

Chapter 6

**PUBLIC USE, BIODIVERSITY, AND
NATIONAL PARK MANAGEMENT
IN BRAZIL AND THE UNITED STATES**

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ABSTRACT

We conducted a comparative analysis of the effectiveness of national park management in the National Capital Region of the National Park Service of the United States and the Chico Mendes Institute of Biodiversity Conservation (ICMBio) Administrative Region CR-8 of Brazil consisting of all national parks in the state of Rio de Janeiro. Our objectives were to measure, from the perspective of park managers, management strategies in national parks under different levels of

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management intensity and public use, and the effect of public use on biodiversity conservation in national parks of the two regions. The RAPPAM (Rapid Assessment and Prioritization of Protected Area Management) survey instrument was administered between 12 March and 26 June 2013. 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. Strong points of park management in both regions included management objectives, park site design, and biological importance of park assets, among others. The biggest differences between the two regions dealt with park vulnerability, legal security of parkland, and infrastructure. Other differences dealt with tourism importance, communication and information, and research. Managers of U.S. parks, with double the number of annual visitors compared with Brazilian parks, indicated that biodiversity was still being conserved. Tourism did not figure among the main pressures and threats of sampled parks in either the U.S. or Brazil.

Keywords: tourism, ecotourism, public use, biodiversity, conservation, park

INTRODUCTION

Brazil and the United States (U.S.) have established notable national parks. In both countries, national parks were designated to maintain the natural qualities of defined areas and to be enjoyed by people. Differences between the two countries exist, however. Park sizes tend to be smaller in the U.S. than in Brazil but with more employees, and parks in the U.S. receive more visitors than do Brazilian parks. In addition, when Brazil created its first national parks, the areas had established human populations. U.S. park areas were largely remote and lacked substantial human populations at time of park designation (Drummond 1997; Diegues 2001; Vallejo 2005).

Our interest in national park management focused largely on the effects of visitor use on biodiversity conservation in national parks as perceived by park managers and implications of the results for management of national parks. Is public use incompatible with biodiversity conservation in national parks? To investigate this question, we studied national parks with low public use (Brazil), and national parks with high public use (U.S.).

STUDY AREAS AND METHODS

In the U.S., parks sampled were in the Administrative Region known as the National Capital Region of the National Park Service, including parks in the states of Maryland, Virginia and West Virginia, and Washington, DC. Brazilian parks studied were within the ICMBio (Brazilian Protected Areas Administration Agency) 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, had large bays (Guanabara and Chesapeake), and both contained large urban centers. In the U.S., parks sampled were Chesapeake and 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 Orgaos National Park, Tijuca National Park, Serra da Bocaina National Park, and Jurubatiba Restinga National Park.

The RAPPAM (Rapid Assessment and Prioritization of Protected Area Management) survey instrument was used in this 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.

The survey questionnaire was completed by park managers 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. Most park personnel completed the questionnaire in 30-45 days. Meetings with park officials and administration of the questionnaire occurred between 12 March and 26 June 2013.

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. The queries were carefully constructed to follow the same pattern of other sections in the RAPPAM methodology. Also added to the survey were questions about the number of annual visitors to the parks and the economic benefits of the parks to surrounding communities.

The RAPPAM methodology organization was structured into five elements of planning, management and evaluation, as follows: context, planning, inputs, processes and outputs. Each of these elements is composed of specific themes and issues covered in different thematic modules (Ervin 2003a)

For the 15 elements of the RAPPAM questionnaire (Table 1), queries had four response options: "yes," "mostly yes," "mostly no," and "no." "Yes" and "mostly yes" were combined as positive responses or strengths, and "no" and "mostly no" were combined as negative responses or weaknesses. For each of the 10-question elements (numbers 1-4 and 15 of Table 1), 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. Totaling responses for each of the 10-question elements for the seven U.S. parks resulted in ratios of "yes" to "no" that summed up to 70. For Brazilian parks, ratios of "yes" to "no" summed to 50 (Table 1). For the remaining 5-question elements (numbers 5-14 of Table 1), the ratio of "yes" to "no" responses could be 5 "yes" and 0 "no," 0 "yes" and 5 "no," or some combination of the two. Totaling responses for each of the 5-question elements for the seven U.S. parks resulted in ratios of "yes" to "no" that summed to 35. For Brazilian parks, ratios of "yes" to "no" summed to 25 (Table 1). We used Fisher's Exact Test (Cherkassky and Mulier 2007) to analyze differences between Brazil and the U.S. for each of the 15 elements.

For Figure 1, the maximum possible score was 50 for each of the two elements (park vulnerability and tourism importance). Each element listed 10 queries to which park managers could respond. Responses could be "yes," "mostly yes," "mostly no," or "no." A "yes" response equaled 5 points, a "mostly yes" response 3 points, a "mostly no" response 1 point, and a "no" response zero points. Responses were totaled for each of the 10-query elements for each of the five parks. Figure 2 was derived from the data of

Table 1 and expressed as the percent of strong responses to total responses for each of the 15 elements for each country.

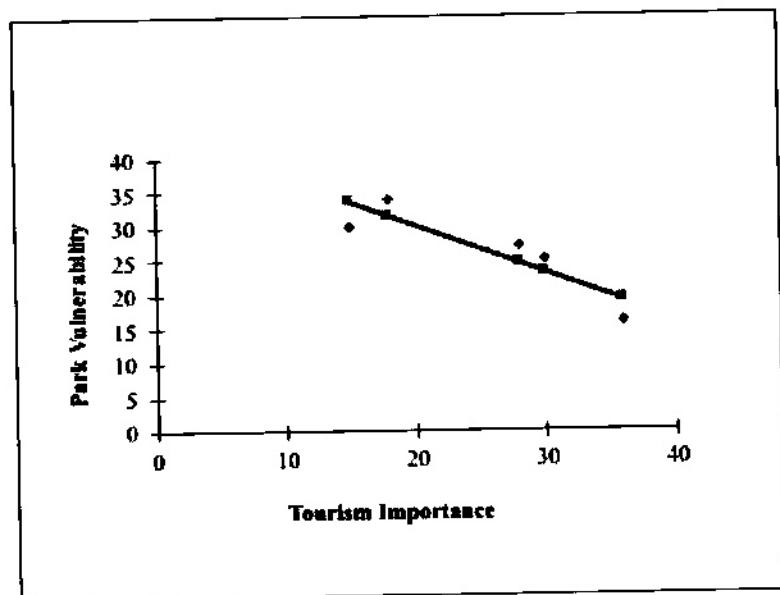


Figure 1. Relationship between tourism and vulnerability of park resources in Brazil, 2013.

RESULTS AND DISCUSSION

Park Objectives and Site Design

Park objectives and site design were strong in both Brazil and the U.S., and for the most part, were similar in the two countries (Table 1). All parks in Brazil and six of seven parks in the U.S. reported that park objectives provided for the protection and maintenance of biodiversity. All parks in both countries stated that management policies and plans were consistent with park objectives and park employees and administrators understood park objectives and policies. All parks in Brazil and four of seven in the U.S. reported that specific biodiversity-related objectives were clearly stated in

the management plan. Local communities supported overall park objectives for all parks in the U.S. and three of five parks in Brazil. Two parks in Brazil reported no local community support or community disagreement with the goals expressed in park management plans. These data likely reflect conflict in the relationship between communities and parks where territory and park boundary issues, and the authoritarian and disjointed government actions, were in dispute (Prado 2000; Mendonca and Fontoura 2010; Ferreira 2011). The issue is discussed further under *Tourism and Vulnerability of Park Resources*.

Pressures and Threats

Results in this study corroborate research of Brandon (1998), Terborgh et al. (2002), Ervin (2003b), and Nchor and Ugogo (2012) that show a long list of pressures and threats faced by protected areas. Some are resurgent and deserve special attention. According to Wilson (1992), and Friedman and Zube (1992), the greatest threats can be differentiated into four categories: overfishing, habitat destruction, the introduction of alien species and the spread of diseases carried by exotic species. In this study, problems with exotic species ranked high in both Brazilian and U.S. national parks sampled (Fontoura et al. 2016). In the U.S., 50% of the species listed as threatened or endangered are at risk because of invasive alien species (Wilcove et al. 1998). The threat is global and is classified as intractable because of the scale of the problem.

In U.S. parks sampled in this study, the white-tailed deer (*Odocoileus virginianus*) was listed among the top pressures and threats (Fontoura et al. 2016). The species is native to North America and historically was a major food source for Native Americans. European settlers in North America also depended heavily on white-tailed deer for food. Few regulations existed on hunting of deer into the early 1900s. As a result, deer populations were greatly reduced. The species was extirpated from most of the state of Maryland by the early 1900s and found only in the western part of the state. Conservation efforts and reintroduction of the species throughout the state

began in 1920. With these measures, and strong enforcement of hunting regulations, the deer population prospered (Maryland 2009). In some parks in recent years, excessive numbers of deer have led to ecological damage and other negative impacts. The most effective means of controlling populations of deer in the parks is through regulated shooting (culling) programs. Hunting in national parks is not allowed. Although controversial, culling programs, sometimes combined with fertility control measures, have been implemented in a number of parks.

For Brazilian national parks, the main pressures and threats were identified as illegal hunting (poaching), habitat fragmentation, and exotic species. Poaching was a top pressure and threat in Brazilian national parks sampled (Fontoura et al. 2016). Although prohibited, illegal hunting and trafficking of wild animals in Brazil are still widely practiced. Protected areas are the last refuges of animals and are targeted by hunters. The inspection limitations and old laws are barriers to reduce hunting in the country (RENTAS 2001). Poaching affects over 80% of the parks in 16 tropical countries on three continents (Van Schaik et al. 1997).

Collection of non-timber forest products (NTFPs) also ranked high as a pressure and threat, scoring 14 and 5.6, respectively, in Brazilian parks sampled (Fontoura et al. 2016). Combining poaching with NTFP yielded scores for pressures and threats of 35 and 24.2, respectively, in Brazilian parks sampled. According to Ervin (2003b), poaching and collection of NTFPs are related to the systematic removal of plants and animals. This may mean a ripple effect through different trophic levels. At the extreme, if not regulated, this activity can lead to extirpation and extinction of species.

Tourism did not figure among the main pressures and threats of sampled parks in either the U.S. or Brazil (Fontoura et al. 2016), despite an average of 1.5 million visitors annually using the sampled parks in the U.S., and an average of 742,000 people visiting sampled Brazilian parks. Of the latter, most individuals were recorded only in Tijuca National Park and the vast majority of these folks were only interested in visiting the Statue of Christ the Redeemer. Based on these results, and others reported later in the chapter, we believe there is growth potential for sustainable tourism in Brazilian national parks without sacrificing biodiversity conservation.

Results in this chapter support findings of Ervin (2003b), Li and Han (2001), and Nchor and Ugogo (2012) reported for other countries where tourism was considered a minor or moderate threat. Other less important pressures and threats like mining, pollution, and fishing were discussed in Fontoura et al. (2016), along with mitigation and management practices in both countries.

Tourism and Biodiversity Conservation

Park managers in both Brazil and the U.S. placed high value on the biological importance of parks (Table 1), which support findings of others (Hockings et al. 2000; Hockings 2003). 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 and that parks were not too developed. Nonetheless, in our view, 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 lacked such capability. Monitoring visitor impacts on the natural features and characteristics of parks also was a weakness in Brazil. We believe park managers in both countries should monitor the impact of visitors on the natural features and characteristics of parks, be aware of any negative impact of park visitors on biodiversity, and have the capability of limiting the number of park visitors if needed.

Parks in Brazil and the U.S. have shown good results with regard to conservation. Exotic species remain a problem in both countries. In addition, 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, does occur. Strong law enforcement helps to deter such activity in the U.S. Tourism was not perceived as a major threat to biodiversity by park managers in either Brazil or the U.S.

Tourism in national parks was considered more important in the U.S. than it was in Brazil ($P = 0.05$) (Table 1). 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 beneficial to local populations in surrounding communities. The importance of parks in contributing to environmental education of park visitors supports the findings of others (Takahashi 1998; Rodrigues 2009). Although park managers in Brazil considered parks beneficial to local populations in surrounding communities, historically, there has been conflict between the establishment of parks and the presence of local communities (Diegues 2001). In Brazil, this issue is important and recurrent, and almost all national parks have land tenure problems (Drummond 1997; Rocha et al. 2010). The issue is discussed further under the section below.

Tourism and Vulnerability of Park Resources

The vulnerability of parks indicates how parks are susceptible to external pressures or illegal activities that threaten biodiversity conservation. Parks in Brazil were more vulnerable ($P < 0.01$) than parks in the U.S. (Table 1). Of the ten questions presented, seven demonstrated an average difference greater than 40%.

In Brazil, but not in the U.S., recruitment and retention of employees was difficult. Part of this difficulty 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. 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. At the time of this study, the U.S. had one federal employee for every 108 ha of parkland, whereas in Brazil the ratio was one federal staff member for every 2,543 ha (Table 2) (Medeiros et al. 2011).

Law enforcement was low in Brazil but high in the U.S. Three of five park managers in Brazil reported low law enforcement in parks. One of seven managers in the U.S. reported low law enforcement. Four of five managers in Brazil reported that staff and financial resources were not

adequate to conduct critical law enforcement activities. In the U.S., three of seven managers reported inadequate resources. Low law enforcement can create favorable conditions for illegal activities and increase the vulnerability of parks.

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. The greatest obstacles to combating wildlife trafficking were the lack of vehicles, appropriate equipment, and training (Renctas 2001). The problem could be minimized with investments in infrastructure and skilled personnel.

With regard to cultural practices, beliefs and traditional uses of park resources by the surrounding populations, none of the American parks reported conflict with the goals of the protected areas, however, 80% of the parks studied in Brazil said that cultural practices and traditional uses conflicted with conservation objectives. Further studies are needed to understand what uses and conflicting practices interfere with park objectives.

When asked about the difficulty of monitoring illegal activities within the protected areas, 57% of U.S. park managers and all Brazilian park managers said parks were difficult to monitor. Parks studied in both countries were easily accessible for such activity.

Disagreements regarding land tenure or use rights and park boundary demarcation (legal security, Table 1) also differed ($P < 0.01$) between Brazil and the U.S. In Brazil, all park managers reported disagreements regarding land tenure or use rights and problems with park boundary demarcation. This is a systemic problem and must be worked out as a priority for the success of management in Brazilian national parks. In the U.S., the majority of managers did not report such disagreements or problems. The majority of managers in both countries reported that conflicts with the local community were resolved fairly and effectively and that parks had long-term legally binding protection. In Brazil, however, 40% of the parks sampled had no support from local communities and all had land problems on the borders.

Further study of this issue is needed, especially information from local communities.

Park managers in Brazil (three of five) felt that tourism (by the presence of people) decreased illegal activities in parks such as poaching, deforestation, and setting of fires. U.S. park managers (three of seven) were more neutral on this issue. In U.S. parks, law enforcement was considered strong and perhaps managers' responses reflected this. A negative relationship ($P = 0.04$) between tourism importance and park vulnerability in Brazil (Figure 1) quantifies these observations.

Tourism and Socioeconomic Benefits

The socioeconomic importance of parks in Brazil and the U.S. was similar ($P = 0.35$) (Table 1). In both Brazil and the U.S., parks had high recreational, educational, and/or scientific value, and possessed unusual features of aesthetic importance. 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., were important sources of employment for local communities.

The greatest difference between Brazil and the U.S. regarding socioeconomic issues dealt with the social, cultural, or economic importance of plants. Four of five parks in Brazil stated that parks contained plant species of high social, cultural, or economic importance. Only one of seven 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.

Table 1. Similarity and difference between Brazil and the United States with regard to 15 important elements of national park management, 2013

Item	Significance ^a	Response	Brazil	U.S.
Biological Importance (P = 0.09)		Strong Weak	45 5	54 16
Tourism Importance (P = 0.05)	*	Strong Weak	29 21	53 17
Socio-economic Importance (P = 0.35)		Strong Weak	30 ^b 19	36 34
Vulnerability (P < 0.01)	**	Strong Weak	17 33	56 14
Objectives (P = 1.00)		Strong Weak	23 2	31 4
Legal Security (P < 0.01)	**	Strong Weak	10 15	27 8
Site Design (P = 0.21)		Strong Weak	18 7	30 5
Staffing (P = 0.27)		Strong Weak	15 10	26 9
Communication/Information (P = 0.03)	*	Strong Weak	11 14	26 9
Infrastructure (P < 0.01)	**	Strong Weak	14 11	33 2
Finances (P = 0.29)		Strong Weak	11 14	20 ^c 13
Management Planning (P = 0.17)		Strong Weak	14 11	26 9
Decision-making (P = 0.12)		Strong Weak	24 1	28 7
Research (P = 0.04)	*	Strong Weak	9 16	23 12
Management Outputs (P = 0.15)		Strong Weak	32 18	54 16

*** P < 0.01; * P ≤ 0.05.

^bDoes not total 50 because one park left one of the 10 queries blank.

^cDoes not total 35 because one park left two of the 5 queries blank.

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 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, 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.

The economic benefit of national parks in both Brazil and the U.S. was substantial, returning more than eight times the annual budgets of the seven U.S. parks and an even greater multiplier effect in Brazil (Fontoura 2014). Another measure of the economic benefit of national parks was apparent when the U.S. federal government shut down for 16 days in October of 2013 because of budget disagreement. 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 and Meldrum 2014). Fourteen states were allowed to reopen national parks with state funding before the end of the federal shutdown. Each dollar of state funding spent during this time period generated an estimated \$10 in visitor spending (Koontz and Meldrum 2014). Medeiros et al. (2011) also pointed out the importance of protected areas to national and local economies.

Resources and Infrastructure

Overall, staffing strong points outweighed weak points in both Brazil and the U.S. (Table 1). In both countries, strong majorities of managers reported that park staff members had adequate skills to conduct critical

management activities and staff performance and progress on targets were periodically reviewed. All parks in Brazil and four of seven in the U.S. stated that training and development opportunities were appropriate to the needs of the staff.

Six of seven parks in the U.S., but only two of five in Brazil reported that staff employment conditions were sufficient to retain high-quality personnel. Both countries stated that the level of staffing was insufficient to effectively manage the area—four of seven parks in the U.S. and four of five parks in Brazil.

Table 2. Budget, area, and number of park employees

Park	Area (ha)	Annual budget Millions USD	Staff	Federal	Out-sourced	Temporary	Volunteer	Other
Assateague	15.170	US\$ 4.9	259	47	10	77	125	--
Catoctin	2.376	US\$ 3.4	--	--	--	--	--	--
C&O Canal	7.689	US\$ 8.69	81	68	5	8	0	--
Great Falls	323	US\$ 0.68	36	12	3	4	60	2
Harpers Ferry	1.475	US\$ 6.0	100	75	5	20	1000	--
Prince William	5.904	US\$ 3.33	77	28	9	20	20	--
Rock Creek	722	US\$ 8.0	65	59	0	6	--	--
Bocaina	104.000	-----	65	15	22	28	0	0
Itatiaia	30.000	-----	131	16	50	35	30	0
Serra dos Órgãos	20.024	US\$ 0.89	165	19	77	35	0	34
Jurubariba	14.922	US\$ 0.21	30	5	11	14	0	0
Tijuca	3.958	US\$ 2.13	205	13	100	13	50	29

Source: Author's elaboration.

A significant difference ($P < 0.01$) was noted between Brazil and the U.S. regarding park infrastructure (Table 1). Most managers in both countries reported that transportation infrastructure and field equipment were adequate to perform critical management activities. Most managers in Brazil, however, stated that maintenance and care of equipment was

inadequate to ensure long-term use, whereas all managers in the U.S. reported adequate maintenance and care of equipment. Most park managers in Brazil also stated that staff and visitor facilities were not adequate to perform critical management activities or appropriate to the level of visitor use, whereas most managers in U.S. parks reported the opposite. This response probably reflects the lack of attention given to attracting visitor use of parks as discussed above under *Tourism and Biodiversity Conservation*.

Research and Management

A significant difference ($P = 0.04$) was noted between Brazil and the U.S. regarding research, monitoring, and evaluation (Table 1). Majorities of managers in both countries reported that park staff had regular access to recent scientific research and advice, and that critical research and monitoring needs were identified and prioritized. Differences were noted, however, with regard to other issues. A majority of park managers (four of seven) in the U.S. stated that the impact of legal and illegal uses of the park were accurately monitored and recorded. Only one of five managers in Brazil made a similar statement. Also, four of seven managers in the U.S. reported that research on key ecological and social issues was consistent with the needs of the park. One of five managers in Brazil made a similar statement. These data confirm the need to strengthen the research of Brazilian parks.

A significant difference ($P = 0.03$) was noted between Brazil and the U.S. regarding communication and information (Table 1). A majority of managers in both countries reported that adequate means existed for collecting new data. However, five of seven managers in the U.S. stated that adequate systems existed for processing and analyzing data, but only two of five managers in Brazil reported the same. Differences also were noted regarding two other issues. A majority of managers in the U.S. reported that existing ecological and socioeconomic data were adequate for management planning, but only one of five managers in Brazil stated the same. Likewise, six of seven managers in the U.S. reported adequate means of

communication between field and office staff, but only two of five managers in Brazil stated the same. A majority of managers in both countries felt there was effective communication with local communities, but the limitation of the methodology used did not reveal the effectiveness and depth of communication.

Overall, strong points outweighed weak points in both Brazil and the U.S. for management planning (Table 1). Majorities of park managers in both countries reported the availability of comprehensive inventories of natural and cultural resources, and recently written management plans. A majority in each country also stated there was an analysis of, and strategy for addressing, park pressures and threats. Differences were noted, however, with two issues. A majority of park managers in the U.S. reported that they had a detailed work plan with specific targets for achieving management objectives, and that results of research and monitoring were routinely incorporated into planning. Most park managers in Brazil did not have detailed work plans and did not routinely incorporate research and monitoring into planning.

The management decision-making process was strong in both Brazil and the U.S. with solid majorities reporting positively on all issues (Table 1). Managers stated that the decision-making process was transparent and that there was effective communication between all levels of park staff and administration with clear internal organization. Also, park staff regularly collaborated with partners, local communities, and other organizations.

Management outputs—the specific products and services accomplished by park staff, volunteers, and community members—did not differ between Brazil and the U.S. (Table 1), with strengths outweighing weaknesses in both countries. A majority of park managers in both countries reported that, in the last 2 years, site restoration and mitigation efforts; visitor and tourist management; infrastructure development; and staff training, development, monitoring, supervision, and evaluation were consistent with pressures and threats, objectives, and annual work plan of the park. There was some inconsistency here regarding park infrastructure development. Elsewhere in the questionnaire, Brazilian park managers reported inadequate visitor and staff facilities (see *Resources and Infrastructure* above). We do not have an

explanation for this discrepancy at this time. Brazil was weak in other areas, including wildlife or habitat management, community outreach and education efforts, management planning and inventorying, and research and monitoring. U.S. parks were strong in all of these areas.

CONCLUSION

Analysis of the information provided in this chapter allowed us to make some inferences about the similarities and differences of sampled national parks in Brazil and the U.S., and to understand the correlation between tourism, biodiversity, socioeconomics and vulnerability of national parks. Although sample sizes were small, some trends were noted that might be confirmed by analyzing larger data sets in the future. For example, exotic species were noted as problems in both countries. Also continued development surrounding parks was of concern in both countries. Illegal hunting was an issue in Brazil but culling of overabundant white-tailed deer in the U.S. was practiced. Land issues regarding park boundaries and surrounding human populations were of concern in Brazil. Tourism did not figure among the main pressures and threats of sampled parks in either the U.S. or Brazil. Strong points of park management in both countries included management objectives, park site design, biological importance of park assets, decision-making process, and management outputs (Figure 2). The biggest differences between the two countries dealt with park vulnerability, legal security, and infrastructure. With regard to vulnerability, three of five park managers in Brazil reported that tourism in parks decreased illegal activities like hunting, deforestation and fires.

The legal security issue mainly refers to land tenure disputes and demarcation of borders in protected areas. The issue is old and complex, but must be solved by political and institutional effort. It is not possible to manage a national park without the legal domain of the territory.

A majority of park managers in Brazil reported that park infrastructure was inadequate for the current level of visitor use. This was not an important issue for managers in the U.S. We believe that additional investment in

infrastructure in Brazil would enhance visitor experiences and economic benefits to the country. Other differences regarding park management between Brazil and the U.S. dealt with tourism importance, communication and information, and research (Figure 2).

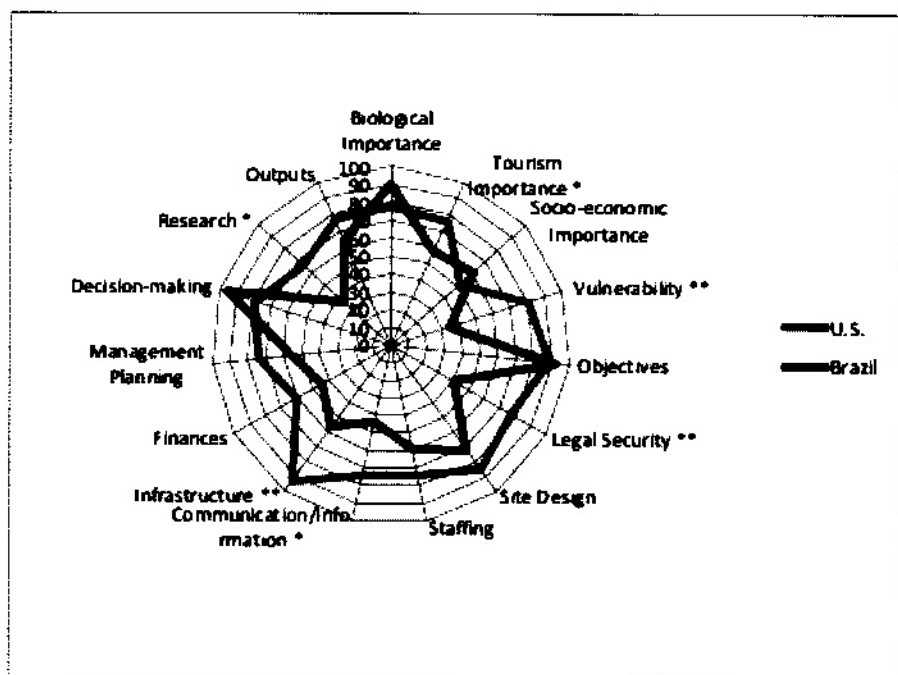


Figure 2. Park management effectiveness in Brazil and the United States.

Managers of U.S. parks, with double the number of annual visitors compared with Brazilian parks, indicated that biodiversity was still being conserved. In both countries, to maintain biodiversity with increased public use, 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 by improving facilities and services, there would be 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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