



## **Ecotourism and biodiversity conservation in national parks of Brazil and the United States**

### ***Ecoturismo e Conservação da Biodiversidade em Parques Nacionais do Brasil e Estados Unidos***

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**ABSTRACT:** We conducted a comparative analysis of national parks in the National Capital Region of the National Park Service of the United States and the ICMBio Administrative Region CR-8 of Brazil consisting of all national parks in the state of Rio de Janeiro. Our objective was to determine park managers' perceptions regarding the effect of public use on biodiversity conservation in national parks. The RAPPAM (Rapid Assessment and Prioritization of Protected Area Management) survey instrument was administered in both countries. Unique to the current study was development of a set of 10 queries designed to investigate the relationship between public use and biodiversity conservation in national parks. Managers in both countries reported that the natural features and characteristics of parks (including their biodiversity) were being maintained with the current level of public use. This perception of park managers held up regardless of number of park visitors ( $P = 0.18$ ). U.S. parks were significantly stronger ( $P = 0.03$ ) about tourism importance and were less vulnerable ( $P < 0.01$ ) to several impacts than Brazilian parks. Management recommendations include maintaining adequate numbers of park personnel and budgets, and capability to monitor and limit public use if necessary.

**KEYWORDS:** Tourism; Ecotourism; Visitors, Biodiversity; Conservation, Park.

**RESUMO:** Realizamos uma análise comparativa dos parques nacionais na Região da Capital Nacional do Serviço Nacional de Parques dos Estados Unidos e na Região Administrativa do ICMBio CR-8 do Brasil, consistindo em todos os parques nacionais do estado do Rio de Janeiro. Nosso objetivo foi determinar as percepções dos gerentes de parques em relação ao efeito do uso público na conservação da biodiversidade em parques nacionais. O instrumento de pesquisa RAPPAM (Avaliação Rápida e Priorização da Gestão de Áreas Protegidas) foi administrado nos parques dos dois países. Único no presente estudo foi o desenvolvimento de um conjunto de 10 perguntas destinadas a investigar a relação entre uso público e conservação da biodiversidade em parques nacionais. Os gestores dos dois países relataram que as características e aspectos naturais dos parques (incluindo sua biodiversidade) estão sendo mantidas com o nível atual de uso público. Essa percepção dos gestores do parque se sustentou, independentemente do número de visitantes do parque ( $P = 0,18$ ). Os parques dos EUA eram significativamente mais fortes ( $P = 0,03$ ) em relação à importância do turismo e eram menos vulneráveis ( $P < 0,01$ ) a vários impactos do que os parques brasileiros. As recomendações de gestão incluem a manutenção de um número adequado de funcionários e orçamento do parque, e a capacidade de monitorar e limitar o uso público, se necessário.

**PALAVRAS CHAVE:** Turismo; Ecoturismo; Visitantes; Biodiversidade; Conservação; Parque.

## Introduction

National parks have been established worldwide beginning with Yellowstone National Park in the United States (U.S.) on 1 March 1872 (DAVIS; HANSEN, 2011; PIEKIELEK; HANSEN, 2012). Yellowstone served as a model for much of the world (DIEGUES, 2001; LANGLEY, 2001; MEDEIROS, 2003; MILANO, 2001; MOREIRA, 2008; RODRIGUES, 2009). National parks were established in Canada in 1885; New Zealand in 1894; Australia, South Africa and Mexico in 1898; and Brazil in 1937.

The Brazilian model was not a mere copy of the U.S. model (MEDEIROS, 2003). Brazil's first instrument (FOREST CODE, 1934) provided two protection modes: National Parks (wilderness model) and the National Forests (with possible exploitation of resources). In Brazil, a geopolitical connotation of nature protection developed, especially during the military dictatorship where park protective actions were camouflaged in the expansion of interest, integration and control of the country. Another differentiating factor between the U.S. and Brazil resides in the spatial, ecological and cultural diversity of Brazil, which subsequently forced the Brazilian model to adapt to the idiosyncrasies and create new categories of protection, more appropriate to the reality and Brazilian demand.

In addition, when Brazil created the first national parks, the areas had established human populations. U.S. park areas were largely remote and lacked established human populations (DIEGUES, 2001; DRUMMOND, 1997; VALLEJO, 2005). The Brazilian model shares liability protection between the state and society. After 2000, when the National Protected Areas System was legally established, all public protected areas required advisory or deliberative boards. The Brazilian constitution states that the government and society share the responsibility of preserving protected areas for present and future generations. The advisory or deliberative boards represent society in this shared task.

In both Brazil and the U.S., national parks were established to maintain the natural qualities of defined areas and also to be enjoyed by people, as can be seen on U.S. National Park Service Organic Act (16 U.S.C. 1 2 3, and 4) consisting of the Act of August 25, 1916 (39 Stat. 535) and amendments thereto. Brazilian Federal Law No. 9.985 of July 18, 2000.

National parks in the U.S. have always been popular with tourists and local residents. In recent years, ecotourism has gained prominence. Ecotourism currently is popular in many parts of world as a means of conserving biodiversity while serving as an important economic driver for local communities (Rodrigues, 1999). This has not been the case in Brazil. Brazil has a history of protecting biodiversity in national parks and keeping people out.

We use the terms public use, number of visitors, and tourists interchangeably here. Parks in the study that recorded data, recorded the number of visitors on a given day, or days, or estimated number of visitors regardless of whether they were local residents or folks travelling from a distance.

Managers of national parks face challenges in preserving park ecological functions and biodiversity while accommodating public use (GASTON *et al.*, 2008). Current levels of demand for ecotourism are unprecedented (EAGLES; MCCOOL; HAYNES, 2002; MONZ *et al.*, 2010; NEWSOME; MOORE; DOWLING, 2002). These important places can only benefit society and fulfil their conservation goals if they are well managed. Proper management of public use has a vital role in providing recreational opportunities, environmental education of visitors, and the conservation of ecosystems (DUDLEY; HOCKINGS; SOLTON, 1999; MUÑOZ-SANTOS; BENAYAS, 2012).

What do we know about public use and biodiversity conservation in national parks? Can we learn anything from long-established parks in developed economies that might be helpful to emerging and developing economies? Does public use reduce biodiversity in national parks? Is public use incompatible with biodiversity conservation in national parks? To investigate these questions, we studied national parks in two countries with different levels of public use—Brazil (low public use), and the U. S. (high public use). Our hypothesis was that, as perceived by park managers, level of public use does not affect biodiversity in national parks.

## **Methods**

The RAPPAM (Rapid Assessment and Prioritization of Protected Area Management) survey instrument was used in the study (ERVIN, 2003a). The methodology was developed by the World Wildlife Fund and has been used in 53 countries and more than 1,600 protected areas in Europe, Asia, Africa, Latin America and the Caribbean, with emphasis on developing countries (LEVERINGTON, *et al.*, 2010). RAPPAM has been widely used as a means of assessing the management effectiveness of protected areas.

Unique to the current study was development of a set of 10 queries designed to investigate the relationship between public use and biodiversity conservation in national parks (Appendix A). The queries were carefully constructed to follow the same pattern of other sections in the RAPPAM methodology.

Park managers completed the survey questionnaire with input from other park officials and specialized staff. It was made clear to park personnel that the answers should reflect the consensus views of all staff of the park, not just views of the individual completing the survey. In many cases, information was available from park management documents. The aim was to obtain the best information available regarding each park sampled. In some parks, the head (Brazil) or superintendent (U.S.) appointed an employee to take responsibility for completing the survey. Research permits were obtained for all sampled parks.

RAPPAM recommended holding a workshop for appropriate park personnel of all parks to be sampled to discuss the research effort and methodology. Because of logistical difficulties in getting all park representatives together in a single meeting, we held individual meetings with employees of the sampled parks. Thus, we held at least one meeting of

about two hours with representatives of each park, explaining the research and methodology. We highlighted the importance of completing the questionnaire accurately, reflecting the reality of the park and issuing an institutional response. Most park personnel completed the questionnaire in 30-45 days.

The adaptation of RAPPAM included, in addition to the 10 queries concerning public use, questions about the number of annual visitors to the parks and the economic benefits of the parks to surrounding communities.

### **Study areas**

In the U.S., parks sampled were in the Administrative Region known as the National Capital Region of the National Park Service including national parks in the states of Maryland and Virginia, and Washington, DC. Brazilian parks were within the ICMBio Administrative Region CR-8, comprising all national parks of the state of Rio de Janeiro. The two regions had similar characteristics. Both were located along the Atlantic Ocean coast and had large bays (Guanabara and Chesapeake). Both contained large urban centres. In the U.S., parks sampled were Chesapeake & Ohio Canal National Historical Park, Assateague Island National Seashore, Prince William Forest Park, Catoctin Mountain Park, Harpers Ferry National Historical Park, Great Falls Park, and Rock Creek Park. In Brazil, parks sampled were Itatiaia National Park, Serra dos Orgãos National Park, Tijuca National Park, Serra da Bocaina National Park, and Jurubatiba Restinga National Park.

### **Methodological analyses**

For Tables 2-5, queries had four response options: 'yes,' 'mostly yes,' 'mostly no,' and 'no.' 'S' refers to strength, where 60% or more of the parks marked 'yes' or 'mostly yes,' following Ervin (2003b). 'W' refers to weakness, where 60% or more of the parks marked 'no' or 'mostly no,' and a dash (-) indicates that the element was neither a strength nor weakness (ERVIN, 2003b).

For Table 6, 'yes' and 'mostly yes' marks were combined as 'yes' responses, and 'no' and 'mostly no' marks combined as 'no' responses. For each of the four 10-question sets (Tourism Importance, Biological Importance, Socioeconomic Importance, and Vulnerability), the ratio of 'yes' to 'no' responses could be 10 'yes' and 0 'no,' 0 'yes' and 10 'no' or some combination of the two. Totalling responses for each of the four 10-question sets for the seven U.S. parks resulted in ratios of 'yes' to 'no' that summed to 70. For Brazilian parks, ratios of 'yes' to 'no' summed to 50 (Table 6). We used Fisher's Exact Test (CHERKASSKY; MULIER, 2007) to analyze differences between Brazil and the U.S. for each of the four 10-question sets.

Data used for the linear regression analysis (Fig. 1) were from Table 1 (Annual Visitors) and Table 2 (Item 2). For Item 2 of Table 2, a 'yes' response equalled 4, a 'mostly yes' response equalled 3, a 'mostly no' response equalled 2, and a 'no' response equalled 1. The analysis was performed with SPSS Statistics 23.0.0 (IBM Corp., Armonk, N.Y.).

## Results

### Tourism and biodiversity conservation

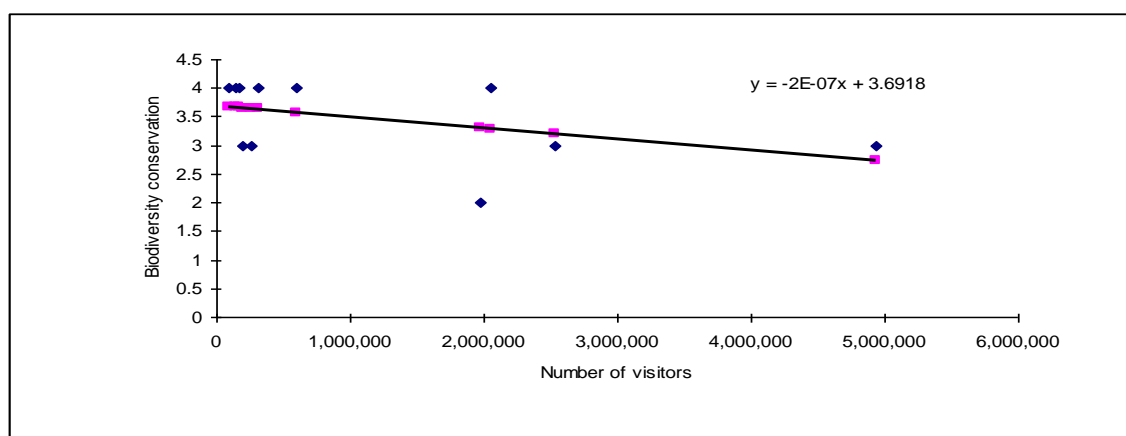
The average number of visitors to parks in the U.S. was more than double the number visiting Brazilian parks, also reflected on economic benefits (Table 1). However, the generated employment was higher in Brazil. The greatest attraction in Brazilian parks was the Statue of Christ in Tijuca National Park and this was reproduced in the highest number of annual visitors among all parks studied.

**Table 1:** Public use and economic benefit of national parks studied in Brazil and the United States<sup>a</sup>

Park	Annual Visitors	Economic Benefit	Generated Employment
Assateague	2,056,827	\$87,529,000	1052
Catoctin	175,213	12,736,000	126
C&O Canal	4,941,367	117,188,000	1188
Great Falls	600,000	-	-
Harpers Ferry	255,714	16,112,000	166
Prince William	309,297	21,945,000	214
Rock Creek	1,968,994	46,748,000	460
Total	9,707,412	302,258,000	3206
Average	1,472,487	50,376,333	534
Bocaina	8,897	199,389 <sup>b</sup>	40
Itatiaia	127,494	2,857,251 <sup>b</sup>	580
Serra dos Órgãos	162,868	4,396,727 <sup>b</sup>	627
Jurubatiba	72,161	1,617,190 <sup>b</sup>	328
Tijuca	2,720,517	160,430,070 <sup>b</sup>	12,371
Total	3,091,937	169,500,627	13,946
Average	618,387	33,900,125	2,789

**Source:** <sup>a</sup>For U.S. parks, data from Cullinane Thomas et al. (2014). For Brazilian parks, data from Rodrigues et al. (2019). <sup>b</sup>Brazilian real converted to U.S. dollar at exchange rate of \$1 = R\$4.60 on March 2020 (Source: Central Bank of Brazil).

Managers in both Brazil and the U.S. reported that the natural features and characteristics of parks (including their biodiversity) were being maintained with the current level of public use and that parks were not too developed as showed on Table 2. This perception of park managers held up for parks regardless of number of park visitors ( $P = 0.18$ ; Fig. 1).



**Figure 1:** Relationship between number of park visitors and biodiversity conservation as perceived by park managers. See text for details.



Park managers in both countries felt that tourism in parks contributed to environmental education of visitors and was an economic benefit to park operation and maintenance, and that parks were considered beneficial to local populations in surrounding communities.

Differences were noted between the two countries regarding several issues (Table 2). Three of the five parks in Brazil (60%) reported that park personnel did not monitor the impact of visitors on the natural features and characteristics of the park and did not have the capability of limiting the number of park visitors if needed to maintain the natural features and characteristics of the park. The U.S. was stronger in this regard.

**Table 2:** Tourism importance of national parks studied in Brazil and the United States.

Issue	U.S.	Brazil
1. Park personnel monitor the impact of visitors on the natural features and characteristics of the park.	-	W
2. The natural features and characteristics of the park (including its biodiversity) are being maintained with the current level of public use.	S	S
3. Park personnel have the capability of limiting the number of park visitors if needed to maintain the natural features and characteristics of the park (including its biodiversity).	S	W
4. Considering the purpose of national parks to maintain unimpaired form for use and enjoyment of the people, the park is not too developed.	S	S
5. Park personnel evaluate the level of satisfaction of visitors with their park visit.	S	W
6. Tourism in the park contributes to environmental education of visitors.	S	S
7. The surrounding community considers the park a benefit to the local population.	S	S
8. Tourism is an economic benefit to park operation and maintenance.	S	S
9. Tourism decreases illegal activities in the park such as poaching, deforestation, and setting of fires.	—	S
10. Research on tourism issues is consistent with the needs of the park.	—	W

Four of five Brazilian parks (80%) did not evaluate the level of satisfaction of visitors with their park visit and four of five (80%) stated that research on tourism issues was not consistent with the needs of the park. U.S. parks were stronger on both issues.

Three of five Brazilian parks (60%) but only three of seven U.S. parks (43%) reported that tourism in parks decreased illegal activities like hunting, deforestation and fires. Considering all 10 of the Tourism Importance queries,

park responses in Brazil were significantly different ( $P = 0.03$ ) from U.S. park responses (Table 6).

Only two areas of divergence were noted with regard to biological resources (Table 3). Four of five parks in Brazil (80%) stated that the park had a relatively high degree of endemism. In the U.S., three of seven parks (43%) reported a high degree of endemism. The second area of divergence dealt with structural diversity of parks. Four of five parks in Brazil (80%) but only four of seven parks in the U.S. (57%) reported that the structural diversity of the park was consistent with historic norms. Considering all 10 of the Biological Importance queries, park responses in Brazil were not considered significantly different ( $P = 0.09$ ) from U.S. park responses (Table 6).

**Table 3.** Biological importance of national parks studied in Brazil and the United States.

Issue	U.S.	Brazil
1. The park contains a relatively high number of rare, threatened, or endangered species.	S	S
2. The park has relatively high levels of biodiversity.	S	S
3. The park has a relatively high degree of endemism.	-	S
4. The park provides a critical landscape function.	S	S
5. The park contains the full range of plant and animal diversity.	S	S
6. The park significantly contributes to the representativeness of the park system.	S	S
7. The park sustains minimum viable populations of key species.	S	S
8. The structural diversity of the park is consistent with historic norms.	-	S
9. The park includes ecosystems whose historic range has been greatly diminished.	S	S
10. The park maintains the full range of natural processes and disturbance regimes.	S	S

### ***Tourism and vulnerability of park resources***

Parks in Brazil appeared more vulnerable than parks in the U.S. (Table 4). In Brazil, but not in the U.S., recruitment and retention of employees was difficult. Law enforcement was low in Brazil but high in the U.S. In Brazil, there was strong demand for vulnerable park resources, market value of park resources was high, and illegal activities within parks were difficult to monitor. Parks in both countries were easily accessible for illegal activities. In Brazil, but not in the U.S., cultural practices, beliefs, and traditional uses conflicted with park objectives.

**Table 4:** Vulnerability of resources in national parks studied in Brazil and the United States.

Issue	U.S.	Brazil
1. Illegal activities within the park are difficult to monitor.	-	W
2. Law enforcement is low in the region.	S	W
3. Bribery and corruption are common throughout the region.	S	S
4. The area is experiencing civil unrest and/or political instability.	S	S
5. Cultural practices, beliefs, and traditional uses conflict with the park objectives.	S	W
6. The market value of the park resources is high.	-	W
7. The area is easily accessible for illegal activities.	W	W
8. There is a strong demand for vulnerable park resources.	S	W
9. The park manager is under pressure to unduly exploit park resources.	S	S
10. Recruitment and retention of employees is difficult.	S	W

Civil unrest, political instability, bribery, and corruption were not problems for the parks sampled. Park managers in both countries reported that they were not under pressure to unduly exploit park resources. Considering all 10 of the Vulnerability queries, park responses in Brazil were significantly different ( $P < 0.01$ ) from U.S. park responses (Table 6).

### ***Tourism and economic benefits***

In both Brazil and the U.S., parks had high recreational, educational, and/or scientific value, and possessed unusual features of aesthetic importance (Table 5). Parks also contributed significant ecosystem services and benefits to communities in both countries. Also in both countries, local communities were not dependent upon park resources for their subsistence, parks did not provide community development opportunities through sustainable resource use, and parks did not have religious or spiritual significance.

Parks in Brazil, but not in the U.S., contained plant species of high social, cultural, or economic importance (Table 5). Parks in both countries did not contain animal species of high social, cultural or economic importance.

Parks in Brazil, but not in the U.S., were important sources of employment for local communities (Table 5). Considering all 10 of the Socioeconomic Importance queries, park responses in Brazil were not considered significantly different ( $P = 0.35$ ) from U.S. park responses (Table 6).



**Table 5:** Socioeconomic importance of national parks studied in Brazil and the United States.

Issue	U.S.	Brazil
1. The park is an important source of employment for local communities.	-	S
2. Local communities depend upon the park resources for their subsistence.	W	W
3. The park provides community development opportunities through sustainable resource use.	W	W
4. The park has religious or spiritual significance.	W	W
5. The park has unusual features of aesthetic importance.	S	S
6. The park contains plant species of high social, cultural, or economic importance.	W	S
7. The park contains animal species of high social, cultural, or economic importance.	-	W
8. The park has a high recreational value.	S	S
9. The park contributes significant ecosystem services and benefits to communities.	S	S
10. The park has a high educational and/or scientific value.	S	S

**Table 6:** Four important elements of management in national parks studied in Brazil and the United States.

	TI <sup>b</sup>		BI <sup>c</sup>		SI <sup>d</sup>		VU <sup>e</sup>	
Response <sup>a</sup>	Brazil	U.S.	Brazil	U.S.	Brazil <sup>f</sup>	U.S.	Brazil	U.S.
Yes	29	54	45	54	30	36	33	14
No	21	16	5	16	19	34	17	56

<sup>a</sup>See analyses section for description of response; <sup>b</sup>Tourism Importance (P=0.03); <sup>c</sup>Biological Importance (P=0.09); <sup>d</sup>Socioeconomic Importance (P=0.35); <sup>e</sup>Vulnerability (P<0.01); <sup>f</sup>Does not total 50 because one park left one of the 10 queries blank.

## Discussion

### *Tourism and biodiversity conservation*

Several factors may be responsible for the difference in visitation to national parks in Brazil and the U.S. Historically, visiting national parks in Brazil has not been a widely practiced recreational activity. The oceanic beaches have been more popular for such activity. A second factor may relate to philosophy of park management. Park officials in Brazil have focused on resource protection with little thought to welcoming people to parks.

Although the relationship between number of park visitors and biodiversity (Fig. 1) was not statistically significant, the dataset was small and the trend was negative (reduced biodiversity with increased number of visitors), so park managers should be vigilant and initiate plans for limiting the number of visitors if necessary to maintain park biodiversity. Most U.S. park managers reported that they had such capability, but three of five parks in Brazil (60%) lacked such capability. Monitoring visitor impacts on the natural features and characteristics of parks also was a weakness in Brazil (Table 2). We believe park managers in both countries should monitor the impact of visitors on the natural features and characteristics of the park, be aware of research on visitor use and biodiversity, and have the capability of limiting the number of park visitors if needed.

Environmental education of park visitors was important in both Brazil and the U.S. and supports findings of others (RODRIGUES, 2009; TAKAHASHI, 1998).

Park managers in Brazil considered parks beneficial to local populations in surrounding communities. However, historically, there has been conflict between the establishment of parks and the presence of local communities (DIEGUES, 2001). In the parks of Rio de Janeiro there are records of these situations on Serra dos Orgaos (Neighbourhoods Bonfim and Jacob), Itatiaia (with lodges and former residents of the park), Tijuca (with slums and intense urbanization), Jurubatiba (with coconut farms and residents of Macaé) and Bocaina (with farmers and the Trindade community). In Brazil, this issue is important and recurrent, and almost all national parks have land tenure problems (DRUMMOND, 2010; ROCHA; DRUMMOND; GANEM, 2010).

In the U.S., most park personnel evaluated the level of satisfaction of visitors with their park visit. This was not typically done in Brazil, perhaps because of insufficient budgets or a policy decision to focus on park conservation and not on public use activities.

Both Brazil and the U.S. had high scores for biological importance of national parks (Table 3), which support findings of others (HOCKINGS; STOLTON; DUDLEY, 2000; HOCKINGS, 2003).

One difference in responses between Brazilian and U.S. parks appeared regarding the consistency of structural diversity according to historical norms. Ervin (2003a) defined structural diversity as the assembly and configuration of species, the landscape, and landscape ecosystem elements. Four of the five Brazilian parks (80%) reported maintaining structural diversity. The exception was Tijuca National Park, where part of the

park consisted of secondary forest recovered in the nineteenth century. Four of seven U.S. parks (57%) responded positively to this query. Influencing factors in the U.S. likely were impact of white-tailed deer (*Odocoileus virginianus*) and non-native species on forest structure change.

Conserving natural processes is especially important for the national parks of Rio de Janeiro considering the extreme stochastic events such as the heavy rains that hit the mountainous region of the state in 2011 causing hundreds of deaths and material damage. Studies (GRAEF *et al.*, 2011; MMA, 2011) have demonstrated the direct relationship of these events to the environmental services provided by protected areas, which help to absorb runoff from storm events, thus directly benefitting people living in the region. Protected areas also help to conserve biodiversity (MEDEIROS *et al.*, 2011).

Parks in Brazil and the U.S. have shown good results with regard to conservation. Exotic species remain a problem in both countries. Brazilian parks require specific actions for monitoring and combating illegal hunting. Illegal hunting in American parks is not a large issue, although poaching of black bears (*Ursus americanus*) for body parts, and other offences, do occur. Strong law enforcement helps to deter such activity in the U.S. Culling of over abundant white-tailed deer populations to reduce impact on native vegetation is used in some U.S. parks. Park managers in either Brazil or the U.S did not perceive tourism as a major threat to biodiversity. We believe it is necessary, however, to properly manage public use to avoid possible negative effects.

In summary, protection of biological resources was strong in both Brazil and the U.S. (Table 3).

### ***Tourism and vulnerability of park resources***

Part of the difficulty regarding recruitment and retention of employees in Brazilian national parks may be in the contracting strategy of officials at ICMBio (only accomplished through public tenders) or the bureaucratic complexity of establishing contracts and bids with service providers. Also, there are still many doubts by the government agencies about appropriateness of increased public use of national parks in Brazil. The general thought is that parks should be protected, and public use limited. One of the consequences of this reasoning is that the parks continue with limited resources, including human resources, fundamental for the management of protected areas. Society, however, understands that the parks are public resources and should be available to the public. Studies conducted by Medeiros *et al.* (2011) showed that Brazil was among the worst countries in the world in the relationship between the protected surface and the number of employees. From the current study, the U.S. had one employee for every 2,125 hectares of parkland, whereas in Brazil the ratio was one staff member for every 18,600 hectares.

According to Ervin (2003a) law enforcement includes both the direct enforcement of laws related to protected areas, and judicial and legal practices such as fines and sentences. Low law enforcement, as reported for Brazilian parks, can create favorable conditions for illegal activities and increase the vulnerability of parks.

All parks analyzed in Brazil said the market value of park resources was high and 60% of Brazilian parks reported strong demand for vulnerable park resources. In U.S. parks, 43% of managers reported high market value of park resources. We could not determine whether managers in the U.S. interpreted this issue by assigning low market value to park resources or considered that the park's resources could never be sold and so did not have high market value. The illegal market value of black bear parts (some estimates as high as \$10,000 per animal) has resulted in poaching of bears for their body parts in some U.S. parks. Law enforcement works to minimize such activity.

In Brazil, the biggest problems reported with regard to vulnerable resources were associated with heart of palm extraction (Açaí palm *Euterpe oleracea* and other species) and the trafficking of wild animals, especially birds, reptiles, and small mammals. Between 1999 and 2000, 6,684 wild animals were seized in Brazil and of these 518 were mammals. The greatest obstacles to combating wildlife trafficking were the lack of contingent vehicles, appropriate equipment, and training (RENCTAS<sup>1</sup>, 2001). The problem could be minimized with investments in infrastructure and skilled personnel.

Park managers in Brazil strongly felt that tourism decreased illegal activities in parks such as poaching, deforestation, and setting of fires. U.S. park managers were more neutral on this issue (Table 2). In Brazil, tourism may serve as an important aid in combating illegal activities harmful to biodiversity and, indirectly, assist in enforcement activities.

### ***Tourism and economic benefits***

The economic benefit of national parks is substantial (Table 1). Annual budgets of the seven U.S. parks totaled about \$35 million, thus the economic return was more than eight times the annual budgets. For the two parks in Brazil for which data could be obtained the multiplier effect was even greater.

Another measure of the economic benefit of national parks was apparent when the U.S. federal government shut down in October of 2013 because Congress would not pass a budget. National parks closed as well as other federal agencies. National Park tourism is important to many state and local communities, and, with the federal government shutdown, these economies were noticeably affected. During the shutdown, the National Park Service estimated a 7.88 million decline in overall park visitation resulting in a loss of \$414 million visitor spending within gateway communities across the country (KOONTZ; MELDRUM, 2014). Fourteen states were allowed to reopen national parks with state funding before the end of the shutdown. Each dollar of state funding spent during this time period generated an estimated \$10 in visitor spending (KOONTZ; MELDRUM, 2014). Medeiros *et al.* (2011) also pointed out the importance of protected areas to national and local economies.

The greatest difference between Brazil and the U.S. regarding socioeconomic issues dealt with the social, cultural, or economic importance of plants (Table 5). Four of five parks (80%) in Brazil stated that parks

contained plant species of high social, cultural, or economic importance. Only one of seven (14%) U.S. parks made such a claim. Brazilian parks were created in areas of remaining forest, where communities historically used a long list of plants present in the national parks that were published in a popular pharmacopoeia. This may have contributed to the high importance placed on plants in Brazil.

Social, cultural, or economic importance of animal species rated higher in U.S. parks than in Brazilian parks. No parks in Brazil reported that animal species had high social, cultural, or economic importance. Three of seven (43%) parks in the U.S. made such claims. This difference may reflect American interest in wildlife watching, which does not seem so well developed in Brazil. Bird watching and other wildlife watching attract many visitors to national parks in the U.S. For example, bison (*Bison bison*), gray wolves (*Canis lupus*), grizzly bears (*Ursus arctos horribilis*), and other animal species are big attractions in Yellowstone National Park and other western parks. Black bears draw big crowds of people in Great Smoky Mountains National Park on the North Carolina-Tennessee border. In the parks sampled in the National Capital Region of the U.S., white-tailed deer attract many viewers. Bird watching also is popular. At Assateague, it is the wild horses (*Equus caballus*) that are the big attractant.

### Management Implications and Conclusions

Managers of U.S. parks, with double the number of annual visitors compared with Brazilian parks, indicated that biodiversity was still being conserved. However, there is no strong statistical evidence linking the perception of biodiversity conservation and tourism to indicate that increasing tourism can keep biodiversity conservation. To maintain biodiversity with increased public use in Brazil, we believe the following are needed: adequate park personnel, including law enforcement staff; adequate budgets to manage park resources and visitors, and capability to monitor and limit public use if necessary.

In Brazil, if national parks were properly structured for tourism, there would be a greater integration of the various interrelated economic sectors, contributing to increased regional dynamism, creating jobs, and providing economic benefits without compromising the environmental and social services the parks provide.

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## Appendix A

### 3.1. Tourism Importance

#### Tourism Background Information:

- a) How many people visited your park in:  
\_\_\_\_\_ 2012, \_\_\_\_\_ 2011, \_\_\_\_\_ 2010?
- b) What was the economic benefit from tourism in your park to local communities in:  
\_\_\_\_\_ 2012, \_\_\_\_\_ 2011, \_\_\_\_\_ 2010?

a) If available, please record the number of local and non-local visitors on day trips and multi-day trips to the park for the years indicated. If unknown, leave blank.

b) Economic benefit should include expenditures for hotels, motels, and other lodging; meals in restaurants or other eating establishments; gas and local transportation; and amusements, groceries, and other retail purchases, for both local and non-local tourists. Do not include park entrance fees or other fees or purchases within the park.

Y	m/y	m/n	N	
0	0	0	0	a) Park personnel monitor the impact of visitors on the natural features and characteristics of the park.
0	0	0	0	b) The natural features and characteristics of the park (including its biodiversity) are being maintained with the current level of public use.
0	0	0	0	c) Park personnel have the capability of limiting the number of park visitors if needed to maintain the natural features and characteristics of the park (including its biodiversity).
0	0	0	0	d) Considering the purpose of national parks to maintain unimpaired form for use and enjoyment of the people, the park is not too developed.
0	0	0	0	e) Park personnel evaluate the level of satisfaction of visitors with their park visit.
0	0	0	0	f) Tourism in the park contributes to environmental education of visitors.
0	0	0	0	g) The surrounding community considers the park a benefit to the local population.
0	0	0	0	h) Tourism is an economic benefit to park operation and maintenance.
0	0	0	0	i) Tourism decreases illegal activities in the park such as poaching, deforestation, and setting of fires.
0	0	0	0	j) Research on tourism issues is consistent with the needs of the Park.

- a) Monitoring might include recording visitor impacts on soil compaction and erosion, and trail integrity. Data might be kept of visitor trampling of vegetation, theft of wild flowers or other park assets, or visitor effects on animal behavior and nesting and denning activities of animals. Monitoring of air and water pollution resulting from visitors, and other monitored impacts should be recorded here.
- b) The current level of public use is sustainable over the long term without damage to the natural features and characteristics of the park. This includes threats to species, rocks, soils, or special environments within the park such as waterfalls and caves.
- c) Park personnel can limit the number of park visitors, or higher-level officials within the park system can limit the number of park visitors, if needed to avoid destruction of park natural features and characteristics by people.
- d) The park is not too heavily developed with roads, lodging and food facilities, shops, and related development that caters to tourists.
- e) The park welcomes feedback from visitors and regularly determines visitors' attitudes regarding their park experience. This is done informally through conversations with visitors, or more formally with a written questionnaire or comment form.
- f) The park provides outdoor educational learning experiences for visitors through brochures, displays, exhibits, films, naturalist-led or self-guided nature walks, or other means. Visitors learn about important issues related to the environment, such as deforestation; pollution of air, water, and soil; wild fires; illegal hunting; waste recycling; plants and animals; and the relationship between humans and the environment.
- g) The local community views the park as an important asset in generating economic development at the local level. The local community considers the park an amenity for outdoor recreation by local residents.
- h) Park entrance fees, camping fees, concession fees, and purchases by visitors within the park contribute to park operation and maintenance. Visitor numbers positively affect annual federal allocation of funds to the park.
- i) The presence of tourists in the park decreases illegal activities in the park because tourists help to observe and report illegal activity.
- j) Tourism research focuses on monies spent by park visitors that benefit the local economy or the operation and maintenance of the park. This focus compliments research on key ecological issues and key social issues of Item 15 of the questionnaire (Research, Monitoring, and Evaluation—Processes).