018

Visitor Expenditures

Visitor spending data was collected via two different techniques: on-site interviews and e-mail (Crompton, 2010) during January-February of 2016. The study focused on visitors at three PAs from the most visited based on recreation class use (Extensive, Intensive, and Highly Intensive) with the purpose to develop an average visitor spending for each class (Driml & McLennan, 2010; Huhtala et al., 2010). The three selected PAs were: São Franciso de Paula National Forest, Chapada dos Guimarães National Park and Tijuca National Park.

Final Index	PA surveyed	Total Surveys	Valid surveys	Margin of error 95% confidence level
Extensive	São Francisco de Paula NF	131	108	4.8%
Intensive	Chapada dos Guimarães NP	329	229	5.5%
Highly Intensive	Tijuca NP	116	97	9.1%
Total		576	434	6.5%

Figure 4-5. PA surveyed for visitor expenditures

São Francisco de Paula National Forest (Extensive Use) - The manager provided an e-mail list of 365 visitors. Based on email contact requests and subsequent reminders, a total of 131 visitors completed the questionnaire (28% response rate). Of which, 108 were deemed useable. Chapada dos Guimarães National Park (Intensive Use) - The manager provided an e-mail list of 4,134 visitors. Similarly, based on email contact and subsequent reminders, 329 visitors responded (8% response rate), while

229 were useable. Tijuca National Park (Highly Intensive Use) – For this park, visitors were interviewed on-site using a systematic sampling process (Crompton, 1999) at two different access points. Data collection occurred during the week and weekends for a period of 30 days. A total of 116 responses were collected, and 97 were included in the study.

Visitor survey

The questionnaire was one-page in length with only essential data requested for this research. Due to field logistics and response issues, the questionnaire was developed in a digital (Qualtrics software) and standard paper version in English and Portuguese languages. The survey collected origin (ZIP code) to identify internationals, locals, and non-local residents. The relevant questions included length of stay, party size of the group, and the amounts spent in specific categories: accommodation, meals, gas and oil, local transportation, retail stores, activities and guided tours and other expenses. In addition, questions were also included to identify multiple destination visitors (Appendix G).

The next paragraphs discuss issues considered in the questionnaire to perform an accurate participation of visitors into the analysis. Visitor expenditures needs to be carefully collected since it is a potential source of error (Crompton, 2010):

Spending region

Spending regions were defined based on gateway communities considering where tourists spend the night, eat and buy supplies. The analysis uses the same gateway communities defined in Chapter 2 in the survey applied to PA managers. The boundaries are municipalities due to theirs political divisions which offer more available data (Cook, 2013).

Local visitors

When conducting local economic impact analysis, local visitors should not be included since their spending would be used in another activity in the region in a hypothetical case that the PA did not exist. To address the issue, Cullinane et al. (2015) recommended to estimating the local share separately. For national economic impact analysis, the study assumes that all spending and effects occur within the country

Zero spending visitors

Some visitors may improperly fill out the questionnaire or do not feel comfortable answering financial questions and may leave some blank ones. A question asking if the visitors spent money or not during the trip was included in the survey to separate questionnaires from tourists that really had no expenditures, from incomplete or incorrect questionnaires (Huhtala et al., 2010). This procedure avoids an under or overestimate of zero spending visitors.

Multiple destination trip

Crompton (2010) addresses the situation of tourists visiting different attractions or destinations in the same trip with a question asking how important the PA was to the decision to visit the region. The importance was calculated based on the responses between 0 and 10. Then, only the correspondent proportion of the visitor spending was attributed to the PA. Such estimates are subject to errors; however, they are more precise than accounting for 100% of visitor spending.

Visitors and visits

Since the economic analysis is focused on the region where the PA is located, the spending was calculated based on the number of the days that the visitor stayed in the region. First the total spending of each visitor was divided by the number of days in

the region to find the spending per day (Huhtala et al., 2010). Only expenditures that occurred during the day of the visit were considered.

Multipliers

National ratios and multipliers are derived from the Input-Output (I-O) Table of Brazil 2013 - 68 sectors. The table was built using data from National Accounts with the methodologies described in Guilhoto & Sesso, 2005 and Guilhoto & Sesso, 2010. The premise is that the national economy did not have significant changes between the year of the I-O table (2013) and the year of the visitor survey (2015). A closed matrix including the families' expenditures was developed to calculate the Type II multipliers. Type II multipliers were used to calculate secondary effects (indirect and induced).

Following the MGM2 methodology, this study focused mainly on the direct effects with greater attention to income and value added as the more reliable impact measurements. The direct effects were presented by spending categories (very similar to economic sectors). Impacts were presented in terms of sales, value added, personal income and jobs (Stynes et al., 2000):

- Sales are the sales of business within the region to visitors after considering the capture rate.
- Jobs corresponds to the number of jobs supported by tourist expenditures. Jobs effects consider full-time, part-time and seasonal jobs.
- Personal income refers to proprietor's income, salary income and wages.
- Value added is a contribution measurement of a region or industry to the gross product, national or state. Rents and profits, personal income and indirect business taxes summed are included in Value Added. It corresponds to the final price of the product or service after removal of the costs of production minus non-labor.

Direct effects

Multipliers and economic ratios were multiplied to each sales category from the local economy. Specific multipliers from six economic sectors were developed for each of the seven corresponding categories of expenditures. Specific multipliers for each sector captures the economic differences of each industry (Crompton, 2010). Direct effects are estimated for each category of expenditure with the following formulas (Stynes, 2001):

- Direct jobs = (direct sales*capture rate)*jobs/sales ratio
- Direct personal income = (direct sales*capture rate)*personal income/sales ratio
- Direct Value added = (direct sales*capture rate)*value added/sales ratio

Total effects

The procedure for total effects is similar to direct effects using the Type II multipliers for each sector. They represent the variation in sales, income, jobs and value added for each additional unit of sales. Indirect effects are estimated in an aggregate form with the following formulas (Stynes et al., 2000):

- Total sales = (direct sales*capture rate)* Type II sales multiplier
- Total jobs = (direct sales*capture rate)* total jobs/sales ratio
- Total personal income = (direct sales*capture rate)* total income/sales ratio
- Total Value added = (direct sales*capture rate)* total value added/sales ratio

Generic multipliers

Multipliers and ratios were developed for the three most important recreational classes of use: extensive, intensive and, highly intensive. They were based on the same economic region considered for visitor expenditures (Stynes et al., 2000).

Extensive Use Large rural areas with population up to 500,000. You can also consider some smaller population communities that serve as the economic center of the surrounding region. Sales multipliers are low to medium and job multipliers are medium to high.
Intensive Use Moderate Size Communities with total population up to 1,000,000. You can also consider some smaller population communities that serve as the economic center of the surrounding region. Sales multipliers are medium to high and job multipliers are medium to low.
Highly Intensive Use State or Metro regions with populations of 1 million and more. Sales multipliers are high and job multipliers are low.

Figure 4-6. Attributes of the Generic Regions

Economic effects spreadsheet

An excel spreadsheet adapted from Stynes et al. (2000) for the MGM2 was used to calculate the economic effects and facilitate study replication[3]. Minor modifications were made to address particular contextual issues to Brazil. More specifically, the spreadsheet was updated with a different set of categories created for visitors' expenditures; generic multipliers were developed from a 2013 input-output matrix for Brazil, and opportunity costs were added as results.

The sectors from the input-output matrix used to extract the multipliers correspond to the spending categories asked in the visitor survey. The Table 4-5 also shows the equivalent International Standard Industrial Classification (ISIC) Revision 4 (UN Stats, 2016) and the Brazilian CNAE (Código Nacional de Atividades Econômicas).

[3] A usable template of the spreadsheet can be accessed in the link: https://docs.google.com/spreadsheets/d/18YXQSHNlTDZUPsrcS94JkYHrdrFCenh3Cm_TMhiXfh8/edit?usp=sharing

Creative, arts and entertainment activities sector was the closest sector to extract Organized Activities multipliers due to its similar classification under the ISIC section R - Art, Entertainment and Recreation. The category Other Expenses used the average from all sectors.

Table 4-5. Corresponding IOM sectors to the spending categories

Categories in the questionnaire	Corresponding sectors IOM	Corresponding sectors CNAE
Gas and Oil	Wholesale trade and retail trade, except motor vehicles	46/47 - Wholesale trade and retail trade, except motor vehicles
Local Transportation	Terrestrial Transport	49 - Terrestrial Transport
Retail Stores	Wholesale trade and retail trade, except motor vehicles	46/47 - Wholesale trade and retail trade, except motor vehicles
Meals	Food processing	56 - Food and beverage service activities
Accommodation	Accommodation	55 - Accommodation
Activities and guided tours	Creative, arts and recreation activities	90 - Creative, arts and recreation activities
Other expenses	Average	-

Results

Visits

Visitors were divided into two segments for each recreation class: local and non-local. Sufficient data was not available to define an international segment. On average, based on visitor spending survey data, 20% were local and 80% were non local. Local visitors spent one day at the PA and non-locals spent three in the PA and four in the region. The figure below shows also the differences between outdoor recreation classes.

Recreation Class	Segment	Percentage of the total	Days in the PA	Days in the region
Extensive	Locals	7%	1.0	1.0
	Non-locals	93%	3.7	4.7
Intensive	Locals	24%	1.4	3.0
	Non-locals	76%	3.0	5.0
Highly Intensive	Locals	30%	1.0	1.0
	Non-locals	70%	1.2	3.3
Average	Locals	20%	1.3	1.7
	Non-locals	80%	2.6	4.3

Figure 4-7. Visitor characteristics per segments in each recreation class

Recreation Class	Segment	Number of Visits
Extensive	Locals	149,551
	Non-locals	1,986,898
Intensive	Locals	662,352
	Non-locals	2,097,447
Highly Intensive	Locals	952,431
	Non-locals	2,222,339
Total		8,071,018

Figure 4-8. Recreation visits per segments in each Recreation Class

The 7,273,684 recreation visits from the 94 PAs sample were allocated to the three recreation opportunity classes using the visit segments shares in Figure 4-7. With the objective of estimating the economic effects of total visitation of 2015, the remaining 797,334 visitors from PA out of the sample were also included to calculate visitor

expenditures. The criteria used was to split the visitors using the percentage criteria of Figure 4-7 and then divide again by local and non-local based on the Figure 4-8. Visitors from Semi Primitive class were included in the Extensive class since they have the closest expenditure characteristics.

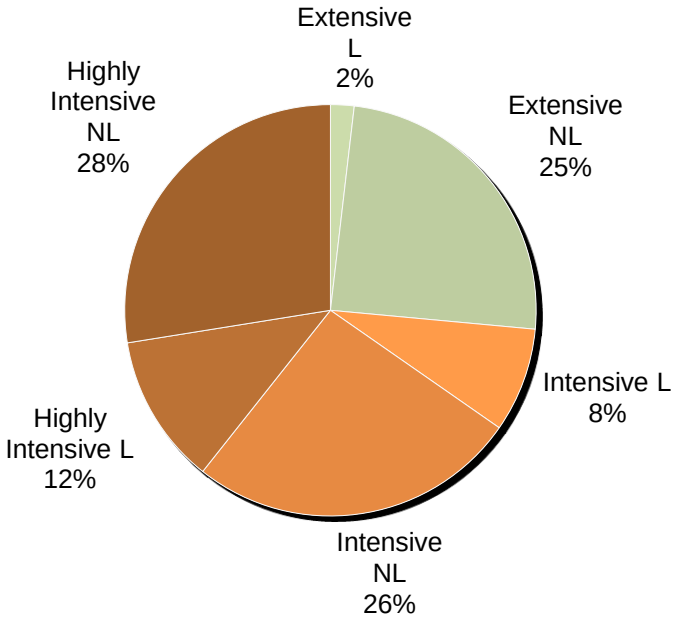


Figure 4-9. Percentage of visitors in each recreation class segment.

Visitor Expenditures

The visitor expenditures questionnaire collected information about spending inside the PAs and within the region. Visit expenditures were divided by number of days in the region, and per group size when responses were made on behalf of an entire group. Then, based on how important the PA was for their decision to visit the region, only the percentage informed by the visitor was considered as final spending per visit per day. The expenditures averages were organized per segment (recreation class - local / non-local) on a visits per day basis (Figure 4-10).

Recreation Class	Segment	Total Expenditures	% attributed to the PA	$ attributed to the PA
Extensive	Locals	$1.58	80%	$1.26
	Non-locals	$26.57	90%	$23.91
Intensive	Locals	$27.04	70%	$18.93
	Non-locals	$71.47	90%	$64.32
Highly Intensive	Locals	$11.07	100%	$11.07
	Non-locals	$91.39	70%	$63.97
Average	Locals	$13.23	83%	$10.42
	Non-locals	$63.14	83%	$50.74

Figure 4-10. Average expenditures and percentage attributed to the PA

	Recreation Classes (L - Local, NL - Non-local)					
	Extensive		Intensive		Highly Intensive	
Spending Categories	L	NL	L	NL	L	NL
Accomodation	$0.32	$5.39	$0.00	$18.49	$0.00	$15.65
Meals	$0.63	$8.01	$6.06	$12.33	$3.97	$11.86
Gas and oil	$0.00	$7.26	$5.33	$9.09	$0.16	$12.52
Local transportation	$0.32	$1.36	$0.35	$5.99	$6.28	$6.91
Activities and guided tours	$0.00	$0.69	$6.37	$14.70	$0.50	$12.52
Retail stores	$0.00	$0.82	$0.47	$2.90	$0.16	$3.75
Other expenses	$0.00	$0.38	$0.35	$0.82	$0.00	$0.76
Total expenditure per tourist/day	$1.26	$23.91	$18.93	$64.32	$11.07	$63.97

Figure 4-11. Average expenditure (dollars per visitor per day) by segment attributed to the PA

On average, local visitors spent $10.42 per visit, and non-local visitors accounted for $50.74. Local visitors spent more money on meals, local transportation, and activities and guided tours. Non-locals spent more on accommodation, meals, gas and oil, and activities and guided tours.

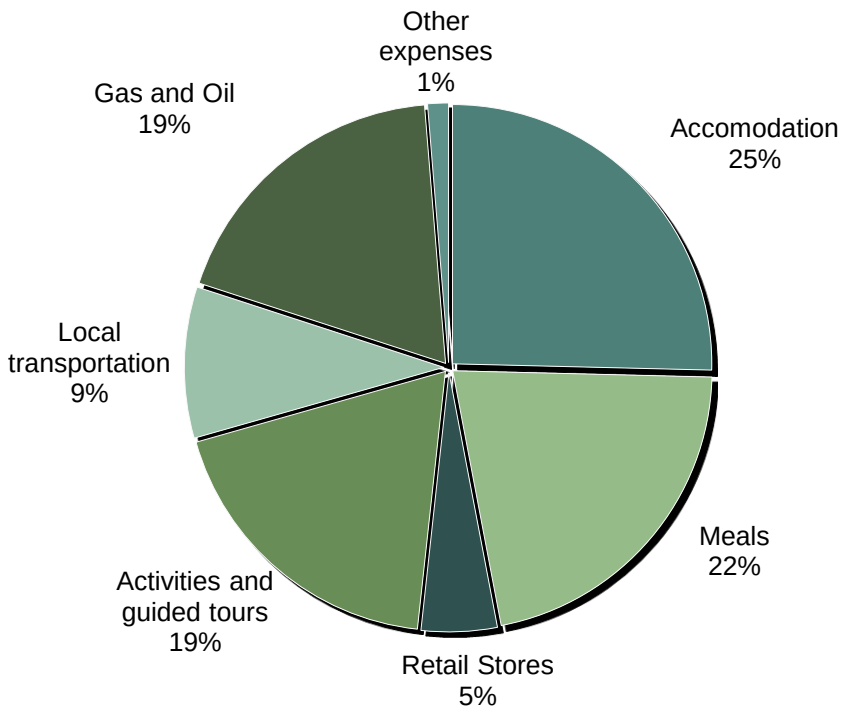


Figure 4-12. Percentage of average visitor expenditure

Total Visitors Expenditures

Total expenditures were estimated by multiplying the average spending by the number of visits for each segment. Collectively, visitors spent $347 million in the PAs in 2015 (after consideration of the capture rate). Visitors to PAs that were classified as Extensive Use spent $47 million. Intensive Use PAs accounted for $147 million, and the Highly Intensive Use recorded $152 million.

Recreation Classes				
Spending Categories	Extensive	Intensive	Highly Intensive	Total
Accomodation	$10,765,144	$38,772,995	$34,772,244	$84,310,383
Meals	$16,014,609	$29,882,440	$30,145,292	$76,042,342
Gas and oil	$14,415,979	$22,586,821	$27,982,042	$64,984,842
Local transportation	$2,742,338	$12,801,287	$21,332,051	$36,875,676
Activities and guided tours	$1,378,920	$35,053,798	$28,312,539	$64,745,257
Retail stores	$1,629,632	$6,400,644	$8,492,760	$16,523,036
Other expenses	$752,138	$1,950,142	$1,682,528	$4,384,808
Total per Class	$47,698,761	$147,448,127	$152,719,457	$347,866,345

Figure 4-13. Total expenditures attributed to PA visits 2015

Tourism Economic Contributions and Impacts - National Effects

National direct and total contributions of visitor expenditure attributed to PAs

National direct contributions consider the direct effects of the expenditures attributable to the days spent in the PAs for all visitors. It also considers a capture rate of 100% with the assumption that all goods are produced nationally. Based on this notion, visitors' expenditures in PAs generated more than $347 million in Direct Sales, $153 million in Personal Income, $194 million in Value Added to the GDP, and supported 23,813 direct jobs (Figure 4-14). These values consider only local expenditures without considering transportation from the origin to the destination. Furthermore, national total contributions consider the direct plus indirect plus induced

effects. Hence, visitors' expenditures generated more than $1.2 billion in Total Sales, $342 million in Personal Income, $473 million in Value Added to the GDP, and supported 43,602 jobs.

	Direct Effects			
Spending category	Sales Captured	Jobs	Personal Income	Value Added
Accomodation	$84,310,383	5,193	$37,939,672	$48,900,022
Meals	$76,042,342	5,838	$31,177,360	$38,021,170
Gas & oil	$64,984,842	3,947	$29,893,027	$41,590,299
Local transportation	$36,875,676	1,481	$12,906,486	$16,594,054
Activities and Guided Tours	$64,745,257	6,106	$32,372,628	$36,904,796
Retail Stores	$16,523,036	1,004	$7,600,596	$10,574,743
Other expenses	$4,384,808	244	$1,585,838	$2,002,395
Total Direct Effects	**$347,866,345**	**23,813**	**$153,475,610**	**$194,587,482**
Secondary Effects	$946,109,299	19,789	$189,397,361	$279,103,778
Total Effects	**$1,293,975,644**	**43,602**	**$342,872,971**	**$473,691,260**

Figure 4-14. Economic contributions of visitor spending to the national economy

Based on recreation class of use, the Extensive classification represented 24% of visitation and 14% of the direct effects. PAs with Intensive Use noted 34% of visitation and 51% of the direct effects. The Highly Intensive classification were responsible for 39% of the visitation and 35% of the direct effects. Due to different expenditures in spending categories, Highly Intensive PAs had more direct effects but the Intensive Use had more total direct effects (Figure 4-15).

	Recreation Classes			
Spending Categories	Extensive	Intensive	Highly Intensive	Total
Direct Sales Captured	$47,698,761	$147,448,127	$152,719,456	$347,866,344
Direct Personal Income	$20,712,587	$65,746,533	$67,016,490	$ 153,475,610
Direct Value Added	$26,883,792	$82,613,344	$85,090,346	$ 194,587,482
Direct Jobs	3,149	10,371	10,292	23,812
Total Sales Captured	$151,630,935	$571,853,960	$570,490,749	$ 1,293,975,644
Total Person Income	$39,776,516	$152,413,559	$150,682,897	$ 342,872,972
Total Value Added	$55,020,932	$210,434,059	$208,236,269	$ 473,691,260
Total jobs	5,106	19,493	19,003	43,602

Figure 4-15. Economic contributions of visitor spending per class: direct effects

Economic impact of an average PA per class

The average spending per recreational class was obtained when the expenditures were divided by the number of PAs in that class. With a mean of 14,600 visitors, the Extensive Use areas had, on average, total sales capture of US$1.1 million and supported 37 jobs. Intensive Use areas had an average of 104,975 visitors, and generated US $2.8 million in total personal income and $3.9 million in total value added. Finally, the Highly Intensive Use areas supported a total number of 2,111 jobs and $63 million in total sales (Figure 4-16).

	Recreation Classes		
Spending Categories	Extensive	Intensive	Highly Intensive
Direct Sales Captured	$348,166	$2,730,521	$16,968,828
Direct Personal Income	$151,187	$1,217,528	$7,446,277
Direct Value Added	$196,232	$1,529,877	$9,454,483
Direct Jobs	23	192	$1,144
Total Sales Captured	$1,106,795	$10,589,888	$63,387,861
Total Person Income	$290,340	$2,822,473	$16,742,544
Total Value Added	$401,613	$3,896,927	$23,137,363
Total jobs	37	361	2,111

Figure 4-16. Average economic contribution per PA in each class

National total contributions attributed to PAs in the improved scenario

Based on the aforementioned improved scenario, the results in direct effects would result in more than US$2.8 billion in Total Sales Captured, US $752 million in Personal Income, US $1 billion in Value Added to the GDP, and support 94,180 jobs for the country (Figure 4-6).

Table 4-6. Economic contributions of visitor spending to the national economy: improved scenario

Spending category	Sales Captured	Jobs	Personal Income	Value Added
Direct Effects	$ 621,680,792	42,725	$ 274,734,880	$ 347,625,218
Total Effects	$ 2,821,185,706	94,180	$ 752,935,141	$1,045,872,259

Discussion

The results contribute academically to the economic impacts analysis literature as it relates to developing countries. This study collected primary visitor expenditures data in three different PAs to develop generic expenditures profiles for the most expressive recreation classes with local and non-local visitors segments. Additionally, based on the 2013 I-O matrix of the Brazilian economy, six specific multipliers and ratios for each spending category were developed for the national level. Using this approach, it was possible to estimate not only sales, but also value added, income and jobs. Overall, this methodology improved the reliability of the results based on primary data collection and rigor of analysis (Stynes et al., 2000).

The results illustrated that the economic impacts of tourism in PAs of Brazil are even higher than the estimations from 2011 (Medeiros & Young, 2011). Instead of the $2 billion in total sales generated from the spending of an expected 16 million visitors in 2016 proposed by Medeiros & Young, this study identified that only the actual 8 million visitors in 2015 have already economically contributed with $1.2 billion in total sales captured. The predicted scenario of 13 million visitors would have an even higher contribution of US $2.8 billion. The results are also compatible with economic contributions analysis done by Semeia in 2014. The present analysis found similar increase of 50.5 thousand new jobs (from 43.6 to 94.1 thousand) and $1.6 billion in total sales captured (from $1.2 to $2.8 billion) in the improved scenario while Semeia estimated 55.8 thousand in jobs and $1.6 billion in total sales. Moreover, this study reinforces the idea that PAs are engines of economic development since expenses in conservation and recreation are actually investments to create and strengthen jobs, income, and GDP. The total sales capture of US$1.2 billion demonstrated to be almost

eight times the ICMBio budget of US $173 million in 2015 (ICMBio, 2016b). In essence, for every US $1 that Brazil invests in the PA system, it generates US $7 in economic benefits nationally. Moreover, it has also been noted that investments of approximately US $220 million for infrastructure development in all federal PAs could generate another US $2.8 billion in total sales (Muanis et al., 2009). In fact, this potential economic impact is almost similar to the GDP of a small State of Roraima which was around US $2.9 billion during the same year.

The limitations of the estimates rely on the precision of the three inputs: number of visits, spending averages, and multipliers (Cullinane et al., 2015). With respect to PAs visitation numbers, this data was based on the information provided via ICMBio headquarters. Basically, the total number of visitors compiled is based on counting procedures that vary from entry ticket sales, visitor counts at the entry gates, visitors signature book, estimations, appointments, and information from the tourist companies. Among these data collection methods, each PA utilitizes one or more to compile the total visitors count as it is dependent on the settings and demand level. However, it is recommended for ICMBio to develop guidelines to increase scientific rigor in data collection, and define a standardized count procedure of visits and visitors. The importance of this is emphasized since the most important input is the estimate of visits, followed by the average spending figures and distribution of visitors across segments (Stynes et al., 2000).

On generic expenditures, spending averages were based on selected three PAs that represented one for each recreation class. With modest sample sizes, overall visitor expenditure in this study was subject to 6.5% sampling error on average. Future

research should focus on increasing the sample size of PAs as well as visitors' segments to include international tourists. It is also recommended to collect data during different times of the year such as the high and low season in order to capture any potential differences. Interpretation of the results should consider that the survey conducted in Tijuca National Park was applied only during two months of summer. Chapada dos Guimarães National Park and São Francisco National Forest had lists of emails that where collected over two years. Further, to avoid inflation on total expenditures, the recommended potential source of errors was treated with the differentiation of local visitors vs non-local, zero spending visitors, local region and multipurpose trip (Crompton, 2010). Another important source to avoid inflation is capture rate which was also applied to the direct sales (Stynes, 2001).

The adaptation of the MGM2 methodology demonstrated to be reliable and efficient. Further research can continue to monitor economic impacts over the years for the federal PAs of Brazil. However, the prerequisite input variable - number of visitors - will need to be collected annually, since expenditures and multipliers can be used for a few years (Huhtala et al., 2010). Since this study only analyzed the effects at the national level, it is recommended that development of local multipliers and the economic impact evaluations be conducted at local and state level too. Hence, the next phase of this study is to explore further and examine at the State and local levels based on the available spreadsheets that has already compiled the calculations and multipliers.

Concluding Remarks

The study reveal the magnitude of an important ecosystem service provided by PAs, tourism and outdoor recreation. Visitation in PAs demonstrated to be a powerful mechanism to develop local economies and the tourism industry in Brazil. Their direct

expenditure generated more than $347 million in Direct Sales, $153 million in Personal Income, $194 million in Value Added to the GDP and supported 23,813 direct jobs to the nation. Total contributions reached more than $1.2 billion in Total Sales, $342 million in Personal Income, $473 million in Value Added to the GDP and supported 43,602 jobs. The analyses demonstrated that every dollar Brazil invested in the PA system produced $7 in economic benefits nationally. These economic effects occurred with around 8 million visits in 2015. In an improved scenario of 13 million visitors, these contributions would increase to $2.8 billion in Total Sales Captured, $752 billion in Personal Income, $1 billion in Value Added and supported 94,180 jobs for the nation. The study reinforced that economic impacts of tourism directly affects the PAs management and associated business, as well as indirectly to other business and the local communities. Since, a good proportion of the sample PAs are located in remote areas, the economic effects have the ability to further generate greater economic benefits for local communities that have a higher household consumption and dependency on the surrounding natural resources. Investments in the PAs are necessary to ensure the conservation of the ecosystem services and the quality of the visitors' experiences. The results highlighted the importance of tourism in PAs and the adjacent regions, which creates an opportunity for Brazil to increase its budget allocation. Additional investments in PAs will stimulate the local economies and generate benefits for communities to ensure the development of sustainable destinations.

CHAPTER 5
CONCLUSION

This study demonstrated that tourism is an important cultural ecosystem service provided by the protected areas in Brazil. The present research illustrates how tourism in PAs can be inventoried in a systematic manner that supports demand and economic analysis, which in turn, are powerful tools to quantify the importance of the ecosystem services. Chapter 5 presents an integrated summary of findings, theoretical and practical implications, limitations and recommendations for future study based on Chapters 2, 3 and 4.

Summary of Major Findings

The research proposes an integrated approach to manage visitation in protected areas of Brazil. The findings demonstrated that PAs can be classified according to their recreational uses. The proposed recreational classes proved to be statistically effective for prediction of visitation demand for the PAs. The predicted demand by classification offered an improved framework to estimate the economic impacts on the Brazilian economy of tourism in the PAs. A summary of major findings is presented below:

- The study demonstrates that the physical, social and managerial attributes of the Recreation Opportunity Spectrum (ROS) are statistically relevant to visitor use management. However, an external setting of the same attributes should be considered to analyze visitation in the context of tourism destination.
- Five different classes (Primitive, Semi Primitive, Extensive, Intensive and Highly Intensive) offer a spectrum of recreational uses that are statistically different from one another, thereby facilitating the development of specific management approaches.
- The analysis indicated that several PAs have different internal and external classifications (e.g.: Semi Primitive Internal Class in an Intensive Class destination, indicating that the PA has been managed to meet its full potential)
- The recreational classes of use based on ROS have correspondence with the zoning system adopted in general management plans in Brazil. This

correspondence makes possible the integration of the ROS approach into the Chico Mendes Institute for Biodiversity Conservation (ICMBio) planning process.

- The regression model using the internal and external attributes as variables was effective for predicting visitation for current and new PAs, as well as for predicting increment or reduction for new investment scenarios.

- The application of ROS at the system level proved to be a strategic tool for visitor use management.

- The recreational classification system can be used to periodically monitor the adequacy of PAs in reaching their visitation potentials.

- The economic impact analysis transformed the predictions of visitor numbers into monetary values, demonstrating the benefits of the PA cultural ecosystem service to society.

- The demand analysis indicated that the federal system has the potential to receive 13.4 million visitors annually, instead of the reported 8.1 million in 2015, an increase of 60%.

- In the same year, the direct expenditures by 8.1 million visitors generated more than $347 million in Direct Sales, $153 million in Personal Income, $194 million in Value Added to the GDP and supported 23,813 direct jobs to the nation. Total contributions reached more than $1.2 billion in Total Sales, $342 million in Personal Income, $473 million in Value Added to the GDP and supported 43,602 jobs.

- The analyses demonstrated that every dollar Brazil invested in the PA system produced $7 in economic benefits nationally.

- In the improved scenario of 13 million visitors, these contributions would increase to $2.8 billion in Total Sales Captured, $752 billion in Personal Income, $1 billion in Value Added and support of 94,180 jobs for the country.

Theoretical Implication

The study analyzed ROS at the system level, a methodology suggested in the literature but rarely applied (Brown et at., 2009; Kil & Confer, 2005). The analysis showed that the system as a whole has the same characteristics as a single PA in regard to total area and number of visitors per class. Generally, in one PA, zones rated as Highly Intensive and Intensive constitute a small percentage of the total area and

concentrate most of the visitation demand, while Extensive and Semi Primitive classes are much larger with lower usage. The same pattern appeared at the national level, where Semi Primitive and Extensive PAs comprise most of the area and Highly Intensive and Intensive areas most of the visitation. This indicates that an overall classification for the PAs is useful for the General Management Plans (GMP) and Visitor Management Plans of each PA (Pettengill & Manning, 2011). The study supported the general understanding among academics that, despite its rare use on the system level, ROS can be very effective and should be used for strategic planning since it can support a vision of the entire system of PAs.

Despite the fact that Recreation Opportunity Spectrum (ROS) was developed in the 1960's and has been applied in many publications, for the first time, a study statistically tested the relationship between the classes and number of visitors (Manning, 2011; Pettengill & Manning, 2011). The findings based on one-way ANOVA verified that all classes statistically differ from one another, demonstrating that visitation demand is affected by the different internal and external settings. This is a demonstration that indicators and standards provide an effective strategy to develop management polices based on the specific characteristics of the PAs.

Another improvement in the ROS methodology is the addition of the external setting with new physical, social and managerial attributes. The initial ROS model considered physical, social and managerial attributes only within the PAs, without considering the external setting of the destinations. However, the decision to travel is determined not only by attributes located inside a PA (i.e. type of landscape, facilities, services) but also by attributes located outside (i.e. distance, access, regional

infrastructure) (Neuvonen et al., 2010, Puustinen et al., 2009, Viveiros de Castro et al., 2015).

The research was able to develop a model that predicts visitation in PAs by measuring the relative importance of various internal and external attributes and overall settings in relation to the number of visitors (Viveiros de Castro et al., 2015). The best fit model selected the overall scores of internal and external ROS settings as better explanatory variables. Using the best fit model, the study built improved visitation scenarios for different groups of federally protected areas.

The economic impact analysis applied the Money Generation Model 2 (Stynes et al., 2000) methodology to a developing country in Latin America, where such analyses are still rare. Moreover, the research developed a grounded demand analysis that served as the basis for economic evaluation. Primary data of visitors' expenditures were collected and specific multipliers for the country were developed.

Policy Implementation

It is important to understand that ROS not only considers development and increment in visitation influx, but also strives to understand the vocation of each area and plan appropriately. It is also important to note that the framework is not a final decision-making tool in the sense that the findings should be implemented without further analysis. The results demonstrate the visitor potential demand for each PA, but other factors, such as conservation objectives and other particularities, should also be considered in the process of incrementing or reducing visitation volume.

The analysis exemplified that the relative importance of different PA attributes is strategic to development of a PA within a tourist destination. The study indicated that tourism demand in the protected areas of Brazil is correlated to the physical, social and

managerial attributes proposed in ROS. Results show that both internal and external settings are considered by visitors. While inner characteristics and management are important, external factors independent of PA governance also play an important role, since outdoor recreation needs to be planned within a larger context of a tourism destination. In this sense, outreach initiatives by managers at the local and regional levels are recommended, as joint actions with other government agencies and the tourism trade are critical to increase visitor flow to the areas and adjacent communities.

The classification system of recreational use also 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. Specifically, for the Brazilian present reality, it is only necessary to use three classes instead of five, since there are no Primitive PAs reporting visitation and only one PA considered to be Highly Intensive. For management purposes, three classes will facilitate current administration; the other categories can be added in the future. It is important to note that the majority of the indicators are sensitive to modifications to the destination (e.g.: new roads) or to the PA characteristics (e.g.: new facilities). This means that PAs can move from one class to another upon specific management actions within the PA or due to investments in the destinations.

The study reinforced the premise that the economic impacts of tourism not only directly affect PA management and the tourism business, but also indirectly affect other types of businesses and the local communities. A good proportion of these PAs are

located in remote areas, and the economic effects can produce even more economic benefits in those local communities which otherwise would need to unsustainably consume more natural resources. Investments in the PAs are necessary to ensure the conservation of the ecosystem services and the quality of the visitors' experiences. The results demonstrated the importance of tourism in PAs and the country's opportunity to increase the budget, stimulate local economies and share benefits with communities to ensure the development of sustainable destinations.

Limitations

The recreational classification analysis focused on national forests and national parks, thereby limiting extrapolations of results to other PA categories. It should also be noted that questionnaires were completed remotely, and that 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.

The economic impact estimates rely on the precision of the three inputs: number of visits, spending averages, and multipliers (Cullinane et al., 2015). ICMBio headquarters released the number of visits for the analysis. The central office can develop guidelines to increase scientific rigor in data collection, as well as define a standardized count procedure for visits and visitors, since the most important input is the estimate of visits, followed by the average spending figures and distribution of

visitors across segments (Stynes et al., 2000). On generic expenditures, spending averages were based on just three PAs, one for each recreational class. It is recommended that the ICMBio invest in new questionnaire applications to increase the number of PAs. It is also interesting to have larger sample sizes to expand the number of visitors' segments, like the inclusion of international tourists, for example. It is also recommended to collect data in different times of the year, such as high and low visitation seasons, to capture the differences. However, to ensure reliable results in the present study, the recommended potential sources of error were treated using the differentiation of local visitors vs non-local, zero spending visitors, local region and multipurpose trip to avoid inflation on total expenditures (Crompton, 2010). Capture rate, another important source to avoid inflation, was also applied to the direct sales (Stynes, 2001).

Future Research

Further research can consider more specifically the recreational opportunity classes within each ecoregion or within specific or different PA categories. Evaluation of better management strategies for each class of use should also be addressed, as well as analysis of more effective indicators and measurements. New studies can look for more accurate indicators to monitor characteristics, such as scenic attractiveness (internal managerial attribute), for example. Another possibility is to test different score scales to verify the accuracy of the output. The results also offer data to further analyze the tourism demand with the same variables used to inventory the supply of recreational opportunities in PAs.

In order to test the results, it is important to continue monitoring the system, collecting data over the years, to evaluate if and how the change in the indicators (PA

internal and external characteristics) are affecting the number of visitors. ICMBio also can select some PAs with potential to increase number of visitors and promote investments based on the parameters of this study to evaluate if visitation grows as predicted.

With regard to demand analysis, new research can develop trend analyses of predictions or comparative evaluations among countries, states, different ecoregions, or PA categories to provide more contrast in the data. The current study focused on national forests and national parks, so estimates for other PAs categories should be carefully examined. Data should be collected in other PA categories to compare results among different PA types. Comparative studies can be done among countries, as well. However, even considering the existence of errors in the PA estimations, the model can be considered reliable, since the predictions followed the same order of magnitude as the actual visitation numbers.

The adaptation of the MGM2 methodology proved to be reliable and efficient. Further research can continue monitoring economic impacts over the years for federal PAs of Brazil. The annual necessary input to produce a new report is the number of visitors, since the same expenditures and multipliers can be used for a few years (Huhtala et al., 2010). The development of local multipliers and the evaluation of the economic impacts at local and state level is another important analysis, since this project looked only at the effects at the national level. However, the study is highly replicable for other PA categories or state and local PA systems, since the available spreadsheets already provide the calculations and multipliers (the most technical part), so that managers need only to insert the number of visitors and expenditures.

APPENDIX A
CLASSIFICATION OF RECREATIONAL USE OF PROTECTED AREAS

Protected Area	Internal				External				Final Class	Number of 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 DE 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
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

Protected Area	Internal				External				Final Class	Number of Visitors 2015
	P	S	M	O	P	S	M	O		
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
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	-

Protected Area	Internal				External				Final Class	Number of Visitors 2015
	P	S	M	O	P	S	M	O		
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
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

Protected Area	Internal				External				Final Class	Number of Visitors 2015
	P	S	M	O	P	S	M	O		
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	-
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

APPENDIX B
LIST OF PROTECTED AREAS PER INCREASE POTENTIAL IN VISITATION

Protected Area	Internal	External	Final Class	Reported Visitors	Increase Potential	Total Potential
PN DE BRASÍLIA	3.7	4.8	4.3	294,682	289,512	584,194
FN DE BRASÍLIA	2.5	4.8	3.6	26,872	227,136	254,008
FN DA RESTINGA DE CABEDELO	1.6	4.2	2.9	0	73,797	73,797
PN DA SERRA DO ITAJAÍ	2.8	4.2	3.5	632	73165	73,797
PN DE SAINT-HILAIRE/LANGE	2.8	3.8	3.3	0	35,117	35,117
PN DOS CAMPOS GERAIS	2.7	3.8	3.3	0	35,117	35,117
PN DA SERRA DA GANDARELA	2.6	3.8	3.2	0	35,117	35,117
PN DAS ILHAS DOS CURRAIS	1.6	3.7	2.6	0	30,299	30,299
FN DE CANELA	2.6	3.7	3.1	692	29,607	30,299
FN DE PALMARES	2.7	3.7	3.2	2,200	28,099	30,299
PN DA RESTINGA DE JURUBATIBA	2.6	4.0	3.3	20,000	24,358	44,358
PN DAS ARAUCÁRIAS	1.9	3.5	2.7	0	20,545	20,545
PN MAPINGUARI	1.9	3.5	2.7	0	20,545	20,545
FN DO ASSUNGUI	1.7	3.5	2.6	0	20,545	20,545
FN DE LORENA	2.6	3.2	2.9	13,719	16,737	30,456
FN DO ARARIPE-APODI	2.6	3.3	3.0	0	14,728	14,728
PN DO MONTE PASCOAL	2.2	3.3	2.8	0	14,728	14,728
PN DE ANAVILHANAS	2.5	3.5	3.0	10,684	13,034	23,718
PN DO VIRUÁ	3.1	2.0	2.5	0	11,729	11,729
FN DE PIRAÍ DO SUL	2.1	3.0	2.5	0	7,569	7,569
FN DE IBIRAMA	1.9	2.7	2.3	0	3,890	3,890
PN SERRA DE ITABAIANA	1.6	2.7	2.1	0	3,890	3,890
FN DE CAPÃO BONITO	1.5	2.7	2.1	0	3,890	3,890
FN DE SOBRAL	1.4	2.7	2.0	0	3,890	3,890

Protected Area	Internal	External	Final Class	Reported Visitors	Increase Potential	Total Potential
PN DO ALTO CARIRI	1.3	2.7	2.0	0	3,890	3,890
PN DOS CAMPOS AMAZÔNICOS	2.6	2.0	2.3	0	3,848	3,848
FN DO AMAPÁ	2.5	1.8	2.2	0	3,391	3,391
PN DO CABO ORANGE	2.5	1.8	2.2	0	3,254	3,254
PN DA SERRA DO PARDO	1.5	2.3	1.9	0	1,999	1,999
FN DE NÍSIA FLORESTA	2.2	2.8	2.5	1,440	1,757	3,197
PN DA SERRA DO DIVISOR	2.2	1.8	2.0	0	1,752	1,752
PN DA CHAPADA DAS MESAS	1.8	2.2	2.0	0	1,433	1,433
PN DO JURUENA	2.1	2.0	2.1	0	1,316	1,316
FN DO TAPAJÓS	2.1	1.8	2.0	0	1,312	1,312
PN SERRA DA MOCIDADE	2.1	2.0	2.0	0	1,163	1,163
FN DE ANAUÁ	1.9	2.0	1.9	0	1,027	1,027
FN DO JAMARI	1.9	2.0	1.9	0	1,027	1,027
PN SERRA DA CUTIA	1.5	2.0	1.8	0	1,027	1,027
FN DE TEFÉ	1.9	1.3	1.6	0	1,008	1,008
PN NASCENTES DO LAGO JARI	1.9	1.5	1.7	0	978	978
FN DE RORAIMA	1.6	1.8	1.7	0	736	736
FN DO AMANA	1.6	1.8	1.7	0	736	736
FN DE PAU-ROSA	1.7	1.3	1.5	0	614	614
FN DO AMAZONAS	1.7	1.2	1.4		593	593
FN DE HUMAITÁ	1.7	1.5	1.6	0	591	591
FN DE SARACÁ-TAQUERA	1.7	1.5	1.6	0	549	549
PN DO JAMANXIM	1.5	1.7	1.6	0	528	528
FN DO CREPORI	1.4	1.7	1.6	0	528	528
PN DE PACAÁS NOVOS	1.3	1.7	1.5	0	528	528
PN DA SERRA DA BODOQUENA	2.4	2.8	2.6	389	475	864

Protected Area	Internal	External	Final Class	Reported Visitors	Increase Potential	Total Potential
FN DE MULATA	1.6	1.3	1.4	0	445	445
FN MAPIÁ - INAUINI	1.4	1.5	1.5	0	378	378
FN DO JATUARANA	1.2	1.3	1.3	0	270	270
FN DE PASSO FUNDO	2.0	3.0	2.5	190	232	422
PN DA TIJUCA	4.7	5.0	4.9	2,945,355	0	2,945,355
PN DO IGUAÇU	4.1	4.0	4.0	1,642,093	0	1,642,093
PN DE JERICOACOARA	4.0	2.8	3.4	780,000	0	780,000
PN DA SERRA DOS ORGÃOS	3.8	4.0	3.9	217,372	0	217,372
FN DE CARAJÁS	3.5	3.2	3.3	194,450	0	194,450
PN DA CHAPADA DOS GUIMARÃES	3.9	3.7	3.8	174,855	0	174,855
PN ITATIAIA	3.9	3.8	3.9	133,801	0	133,801
PN DE APARADOS DA SERRA	3.0	3.0	3.0	106,899	0	106,899
PN DE UBAJARA	2.6	2.2	2.4	104924	0	104,924
PN DE SÃO JOAQUIM	2.9	3.0	3.0	94,412	0	94,412
PN DE FERNANDO DE NORONHA	3.7	3.2	3.4	85,386	0	85,386
PN DA SERRA GERAL	2.5	2.7	2.6	82,440	0	82,440
PN DA SERRA DA BOCAINA	3.6	3.7	3.6	70,122	0	70,122
PN DA CHAPADA DOS VEADEIROS	3.1	2.7	2.9	56,629	0	56,629
PN DO CAPARAÓ	3.1	1.8	2.5	54,548	0	54,548
PN DA SERRA DO CIPÓ	3.6	3.3	3.5	53,660	0	53,660
FN DE IPANEMA	3.3	3.3	3.3	53,281	0	53,281
PN DA SERRA DA CANASTRA	2.7	2.7	2.7	52,673	0	52,673
PN DOS LENÇOIS MARANHENSES	3.0	2.7	2.8	40,000	0	40,000
PN DA ILHA GRANDE	2.4	2.7	2.5	36,850	0	36,850
FN DE PASSA QUATRO	2.7	2.7	2.7	30,461	0	30,461
PN DA CHAPADA DIAMANTINA	3.4	3.0	3.2	21,435	0	21,435

Protected Area	Internal	External	Final Class	Reported Visitors	Increase Potential	Total Potential
PN DE SETE CIDADES	3.3	1.5	2.4	17,303	0	17,303
PN DA SERRA DA CAPIVARA	3.2	1.5	2.4	16,238	0	16,238
PN DO SUPERAGUI	3.4	3.3	3.4	12,711	0	12,711
PN MARINHO DOS ABROLHOS	2.8	2.8	2.8	5,114	0	5,114
PN DA LAGOA DO PEIXE	2.1	2.0	2.0	4,923	0	4,923
FN DE SÃO FRANCISCO DE PAULA	2.9	3.3	3.1	3,832	0	3,832
FN DE RITÁPOLIS	2.6	3.0	2.8	3,459	0	3,459
FN DE TRÊS BARRAS	2.6	2.7	2.6	3,187	0	3,187
PN CAVERNAS DO PERUAÇU	2.4	2.2	2.3	2,938	0	2,938
FN DE IRATI	2.1	2.5	2.3	2,191	0	2,191
PN DO MONTE RORAIMA	3.2	1.2	2.2	2,174	0	2,174
PN DAS EMAS	3.0	2.5	2.8	1,681	0	1,681
PN DA AMAZÔNIA	2.8	1.8	2.3	1,112	0	1,112
FN DE SILVÂNIA	2.1	2.3	2.2	1,110	0	1,110
PN DO JAÚ	2.8	2.0	2.4	920	0	920
PN GRANDE SERTÃO VEREDAS	2.2	1.8	2.0	570	0	570
PN DO PANTANAL MATOGROSSENSE	2.0	1.7	1.8	140	0	140
PN DAS SEMPRE-VIVAS	2.5	2.8	2.7	26	0	26
P - Physical, S - Social, M - Managerial, O - Overall				7,482,775	1,074,429	8,557,204

APPENDIX C
DESCRIPTIVE STATISTIC OF THE INTERNAL SETTINGS

Internal Physical Setting

During the survey, PA managers identified 25 classes of natural attractions and 11 man-made attractions. Some PA reported only one and Serra da Bocaina NP was the one who informed the largest number - 16. In average, PA reported 6 classes of attractions. The five more common attractions were: Forest (73%), Rivers (67%), Waterfalls (48%), Geological Formations (42%), and Cultural Heritage (39%).

Table C-1. Classes of natural attractions in PA of Brazil

Coral Reefs	Caves	Geological Formations
Paleontological Sites	Centennial trees	Waterfall
Swamps	Fauna Hotspots	Rivers
Underwater visibility	Natural overlooks	Specific vegetation formations
Mangroves	Natural pools	Bird Migrating routes
Dunes	Meadows	Beach
Ocean	Mountains	Snow
River islands	Rapids	
Wetlands	Lakes and Lagoons	

Table C-2. Classes of cultural attractions in PA of Brazil

Traditional Communities	Museun
Cultural Heritage	Church
Architecture Heritage	Plantation Areas
Archeological Sites	Soccer Field
Environmental Education Center	Artificial Lakes
Visitor Center	

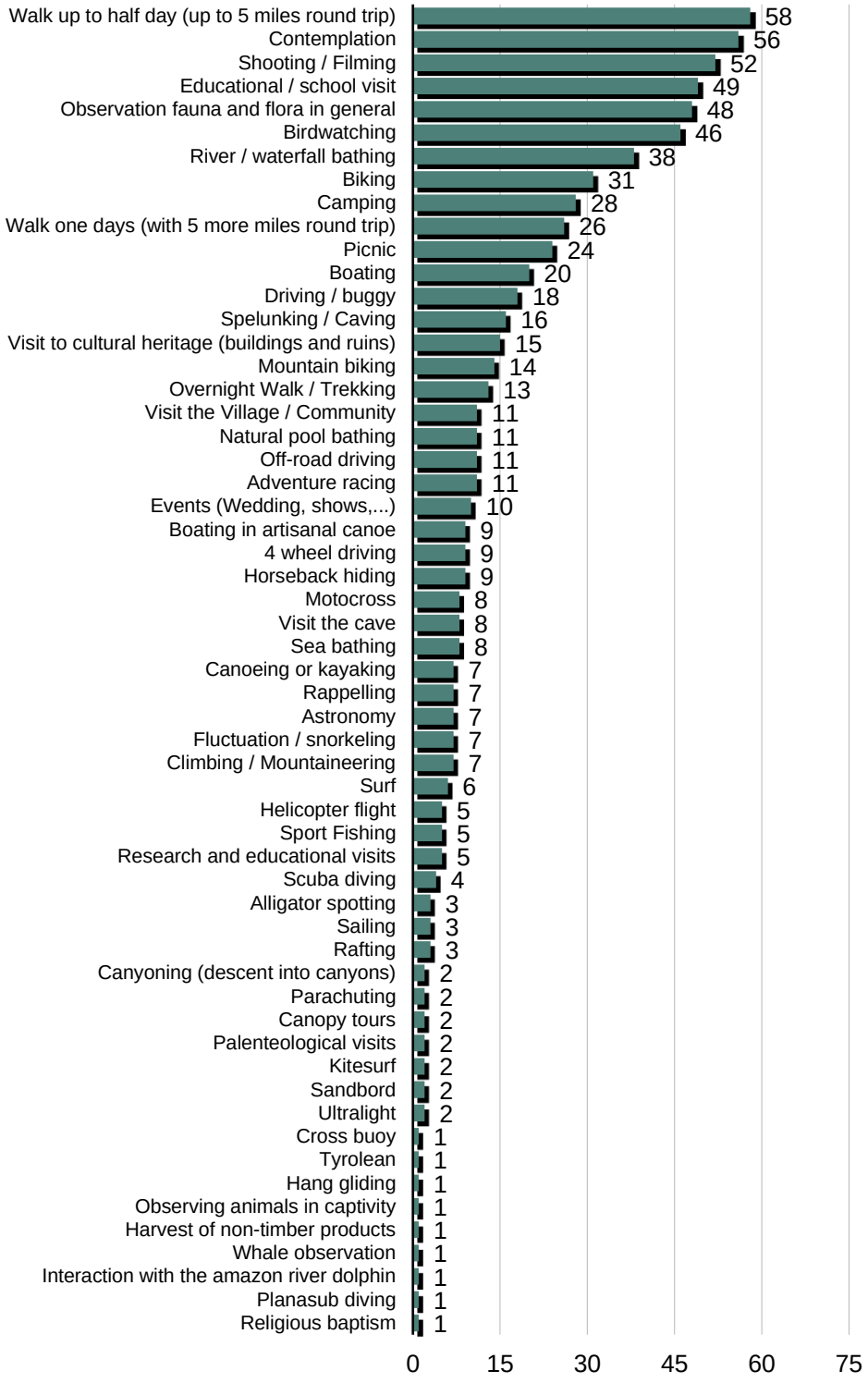


Figure C-1. Different Activities in PA of Brazil

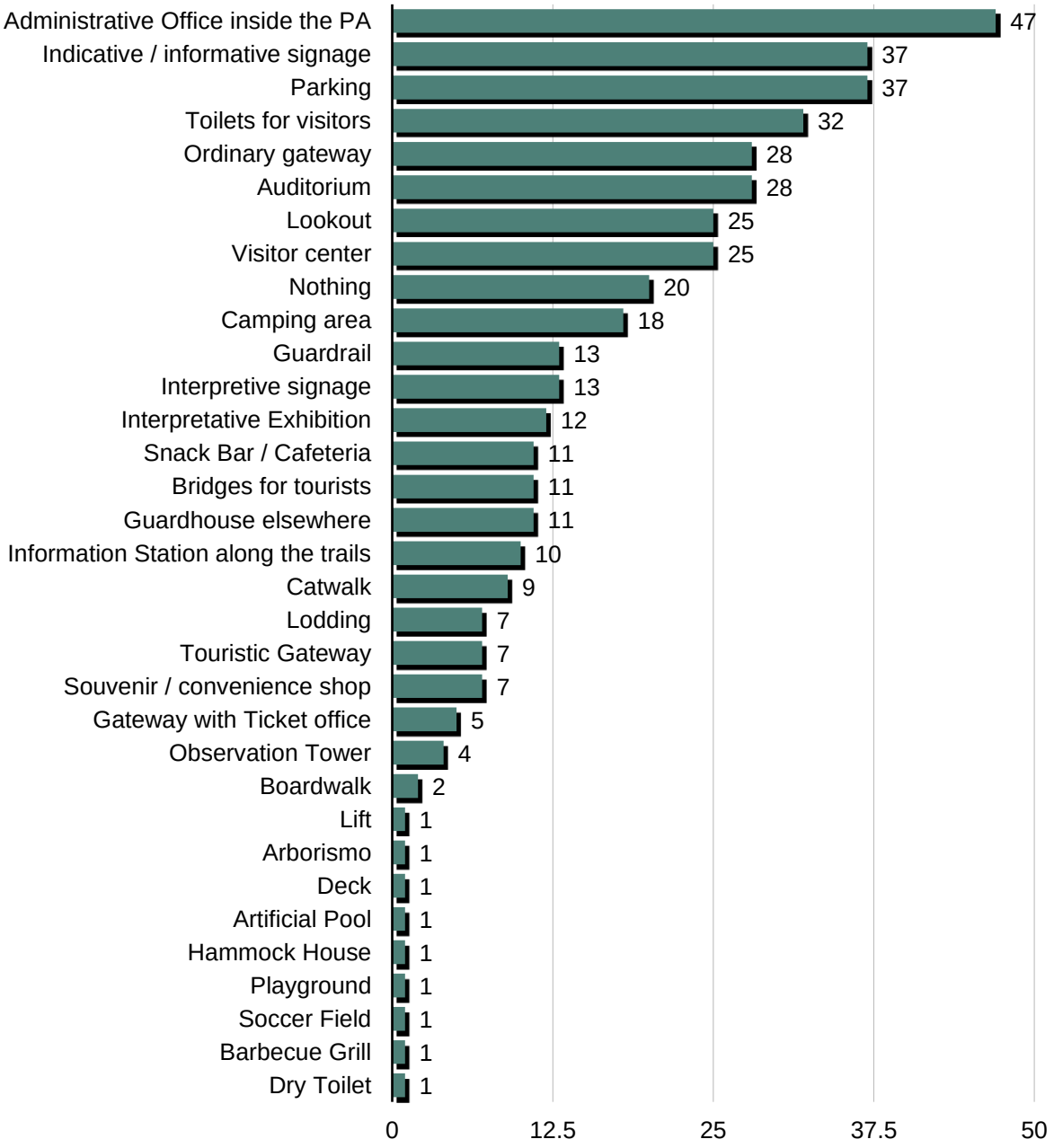


Figure C-2. Different Facilities in PA of Brazil

Internal Social Setting

Managers identified 58 different activities that are currently happening in PA of Brazil. Lençois Maranhenses NP with 26 and Jericoacoara NP with 25 were the areas

who informed the greater spectrum of activities. In average, PA who receive visitors, reported to have 10 different activities (Figure C-1).

Internal Managerial Setting

Infrastructure level varies within the system. While 13 PA reported to have no facilities, on the other side Tijuca NP (18), Serra da Capivara NP (17), and Itatiaia NP (17) were the most structured. In average, the PA who reported to have facilities, have 6 different infrastructures (Figure C-2).

Within facilities, the questionnaire examined separately trails and internal roads. The results showed that 71% of the PA provide trails for visitors. The total length of the trail system reported was 1725 kilometers with a mean of 32 kilometers per area. In the extremes, Ilha Grande NP reported to have one trail of 600 meters, and Chapada Diamantina NP reported 287 kilometers.

Table C-3. Recreational Trail system in PA of Brazil

Question		
Does the PA has trails for visitation?	Yes - 71%	No - 29%
If yes, how many kilometers?	Total:	1675

The research showed that 70% of PA have internal roads. From the total of 3090 kilometers of unpaved roads, 1023 are open to visitation and from the total of 348 kilometers of paved roads, 184 are also available to be used by visitors. Brasília National Forest is the PA who offers more unpaved roads for recreation - 100 kilometers and Tijuca National Park is the one who provide more paved roads - 42 kilometers.

Table C-4. Internal Road System in PA of Brazil

Question		
Does the PA has internal roads?	Yes - 70%	No - 30%
Unpaved roads (km)?	Total:	3090
Unpaved roads for visitation (km)?	Total:	1023
Paved roads (km)?	Total:	348
Paved roads for visitation (km)?	Total:	185

Table C-5. Commercial Services provide by PA of Brazil

Question		
Select the services that exist in the PA (offered by ICMBio, concessionaires or informally):		
Registered Guide Service	30%	Total: 1356
Internal transport	22%	
Adventure tourism	17%	
Food - Snack	14%	
Charging admission fee	13%	
Cabins	11%	Total beds: 78
Food - Restaurant	10%	
Structured Camping	9%	Total spots: 185
Hotel / guesthouse	8%	Total rooms: 180
Souvenirs Shop	8%	
Bike renting	5%	

The study found that 30% of PA offer some kind of commercial services for the public (Table C-5). Guidance is the service more offered in PA of Brazil with 1356 people registered. Fernando de Noronha Marine National Park has the largest group with 324 guides registered. Internal transportation is offered in 22% of the areas in several different ways. Visitors are conducted in train, buses, vans, taxis, regular and 4x4 vehicles, regional boats and motorized canoes. Related to eating, 14% of the PA

informed to have some kind of snack bars for visitors and 10% have restaurant. Related to lodging, 11% have cabins (78 beds), 9% offer structured camping (185 sites) and 8% have hotels or get houses (180 rooms). Carajás National Forest and Itatiaia National Park are the PA who offer more cabin beds - 20 each, Campos Gerais National Park has the greater number of camping sites - 80, and Iguaçu National Park has the largest number of hotel rooms - 100.

From the total, 88 PA reported to have together 434 environmental analysts working with a mean of 5 employees per area. Brasília NP has the larger staff with 31 analysts and there is one area with no employee - Amazonas NF. The same 88 respondents have also a total of 837 supportive staff (security guard, cleaning and secretariat) with a mean of 9.5 staff per area. However, Tijuca National Park have 130 supportive staff and 15 PA reported none.

APPENDIX D
ECONOMIC IMPACTS OF PROTECTED AREAS OF BRAZIL

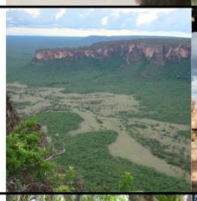
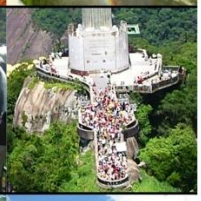
Protected Area	Final Class	Reported Visitors	Total Visitor Spending	Total Output/Sales	Total Personal Income	Total Value Added	Total Jobs
PN DA TIJUCA	4.9	2,945,355	$141,683,654	$529,265,988	$139,794,260	$193,188,715	17,630
PN DO IGUAÇU	4.0	1,642,093	$87,732,315	$340,255,743	$90,686,770	$125,209,236	11,598
PN DE JERICOACOARA	3.4	780,000	$17,414,423	$55,359,199	$14,522,077	$20,087,687	1,864
PN DE BRASÍLIA	4.3	294,682	$15,744,013	$61,060,636	$16,274,205	$22,469,439	2,081
PN DA SERRA DOS ORGÃOS	3.9	217,372	$11,613,562	$45,041,341	$12,004,658	$16,574,568	1,535
FN DE CARAJÁS	3.3	194,450	$4,341,326	$13,800,764	$3,620,279	$5,007,757	465
PN DA CHAPADA DOS GUIMARÃES	3.8	174,855	$9,342,001	$36,231,455	$9,656,600	$13,332,656	1,235
PN ITATIAIA	3.9	133,801	$7,148,603	$27,724,714	$7,389,338	$10,202,297	945
PN DE APARADOS DA SERRA	3.0	106,899	$2,386,647	$7,586,978	$1,990,251	$2,753,017	255
PN DE UBAJARA	2.4	104924	$2,342,552	$7,446,806	$1,953,480	$2,702,155	251
PN DE SÃO JOAQUIM	3.0	94,412	$2,107,860	$6,700,734	$1,757,767	$2,431,434	226
PN DE FERNANDO DE NORONHA	3.4	85,386	$1,906,344	$6,060,129	$1,589,721	$2,198,984	204
PN DA SERRA GERAL	2.6	82,440	$1,840,571	$5,851,042	$1,534,872	$2,123,114	197
PN DA SERRA DA BOCAINA	3.6	70,122	$3,746,417	$14,529,879	$3,872,581	$5,346,787	495
PN DA CHAPADA DOS VEADEIROS	2.9	56,629	$1,264,309	$4,019,149	$1,054,321	$1,458,392	135
PN DO CAPARAÓ	2.5	54,548	$1,217,849	$3,871,453	$1,015,577	$1,404,799	130
PN DA SERRA DO CIPÓ	3.5	53,660	$1,198,023	$3,808,429	$999,044	$1,381,930	128
FN DE IPANEMA	3.3	53,281	$1,189,561	$3,781,530	$991,988	$1,372,169	127
PN DA SERRA DA CANASTRA	2.7	52,673	$1,175,987	$3,738,378	$980,668	$1,356,511	126
PN DOS LENÇOIS MARANHENSES	2.8	40,000	$893,047	$2,838,933	$744,722	$1,030,138	96
PN DA ILHA GRANDE	2.5	36,850	$822,720	$2,615,367	$686,075	$949,015	88
FN DE PASSA QUATRO	2.7	30,461	$680,078	$2,161,919	$567,124	$784,476	73
FN DE BRASÍLIA	3.6	26,872	$1,435,694	$5,568,109	$1,484,042	$2,048,984	190

Protected Area	Final Class	Reported Visitors	Total Visitor Spending	Total Output/Sales	Total Personal Income	Total Value Added	Total Jobs
PN DA CHAPADA DIAMANTINA	3.2	21,435	$478,562	$1,521,313	$399,078	$552,025	51
PN DA RESTINGA DE JURUBATIBA	3.3	20,000	$446,524	$1,419,467	$372,361	$515,069	48
PN DE SETE CIDADES	2.4	17,303	$386,310	$1,228,051	$322,148	$445,612	41
PN DA SERRA DA CAPIVARA	2.4	16,238	$362,532	$1,152,465	$302,320	$418,185	39
FN DE LORENA	2.9	13,719	$306,293	$973,683	$255,421	$353,311	33
PN DO SUPERAGUI	3.4	12,711	$283,788	$902,142	$236,654	$327,352	30
PN DE ANAVILHANAS	3.0	10,684	$238,533	$758,279	$198,915	$275,150	26
PN MARINHO DOS ABROLHOS	2.8	5,114	$114,176	$362,958	$95,213	$131,703	12
PN DA LAGOA DO PEIXE	2.0	4,923	$109,912	$349,402	$91,657	$126,784	12
FN DE SÃO FRANCISCO DE PAULA	3.1	3,832	$85,554	$271,970	$71,344	$98,687	9
FN DE RITÁPOLIS	2.8	3,459	$77,226	$245,497	$64,400	$89,081	8
FN DE TRÊS BARRAS	2.6	3,187	$71,154	$226,192	$59,336	$82,076	8
PN CAVERNAS DO PERUAÇU	2.3	2,938	$65,594	$208,520	$54,700	$75,664	7
FN DE PALMARES	3.2	2,200	$49,118	$156,141	$40,960	$56,658	5
FN DE IRATI	2.3	2,191	$48,917	$155,503	$40,792	$56,426	5
PN DO MONTE RORAIMA	2.2	2,174	$48,537	$154,296	$40,476	$55,988	5
PN DAS EMAS	2.8	1,681	$37,530	$119,306	$31,297	$43,291	4
FN DE NÍSIA FLORESTA	2.5	1,440	$32,150	$102,202	$26,810	$37,085	3
PN DA AMAZÔNIA	2.3	1,112	$24,827	$78,922	$20,703	$28,638	3
FN DE SILVÂNIA	2.2	1,110	$24,782	$78,780	$20,666	$28,586	3
PN DO JAÚ	2.4	920	$20,540	$65,296	$17,129	$23,693	2
FN DE CANELA	3.1	692	$15,450	$49,114	$12,884	$17,821	2
PN DA SERRA DO ITAJAÍ	3.5	632	$14,110	$44,855	$11,767	$16,276	2
PN GRANDE SERTÃO VEREDAS	2.0	570	$12,726	$40,455	$10,612	$14,679	1
PN DA SERRA DA BODOQUENA	2.6	389	$8,685	$27,609	$7,242	$10,018	1

Protected Area	Final Class	Reported Visitors	Total Visitor Spending	Total Output/Sales	Total Personal Income	Total Value Added	Total Jobs
FN DE PASSO FUNDO	2.5	190	$4,242	$13,485	$3,538	$4,893	0
PN DO PANTANAL MATOGROSSENSE	1.8	140	$3,126	$9,936	$2,607	$3,605	0

The Appendix D presents the PA that reported visitors in 2015.

APPENDIX E
VISUAL PRESENTATION OF ROS SETTINGS AND ATTRIBUTES

Attributes/ Classes	Primitive	Semi-Primitive	Extensive	Intensive	Highly Intensive
Internal Setting					
Physical					
Social					
Managerial					
Attributes/ Classes	Primitive	Semi-Primitive	Extensive	Intensive	Highly Intensive
External Setting					
Physical					
Social					
Managerial					

APPENDIX F
QUESTIONNAIRE FOR PROTECTED AREAS MANAGERS

English

EFFECTIVENESS INDEX IN OUTDOOR RECREATION: A CASE STUDY OF PROTECTED AREAS IN BRAZIL

Dear managers,

We are developing this study seeking to better understand the factors that determine the intensity of visitation in the Brazilian Protected Areas. The objective of the study is to evaluate which factors significantly influence the number of visitors of a Protected Areas through the analysis of supply and demand factors. The variables are geographical, administrative and socio-economic attributes, related to the internal and external context of UC. The study will improve the understanding of the variables which have the greatest influence on visitation. We hope that the results can make most effective, the scarce investment in public use. We are conducting this survey to all the national parks and national forests. Please complete the questionnaire thinking about the proteced area that you are working nowadays.

There are no anticipated risks, compensation or other direct benefits to you as a participant in this study. You do not have to answer any question you do not want to. You are free to withdraw

your consent to participate and may discontinue your participation at any time without consequence.

If you have any questions about this research protocol, please contact Dr. Brijesh Thapa, University of Florida Professor via email bthapa@hhp.ufl.edu or Thiago Souza, ICMBio Analyst and University of Florida PhD Candidate via email at thiago.beraldo@icmbio.gov.br. Questions or concerns about your rights as a research participant rights may be directed to the IRB02 office, University of Florida, Box 112250, Gainesville, FL 32611, USA; (1) 352 392-0433.

Will you participate in this study?

[ ] Yes [ ] No
If Yes, Thank you for taking the time to complete this survey!
If No ® If No, Thank You!

Thank you for your contribution,

Thiago do Val S. B. Souza

Do you want to participate in the study?

Yes ○ No ○

Thank you.

Choose the Protected Area name:

Protected Area

Indicate the main attraction of your protected area (legally, illegally visited or even not visited yet):

Attraction

Select the classes of attractions that the PA has:

- [ ] Fauna Hotspots
- [ ] Caves
- [ ] Waterfall
- [ ] Rapids
- [ ] Meadows
- [ ] Wetlands
- [ ] Cultural Heritage
- [ ] Traditional Communities
- [ ] Dunes
- [ ] Architecture Heritage
- [ ] Forest
- [ ] Geological Formations
- [ ] Lakes and Lagoons
- [ ] Mangroves
- [ ] Mountains
- [ ] Ocean
- [ ] Beach
- [ ] Rivers
- [ ] Swamps
- [ ] Coral Reefs
- [ ] Archeological Sites
- [ ] Paleontological Sites
- [ ] Underwater visibility
- [ ] Other

Is the PA currently receiving visitors?

Yes ○ No ○

If you receive visitors, the PA has some control of the number of visitors?

Yes ○ No ○

If you receive visitors, how the PA control the number of visitors?

- ☐ PA does not receive visitors yet
- ☐ Visitors Signature Book
- ☐ Counting at the gate
- ☐ By the number of sold tickets
- ☐ Estimating
- ☐ Another method

If the PA receive visitors, do you forward these data to the General Coordination of Public Use/Visitation?

Yes ○ No ○

Select the management instruments of the Protected Area

- ☐ Does not have a general management plan yet

- [ ] Emergency Action Plan
- [ ] Outdated general management plan
- [ ] General management plan in preparation / or updated
- [ ] Management Plan updated and one or more tools (environmental interpretation program, signaling, economic evaluation, etc ...)

Select activities for public use currently occurring in the PA (select all that occur):

- [ ] No activity
- [ ] Camping
- [ ] Climbing / Mountaineering
- [ ] Canopy tours
- [ ] Sea bathing
- [ ] Natural pool bathing
- [ ] River / waterfall bathing
- [ ] Cross buoy
- [ ] Walk up to half day (up to 5 miles round trip)
- [ ] Walk one days (with 5 more miles round trip)
- [ ] Overnight Walk / Trekking
- [ ] Contemplation
- [ ] Canoeing or kayaking
- [ ] Canyoning (descent into canyons)
- [ ] Horseback hiding
- [ ] Biking
- [ ] Adventure racing
- [ ] Alligator spotting
- [ ] Shooting / Filming
- [ ] Sailing
- [ ] Kitesurf
- [ ] Fluctuation / snorkeling

- [ ] Scuba diving
- [ ] Mountain biking
- [ ] Motocross
- [ ] Astronomy
- [ ] Birdwatching
- [ ] Observation fauna and flora in general
- [ ] Driving / buggy
- [ ] Off-road driving
- [ ] 4 wheel driving
- [ ] Boating
- [ ] Boating in artisanal canoe
- [ ] Parachuting
- [ ] Picnic
- [ ] Sport Fishing
- [ ] Rafting
- [ ] Rappelling
- [ ] Sandbord
- [ ] Helicopter flight
- [ ] Surf
- [ ] Tyrolean
- [ ] Visit the Village / Community
- [ ] Visit the cave
- [ ] Educational / school visit
- [ ] Spelunking / Caving
- [ ] Visit to cultural heritage (buildings and ruins)
- [ ] Palenteological visits
- [ ] Ultralight
- [ ] Hang gliding
- [ ] Events (Wedding, shows,...)
- [ ]

Others:

Select infrastructures that exist in the PA:

- [ ] Nothing
- [ ] Camping area
- [ ] Auditorium
- [ ] Visitor center
- [ ] Interpretative Exhibition
- [ ] Parking
- [ ] Guardrail
- [ ] Snack Bar / Cafeteria
- [ ] Souvenir / convenience shop
- [ ] Lodding
- [ ] Lookout
- [ ] Catwalk
- [ ] Bridges for tourists
- [ ] Touristic Gateway
- [ ] Ordinary gateway
- [ ] Gateway with Ticket office
- [ ] Guardhouse elsewhere
- [ ] Information Station along the trails
- [ ] Administrative Office inside the PA
- [ ] Toilets for visitors
- [ ] Indicative / informative signage
- [ ] Interpretive signage
- [ ] Boardwalk
- [ ] Lift
- [ ] Observation Tower

- [ ] Others:

Does the PA has trails for visitation?

- [ ] Yes
- [ ] No
- [ ] If yes, how many kilometers?

Does the PA has internal roads

- [ ] Yes
- [ ] No
- [ ] Unpaved roads - approximately how many kilometers?
- [ ] Unpaved roads for visitation - approximately how many kilometers?
- [ ] Paved roads - How many kilometers about?
- [ ] Paved roads for visitation - approximately how many kilometers?

Select the services that exist in the PA (offered by ICMBio, concessionaires or informally:

- [ ] Charging admission fee
- [ ] Internal transport - which?
- [ ] Adventure tourism - which?
- [ ] Guide service registered - how many?
- [ ] Structured Camping - how many spots?

- [ ] Cabins - how many beds?
- [ ] Hotel / guesthouse - how many rooms?
- [ ] Food - Snack
- [ ] Food - Restaurant
- [ ] Souvenirs Shop
- [ ] Bike renting
- [ ] Others:

Select the type of services contracts that exist in the PA (authorization, permission, concession):

- [ ] Authorization
- [ ] Permission
- [ ] Concession

Estimate the percentage of the regularized area of PA?

Gateway municipalities:

What city is the main gateway to the PA?
If the PA does not have visitation yet, which would be the potential one?

State
Municipality

Municipality 2:

Does the Pa has another city as gateway?

State

Municipality

Municipality 2:

Does the Pa has another city as gateway?

State

Municipality

Are there other municipalities with other attractions that are usually visited on the same trip?
Which one is the most important?

State

Municipality

Sometimes, when the gateway city is too small or poor, there are other adjacent municipalities that provide support for tourism (where visitors stay, eat...).
Are there other municipalities that have this characteristic? Which one is the most important?
If the PA does not have visitation yet, use as reference, the city that the PA staff uses?

State

Municipality

What is the city with the airport (used by visitors and / or PA staff) nearest to the main entrance?

State

Municipality

* How many main staff currently working in the PA?

* How many supportive staff currently working in the PA?

* What was the budget in 2015?

* The next phase of the research is an analysis of economic impacts of tourism in the PA. The economic impacts reports of environmental services, such as visitation, are fundamental for ICMBio budgetary and political negotiations. Primary data of visitor expenditure is necessary for developing the study of economic impacts. PA in different classes of visitation are being selected for this phase. Participants PA will need to collect information from visitors through a simple one-page questionnaire. In return, they will receive a detailed visitors expenditure profile. Check below if your PA is interested in applying the spending surveys and we will contact you:

Yes ○ No ○

* Does the PA has any study of visitors profile or spending available?

Yes ○ No ○

Use this space if you want to add something that was not mentioned in the questions or if you want make any suggestions or comments.

Protected Area Profile

Name of the research participant	
Contact Phone	
e-mail	

Thank you for your cooperation !!!

Thiago Beraldo
General Coordination of Outdoor Recreation and Business - COECO
PhD Candidate in Interdisciplinary Ecology in the University of Florida/USA

Ernesto Viveiros de Castro
Manager of Tijuca National Park - ICMBio

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APPENDIX G
VISITOR SPENDING QUESTIONNAIRE

English

Economic Significance Questionnaire - Chapada dos Guimarães National Park

Dear Visitor,

We are developing this study to measure the economic impacts of tourism in protected areas. We are interested in finding out the approximate amount of money you and other visitors in your immediate group spent. We understand that this is a difficult question, but please do your best because your responses are very important. The survey is only one page and will take around 5 min.
There are no anticipated risks, compensation or other direct benefits to you as a participant in this study. You do not have to answer any question you do not want to. You are free to withdraw your consent to participate and may discontinue your participation at any time without consequence.

If you have any questions about this research protocol, please contact Dr. Brijesh Thapa, University of Florida Professor via email bthapa@hhp.ufl.edu or Thiago Souza, ICMBio Analyst and University of Florida PhD Candidate via email at

thiago.beraldo@icmbio.gov.br. Questions or concerns about your rights as a research participant rights may be directed to the IRB02 office, University of Florida, Box 112250, Gainesville, FL 32611, USA; (1) 352 392-0433.

Will you participate in this study?

Yes ○ No ○

Thank You!

1. Where are you from:

Are you Brazilian or foreign?

If you are Brazilian, from which State?

If you are from Mato Grosso, from which City?

2a. How many days did you stay during your most recent visit in the National Park?

2b. How many days did you stay during this visit altogether in the National Park and in the region (Cuiabá e Chapada dos Guimarães)?

3. How many people were in your family or group (counting you)?

4. Have you spent money on in the national park or in the region?

yes (please answer the following questions) ○

no (move on to question 7) ○

5. In the next question, we will estimate your total expenses not included in package tours, please tick the box that indicates whether you are estimating:

Your personal expenses and/or your share of your group's joint expenses ○

The total expenses of your family or group ○

6. Indicate below (points A–G) your total expenses for this trip in the national park and the region. If you reported expenditures for package tours, please only include individual expenses that were NOT part of your package tour(s).

0 A - Fuel or other purchases from service stations (auto, boats, RV)

0 B - Local transportation (bus, rental car, taxi, etc.)

0 C - Retail shopping (clothing, souvenirs, gifts, etc.)

0 D - Meals (restaurants, bars, night clubs, groceries, etc.)

0 E - Accommodation (hotel, motel, camping, etc.)

0 F - Organized activities and recreational services (eg. entry fees, guided tours and exhibitions)

0 G - Other expenses (e.g. permits, equipment hire, etc.)

0 H - Tourism Package (respond question below)

0 Mark 1 for expenses in Dollars and 2 for Reais

7. Which of the following were included in the package tour(s) as part of your visit? Please mark all that apply.

- ☐ Local air transportation
- ☐ Local ground transportation
- ☐ Local Lodging
- ☐ Meals
- ☐ Guide services
- ☐ Fees

8. Would you have come to the region at this time even if the national park was not here?

Yes	No
○	○

9. Circle the number below that best describes how important the national park was in your decision to visit the region on this trip, where 0 indicates it had no influence and you would have come to the area anyway and 10 indicates that this national park is the decisive reason for visiting the region on this trip.

None: I would have come to the area anyway — My only reason for coming to the area.

0	1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○	○

>>

APPENDIX H
INSTITUTIONAL REVIEW BOARD APPROVAL

UF | Institutional Review Board
UNIVERSITY of FLORIDA

PO Box 112250
Gainesville, FL 32611-2250
352-392-0433 (Phone)
352-392-9234 (Fax)
irb2@ufl.edu

December 18, 2015

TO: Brijesh Thapa, PhD; Thiago Do Val S.B. Souza
PO Box 118208
Campus

FROM: Ira S. Fischler, PhD, Chair
University of Florida
Institutional Review Board 02

SUBJECT: **Exemption of Protocol #2015-U-1443**
Integrated Analyzes of Visitation Supply, Demand and Economic Significance of the Federal Protected Areas of Brazil

SPONSOR: None

Your protocol submission was reviewed by the IRB. The Board determined that your protocol is exempt based on the following category:

> *45 CFR 46.101(b)(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior*

Should the nature of your study change or if you need to revise this protocol in any manner, please contact this office before implementing the changes.

IF:dl

APPENDIX I
RESEARCH AUTHORIZATION - ICMBIO BRAZIL

Ministério do Meio Ambiente - MMA
Instituto Chico Mendes de Conservação da Biodiversidade - ICMBio
Sistema de Autorização e Informação em Biodiversidade - SISBIO

Autorização para atividades com finalidade científica

Número: 52138-1	Data da Emissão: 14/12/2015 10:40	Data para Revalidação*: 12/01/2017

* De acordo com o art. 28 da IN 03/2014, esta autorização tem prazo de validade equivalente ao previsto no cronograma de atividades do projeto, mas deverá ser revalidada anualmente mediante a apresentação do relatório de atividades a ser enviado por meio do Sisbio no prazo de até 30 dias a contar da data do aniversário de sua emissão.

Dados do titular

Nome: THIAGO DO VAL SIMARDI BERALDO	CPF: 279.790.398-66
Título do Projeto: Integrated Analyses of Visitation Supply, Demand and Economic Significance of the Federal Protected Areas of Brazil	
Nome da Instituição : Instituto C. Mendes de Cons. da Biodiversidade-ICMBio (Sede)	CNPJ: 08.829.974/0002-75

Cronograma de atividades

#	Descrição da atividade	Início (mês/ano)	Fim (mês/ano)
1	Aplicação de questionários	12/2015	03/2016

Observações e ressalvas

1	As atividades de campo exercidas por pessoa natural ou jurídica estrangeira, em todo o território nacional, que impliquem o deslocamento de recursos humanos e materiais, tendo por objeto coletar dados, materiais, espécimes biológicos e minerais, peças integrantes da cultura nativa e cultura popular, presente e passada, obtidos por meio de recursos e técnicas que se destinem ao estudo, à difusão ou à pesquisa, estão sujeitas a autorização do Ministério de Ciência e Tecnologia.
2	Esta autorização NÃO exime o pesquisador titular e os membros de sua equipe da necessidade de obter as anuências previstas em outros instrumentos legais, bem como do consentimento do responsável pela área, pública ou privada, onde será realizada a atividade, inclusive do órgão gestor de terra indígena (FUNAI), da unidade de conservação estadual, distrital ou municipal, ou do proprietário, arrendatário, posseiro ou morador de área dentro dos limites de unidade de conservação federal cujo processo de regularização fundiária encontra-se em curso.
3	Este documento somente poderá ser utilizado para os fins previstos na Instrução Normativa ICMBio nº 03/2014 ou na Instrução Normativa ICMBio nº 10/2010, no que especifica esta Autorização, não podendo ser utilizado para fins comerciais, industriais ou esportivos. O material biológico coletado deverá ser utilizado para atividades científicas ou didáticas no âmbito do ensino superior.
4	O titular de licença ou autorização e os membros da sua equipe deverão optar por métodos de coleta e instrumentos de captura direcionados, sempre que possível, ao grupo taxonômico de interesse, evitando a morte ou dano significativo a outros grupos; e empregar esforço de coleta ou captura que não comprometa a viabilidade de populações do grupo taxonômico de interesse em condição in situ.
5	O titular de autorização ou de licença permanente, assim como os membros de sua equipe, quando da violação da legislação vigente, ou quando da inadequação, omissão ou falsa descrição de informações relevantes que subsidiaram a expedição do ato, poderá, mediante decisão motivada, ter a autorização ou licença suspensa ou revogada pelo ICMBio, nos termos da legislação brasileira em vigor.
6	Este documento não dispensa o cumprimento da legislação que dispõe sobre acesso a componente do patrimônio genético existente no território nacional, na plataforma continental e na zona econômica exclusiva, ou ao conhecimento tradicional associado ao patrimônio genético, para fins de pesquisa científica, bioprospecção e desenvolvimento tecnológico. Veja maiores informações em www.mma.gov.br/cgen
7	Em caso de pesquisa em UNIDADE DE CONSERVAÇÃO, o pesquisador titular desta autorização deverá contactar a administração da unidade a fim de CONFIRMAR AS DATAS das expedições, as condições para realização das coletas e de uso da infra-estrutura da unidade

Outras ressalvas

1	1) O pesquisador deverá entrar em contato prévio com os gestores das unidades de conservação para informar o número da autorização recebida, consultar sobre a possibilidade e pertinência do preenchimento do questionário pela unidade e, quando pertinente, agendar um período para o preenchimento.2) No relatório de atividades, no campo "Localidades", deverão ser incluídas, uma a uma, todas as unidades de conservação que responderem ao questionário.

Locais onde as atividades de campo serão executadas

#	Município	UF	Descrição do local	Tipo
1		AC	FLORESTA NACIONAL DE SANTA ROSA DO PURUS	UC Federal
2		AC	FLORESTA NACIONAL DE SÃO FRANCISCO	UC Federal
3		AC	FLORESTA NACIONAL DO MACAUÃ	UC Federal
4		AC	PARQUE NACIONAL DA SERRA DO DIVISOR	UC Federal
5		AP	FLORESTA NACIONAL DO AMAPÁ	UC Federal
6		AP	PARQUE NACIONAL DO CABO ORANGE	UC Federal
7		AP	PARQUE NACIONAL MONTANHAS DO TUMUCUMAQUE	UC Federal
8		AM	FLORESTA NACIONAL DE BALATA-TUFARI	UC Federal
9		AM	FLORESTA NACIONAL DE HUMAITÁ	UC Federal
10		AM	FLORESTA NACIONAL DE PAU-ROSA	UC Federal

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Página 1/6

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Instituto Chico Mendes de Conservação da Biodiversidade - ICMBio
Sistema de Autorização e Informação em Biodiversidade - SISBIO

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Nome da Instituição : Instituto C. Mendes de Cons. da Biodiversidade-ICMBio (Sede)	CNPJ: 08.829.974/0002-75

11		AM	FLORESTA NACIONAL DE TEFÉ	UC Federal
12		AM	FLORESTA NACIONAL DO AMAZONAS	UC Federal
13		AM	FLORESTA NACIONAL DO IQUIRI	UC Federal
14		AM	FLORESTA NACIONAL DO JATUARANA	UC Federal
15		AM	FLORESTA NACIONAL DO PURUS	UC Federal
16		AM	FLORESTA NACIONAL MAPIA-INAUINI	UC Federal
17		AM	PARQUE NACIONAL DA AMAZÔNIA	UC Federal
18		AM	PARQUE NACIONAL DE ANAVILHANAS	UC Federal
19		AM	PARQUE NACIONAL DO JAU	UC Federal
20		AM	PARQUE NACIONAL DO JURUENA	UC Federal
21		AM	PARQUE NACIONAL DO PICO DA NEBLINA	UC Federal
22		AM	PARQUE NACIONAL NASCENTES DO LAGO JARI	UC Federal
23		AM	PARQUE NACIONAL SERRA DA MOCIDADE	UC Federal
24		BA	FLORESTA NACIONAL DE CONTENDAS DO SINCORA	UC Federal
25		BA	FLORESTA NACIONAL DE CRISTÓPOLIS	UC Federal
26		BA	PARQUE NACIONAL DA CHAPADA DIAMANTINA	UC Federal
27		BA	PARQUE NACIONAL DA SERRA DAS LONTRAS	UC Federal
28		BA	PARQUE NACIONAL DAS NASCENTES DO RIO PARNAÍBA	UC Federal
29		BA	PARQUE NACIONAL DE BOA NOVA	UC Federal
30		BA	PARQUE NACIONAL DO ALTO CARIRI	UC Federal
31		BA	PARQUE NACIONAL DO DESCOBRIMENTO	UC Federal
32		BA	PARQUE NACIONAL DO MONTE PASCOAL	UC Federal
33		BA	PARQUE NACIONAL DO PAU BRASIL	UC Federal
34		BA	PARQUE NACIONAL GRANDE SERTÃO VEREDAS	UC Federal
35		BA	PARQUE NACIONAL MARINHO DOS ABROLHOS	UC Federal
36		CE	FLORESTA NACIONAL DE ARARIPE-APODI	UC Federal
37		CE	FLORESTA NACIONAL DE SOBRAL	UC Federal
38		CE	PARQUE NACIONAL DE JERICOACOARA	UC Federal
39		CE	PARQUE NACIONAL DE UBAJARA	UC Federal
40		DF	FLORESTA NACIONAL DE BRASÍLIA	UC Federal
41		DF	PARQUE NACIONAL DE BRASÍLIA	UC Federal
42		ES	FLORESTA NACIONAL DE GOYTACAZES	UC Federal
43		ES	FLORESTA NACIONAL DE PACOTUBA	UC Federal
44		ES	FLORESTA NACIONAL DO RIO PRETO	UC Federal
45		ES	PARQUE NACIONAL DE CAPARAÓ	UC Federal
46		GO	FLORESTA NACIONAL DA MATA GRANDE	UC Federal
47		GO	FLORESTA NACIONAL DE SILVÂNIA	UC Federal
48		GO	PARQUE NACIONAL DA CHAPADA DOS VEADEIROS	UC Federal
49		GO	PARQUE NACIONAL DAS EMAS	UC Federal
50		MA	PARQUE NACIONAL DA CHAPADA DAS MESAS	UC Federal
51		MA	PARQUE NACIONAL DOS LENÇOIS MARANHENSES	UC Federal
52		MT	PARQUE NACIONAL DA CHAPADA DOS GUIMARÃES	UC Federal
53		MT	PARQUE NACIONAL DO PANTANAL MATOGROSSENSE	UC Federal
54		MS	PARQUE NACIONAL DA SERRA DA BODOQUENA	UC Federal
55		MG	FLORESTA NACIONAL DE PARAOPEBA	UC Federal
56		MG	PARQUE NACIONAL DA SERRA DA CANASTRA	UC Federal
57		MG	FLORESTA NACIONAL DE PASSA QUATRO	UC Federal
58		MG	FLORESTA NACIONAL DE RITÁPOLIS	UC Federal
59		MG	PARQUE NACIONAL CAVERNAS DO PERUAÇU	UC Federal
60		MG	PARQUE NACIONAL DA SERRA DA CIPÓ	UC Federal

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61		MG	PARQUE NACIONAL DA SERRA DO GANDARELA	UC Federal
62		MG	PARQUE NACIONAL DAS SEMPRE VIVAS	UC Federal
63		PA	FLORESTA NACIONAL DE ALTAMIRA	UC Federal
64		PA	FLORESTA NACIONAL DE CARAJÁS	UC Federal
65		PA	FLORESTA NACIONAL DE CAXIUANÃ	UC Federal
66		PA	FLORESTA NACIONAL DE ITAITUBA I	UC Federal
67		PA	FLORESTA NACIONAL DE ITAITUBA II	UC Federal
68		PA	FLORESTA NACIONAL DE MULATA	UC Federal
69		PA	FLORESTA NACIONAL DE SARACÁ-TAQUERA	UC Federal
70		PA	FLORESTA NACIONAL DO CREPORI	UC Federal
71		PA	FLORESTA NACIONAL DO ITACAIÚNAS	UC Federal
72		PA	FLORESTA NACIONAL DO JAMANXIM	UC Federal
73		PA	FLORESTA NACIONAL DO TAPAJÓS	UC Federal
74		PA	FLORESTA NACIONAL DO TAPIRAPÉ-AQUIRI	UC Federal
75		PA	FLORESTA NACIONAL DO TRAIRÃO	UC Federal
76		PA	PARQUE NACIONAL DA SERRA DO PARDO	UC Federal
77		PA	PARQUE NACIONAL DO JAMANXIM	UC Federal
78		PA	PARQUE NACIONAL DO RIO NOVO	UC Federal
79		PB	FLORESTA NACIONAL DA RESTINGA DE CABEDELO	UC Federal
80		PR	FLORESTA NACIONAL DE ASSUNGUI	UC Federal
81		PR	FLORESTA NACIONAL DE IRATI	UC Federal
82		PR	FLORESTA NACIONAL DE PIRAÍ DO SUL	UC Federal
83		PR	PARQUE NACIONAL DE ILHA GRANDE	UC Federal
84		PR	PARQUE NACIONAL DE SAINT-HILAIRE/LANGE	UC Federal
85		PR	PARQUE NACIONAL DO IGUAÇU	UC Federal
86		PR	PARQUE NACIONAL DO SUPERAGUI	UC Federal
87		PR	PARQUE NACIONAL DOS CAMPOS GERAIS	UC Federal
88		PR	PARQUE NACIONAL GUARICANA	UC Federal
89		PR	PARQUE NACIONAL MARINHO DAS ILHAS DOS CURRAIS	UC Federal
90		PE	FLORESTA NACIONAL NEGREIROS	UC Federal
91		PE	PARQUE NACIONAL DO CATIMBAU	UC Federal
92		PE	PARQUE NACIONAL MARINHO DE FERNANDO DE NORONHA	UC Federal
93		PI	FLORESTA NACIONAL DE PALMARES	UC Federal
94		PI	PARQUE NACIONAL DA SERRA DA CAPIVARA	UC Federal
95		PI	PARQUE NACIONAL DA SERRA DAS CONFUSÕES	UC Federal
96		PI	PARQUE NACIONAL DE SETE CIDADES	UC Federal
97		RJ	FLORESTA NACIONAL MÁRIO XAVIER	UC Federal
98		RJ	PARQUE NACIONAL DA SERRA DOS ÓRGÃOS	UC Federal
99		RJ	PARQUE NACIONAL DA SERRA DA BOCAINA	UC Federal
100		RJ	PARQUE NACIONAL DA TIJUCA	UC Federal
101		RJ	PARQUE NACIONAL DE ITATIAIA	UC Federal
102		RJ	PARQUE NACIONAL RESTINGA DE JURUBATIBA	UC Federal
103		RN	FLORESTA NACIONAL DE AÇU	UC Federal
104		RN	FLORESTA NACIONAL DE NÍSIA FLORESTA	UC Federal

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105		RN	PARQUE NACIONAL DA FURNA FEIA	UC Federal
106		RS	FLORESTA NACIONAL DE CANELA	UC Federal
107		RS	FLORESTA NACIONAL DE PASSO FUNDO	UC Federal
108		RS	FLORESTA NACIONAL DE SÃO FRANCISCO DE PAULA	UC Federal
109		RS	PARQUE NACIONAL DA LAGOA DO PEIXE	UC Federal
110		RS	PARQUE NACIONAL DA SERRA GERAL	UC Federal
111		RS	PARQUE NACIONAL DE APARADOS DA SERRA	UC Federal
112		RO	FLORESTA NACIONAL DE JACUNDÁ	UC Federal
113		RO	FLORESTA NACIONAL DO BOM FUTURO	UC Federal
114		RO	FLORESTA NACIONAL DO JAMARI	UC Federal
115		RO	PARQUE NACIONAL DE PACAÁS NOVOS	UC Federal
116		RO	PARQUE NACIONAL DA SERRA DA CUTIA	UC Federal
117		RO	PARQUE NACIONAL DOS CAMPOS AMAZÔNICOS	UC Federal
118		RO	PARQUE NACIONAL MAPINGUARI	UC Federal
119		RR	FLORESTA NACIONAL DE ANAUÁ	UC Federal
120		RR	FLORESTA NACIONAL DE RORAIMA	UC Federal
121		RR	PARQUE NACIONAL DO MONTE RORAIMA	UC Federal
122		RR	PARQUE NACIONAL VIRUÁ	UC Federal
123		SC	FLORESTA NACIONAL DE CHAPECÓ	UC Federal
124		SC	FLORESTA NACIONAL DE IBIRAMA	UC Federal
125		SC	FLORESTA NACIONAL DE CAÇADOR	UC Federal
126		SC	FLORESTA NACIONAL DE TRÊS BARRAS	UC Federal
127		SC	PARQUE NACIONAL DA SERRA DO ITAJAÍ	UC Federal
128		SC	PARQUE NACIONAL DAS ARAUCÁRIAS	UC Federal
129		SC	PARQUE NACIONAL DE SÃO JOAQUIM	UC Federal

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Nome: THIAGO DO VAL SIMARDI BERALDO	CPF: 279.790.398-66
Título do Projeto: Integrated Analyses of Visitation Supply, Demand and Economic Significance of the Federal Protected Areas of Brazil	
Nome da Instituição : Instituto C. Mendes de Cons. da Biodiversidade-ICMBio (Sede)	CNPJ: 08.829.974/0002-75

130		SP	FLORESTA NACIONAL DE CAPÃO BONITO	UC Federal
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132		SP	FLORESTA NACIONAL DE LORENA	UC Federal
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BIOGRAPHICAL SKETCH

Thiago do Val Simardi Beraldo Souza grew up in the third largest city in the world--São Paulo, Brazil, but he found his purpose in life in an “Avatar Experience” when traveling to natural areas. He realized that the source of modern society’s problems is the disconnection from the natural world, and since then he decided to guide city dwellers to the enchantments of nature.

Souza completed his early education in Brazil and earned a bachelor’s degree in Social Communication from the UMESP - Methodist University of Sao Paulo in 2001. Since 2002, he has worked for the Chico Mendes Institute for Biodiversity Conservation (ICMBio), a government agency responsible for the federally protected areas of Brazil. He spent 6 years working in the Amazon in the Pacaás National Park and 4 years working within the National Coordination of Visitors Management.

In 2012, Souza was granted a leave-of-absence to pursue a Ph.D. in Interdisciplinary Ecology with a focus on Tourism and Recreation Management at the University of Florida, USA, which he completed in December 2016. His objective was to understand the relationships between supply, demand and economic benefits of outdoor recreation in protected areas. At the same time, he completed a minor in Tropical Conservation Development and received a Certification in Environmental Education and Interpretation. During this period in the USA, he also became a member of IUCN WCPA - World Conservation of Protected Areas - Tourism and Protected Areas Specialist Group.

Meanwhile, Souza was blessed by a wonderful wife and two amazing daughters, built a tree house, visited protected areas in the Americas, Hawaii, Africa, and Australia, and completed one marathon, two 70.3 and one full ironman triathlon.