

Walking Tracks and Environmental Impact on an Urban Forest Remnant in Rio de Janeiro, Brazil

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Although ecotourism is recognized as a potentially valuable tool for sustainable development, it may lead to environmental impacts. Walking tracks, which can be perceived as being associated with low-impact activities, may be deleterious when the frequency of visitors is high and the area is not properly managed. Such is the case for urban forests in the city of Rio de Janeiro (Brazil), an example of which is discussed in this article. Walking tracks have the potential to bring positive social outcomes to developing nations, but an adequate management plan needs to be in place to mitigate possible ecosystem impacts.

Introduction

The United Nations Environment Programme (UNEP) has recognized ecotourism as a valuable tool for sustainable development, with the potential to sustain local communities while protecting the environment (Doan 2000; UNEP 2001). There are numerous definitions of *ecotourism* (Fennel 2001; Higham and Lück 2002), but in Brazil it seems to apply to any activity that brings people in close contact with nature that, in theory, causes no deleterious effect on it. However, *ecotourism* is a term so variedly used as to become almost meaningless (Paul Dingwall, pers. comm. 2003).

Although the deleterious effects of recreational activities on ecosystems are still poorly understood (Doan 2000), their impact has been documented in several studies (e.g., Cole and Marion 1988; Farrell and Marion 2001; Johnson 1967; Liddle 1975; Obua and Harding 1997), and these are positively correlated with frequency of visitors (Cole and Landres 1996; Obua and Harding 1997). Cessford and Dingwall (1997) discussed many effects associated with walking tracks:



Longtime friends and climbing partners Luiz Alexandre Valadão (left) and José Derraik (right) on Pão-de-Açúcar (Sugar Loaf). The area is surrounded by Floresta da Urca, an urban haven in Rio de Janeiro, Brazil.

impacts on flora (such as trampling of plants, tree bases, and roots), promotion of accelerated drainage, as well as soil compaction and structural disruption. Further, there are deleterious effects on fauna, such as behavior modification, deliberate and unintentional feeding of wildlife, not to mention the direct impact of collecting and hunting (Cessford and Dingwall 1997). The presence of visitors in remote areas may also expose free-ranging wildlife to diseases, such as the tuberculosis outbreak among banded mongooses (*Mungos mungo*) in Botswana (Alexander et al., 2002). However, to detect these environmental impacts, it is necessary to invest time and financial resources in adequate monitoring, which seldom takes place, particularly in the long-term.

There is anecdotal evidence that an increasing number of visitors are utilizing walking tracks in natural areas in Brazil, where such activities appear to be mistakenly perceived as “low impact” (Embratur 2001). In this article, we discuss the impact of a walking track on an urban remnant of the Brazilian Atlantic coastal forest.

Rio de Janeiro's Atlantic Forest, Walking Tracks, and the Degradation Process

Several of Brazil's natural areas are under threat, two of which were listed among the biodiversity hotspots of the world (Myers et al. 2000). One such area is the Mata Atlântica (Brazilian Atlantic Forest), which is arguably the most biodiverse ecosystem on the planet (Rocha 2000). In view of its global significance, the Mata Atlântica Biosphere Reserve was established in 1992 by UNESCO (Diegues 1995). This ecosystem has already been overexploited (Dean 1997), and little of the original forest cover is left. It is estimated that 97% of the area of the state of Rio de Janeiro was once covered by the Atlantic Forest, which is now reduced to about 20% (Tanizaki-Fonseca and Moulton 2000). Approximately 5% to 10% (ca. 29,000 km²/11,197 mi²) of its original area remains in the whole country (Fonseca 1985; Diegues 1995).

Lowland forests in their natural state are rapidly diminishing globally. Such areas are usually of economic significance, and, consequently, have been steadily replaced by settlements and agricultural land. Along the Brazilian coastline, little remains from the original cover of lowland forest ecosystems, with the larger remnants persisting in sites of more difficult access, as is the case in other countries, including New Zealand (Department of Conservation and Ministry for the Environment 2000).

The state of Rio de Janeiro harbors some of the largest remnants of the Atlantic Forest (Diegues 1995). In the city of Rio de Janeiro, however, even areas within national parks have been affected through illegal encroachment of human settlements, which occurs mainly via the expansion of *favelas* (slums), but occasionally also through the establishment of dwellings for the wealthy. Nonetheless, there are small remnants of the original Atlantic Forest cover that persist outside national parks and reserves. Most have undergone some level of modification, but may still harbor animal and plant species of conservation significance. In the city of Rio de Janeiro, one such area is likely to be Floresta da Urca (Urca Forest), which covers an area of about 50 hectares (124 acres), occupying the slopes surrounding two granite gneiss outcrops, Morro da Urca and Pão-de-Açúcar, on the shores of Baía de Guanabara (Guanabara Bay) (see figure 1). The area is located at the narrow (and only) entrance to Guanabara Bay, and is considered to be of national security importance, having consequently been controlled by the military for more than four centuries, which has protected the area to some extent.

Pão-de-Açúcar (Sugar Loaf) is a major national and international tourist destination. Although it has not been officially awarded the status of a park under any jurisdiction (municipal, regional, or national), it is protected as a “natural monument” under municipal (Prefeitura da Cidade do Rio de Janeiro 2006) and federal laws (Rambaldi et al. 2003). The local inhabitants are attracted to the area by its striking beauty, enhanced by the presence of a pleasant beach and the perceived safety provided by the 24-hour presence of the military. A paved walkway about 1.3 kilometers (.81 mile) long allows visitors to walk around the southern side of the mountains, providing easy access to the forest remnants. Until relatively recently, the tracks within these remnants were narrow and used primarily by rock climbers and a few locals. In the past two decades, however, the frequency of visitors to one particular track (leading to the cable car station on top of Morro da Urca) has increased considerably, leading to extensive erosion.

Although no data are available to quantify the actual impact, in early 2004 the deterioration of the forest surrounding the main track was already



Figure 1—Aerial photograph of Floresta da Urca (© 2010 photo by Google Earth).



Figure 2—Photographic evidence of environmental impact at the walking track at Floresta da Urca (February 2004). The original track was relatively narrow, but visitors move to the flanks using trees as an aid, frequently uprooting trees and steadily widening the path. Photo courtesy of authors.

blatant, with many physical effects being easily observed. Photographic evidence taken in February 2004 illustrates the erosion process (see figures 2, 3a, 3c). Several trees were uprooted and had consequently fallen (see figures 2, 3a, 3c), particularly in steeper sections. Numerous other trees were precariously standing, with large sections of their root system exposed and/or damaged (see figures 2, 3a).



Figure 3—Further evidence of degradation of the walking track at Floresta da Urca in February 2004 (a, c), and the same sections in April 2009, showing some improvement following the track recovery work (b, s). Photo courtesy of authors.

As the erosion made the track increasingly bare and slippery, people moved to its flanks, clinging on to the surrounding trees as aid during ascent and descent, increasing the stress load on the plants and aggravating the degradation pathway. The numerous visitors using the track and Rio's characteristic torrential summer rains exacerbated the process, as most visitors would avoid the slippery track and create shortcuts through the surrounding vegetation. As a result, the area affected by erosion was constantly deepening and widening.

This situation at Floresta da Urca is representative of the environmental impact occurring in other Atlantic Forest remnant sites in the region. For example, in the heart of the city of Rio de Janeiro lies the Parque Nacional da Tijuca (Tijuca National Park), one of the world's largest urban forests (32 km²/12 mi²), most of which was replanted or regenerated in the 19th century, since the original forest had been replaced primarily by coffee and

sugar cane plantations (IBAMA 1998; Freitas et al. 2006). The Parque Nacional da Tijuca still harbors important floral and faunal species, including birds and mammals of conservation significance (Freitas et al. 2006). Unfortunately, many of the tracks at Parque Nacional da Tijuca also show signs of extensive erosion due to unmanaged human visitation, similar to those observed at Floresta da Urca.

At Urca, however, instigated by the total inaction of authorities, volunteer organizations led by the local climbing federation decided to take some action to mitigate the track's steadfast degradation. The work on the track started in 2005, primarily consisting of building steps on steeper sections and fencing off shortcuts (see figure 4).

Despite the relatively rudimentary nature of the work carried out, the positive impact on many areas of the track is clear. In a number of steeper sections the erosion has been considerably reduced (see figures 3b, 3d). The steps allowed for easier progress up the track, minimizing the use of shortcuts and the consequent trampling of tree roots and surrounding vegetation (see figure 3b). Volunteer maintenance work appears to continue as, despite a formal agreement with the city council's environmental agency, little or no funding has been provided to assist in its maintenance (Waldecy Lucena, pers. comm. 2009).

Unfortunately, however, there has been a simultaneous and exponential increase in the number of visitors utilizing the track, although there is no actual data to adequately quantify it. The number of ecotourism ventures currently taking groups to the area is large (pers. obs.), and certainly many times above the carrying capacity of the existing track. For many people, the area is apparently seen as a gold mine, since it is easily accessible and there are no costs

associated with its use. Ecotourism is a completely unregulated business in Brazil, and literally anyone can proclaim him- or herself to be a guide. As a result, numerous so-called guides can be seen leading very large groups (including dozens of people at a time) into the area (pers. obs.). We observed that about 400 people per hour were passing through the track during a sunny autumn weekend. This huge influx is now also causing problems for the company that administers the Sugar Loaf cable car, with thousands more people utilizing their facilities at the station on Morro da Urca (Waldecy Lucena, pers. comm. 2009). As a result, the level of impact to the area is increasing, and, for example, the steps created cannot withstand the unforeseen influx of people in the long term. The current frequency of visitors, although not quantified, is certainly unsustainable in view of the complete lack of a management plan for the area.

One could argue that rather than protecting the forest, the easier access provided by the steps on steeper section may have actually helped boost the frequency of visitors, increasing the pressure on the local ecosystem. Although the work of the volunteer groups has been very laudable, the lack of proper oversight, funding, and a long-term management plan threatens the viability of the walking track at Floresta da Urca. Thus, this case shows that in areas with a high frequency of visitors, only an adequately funded management program would likely be effective in protecting the local ecosystem.

Problems and Potential Solutions

In the case of Floresta da Urca, since prohibition of human visitation would be unlikely and undesirable, only extensive track management would prevent further degradation and allow the ecosystem to recover. Management

measures could include the adoption of proper stairways, adequate educational signage, as well as proper closure of existing and potential shortcuts.

Unfortunately, there are no available examples of adequate walking track management of such areas in Brazil. Further, there seems to be an apparent lack of scientific input into tourism policy making and management in the country, particularly in relation to walking tracks. A 2001 workshop sponsored by Embratur (Brazilian Institute of Tourism) sought to prepare the National Plan for the Sustainable Development of Adventure Tourism (Embratur 2001), which would be used as a guideline for future policies. The environmental impact of different adventure sports was subjectively assessed, based on the perception of the members of the panel, who concluded that hiking causes minimum or no environmental impact. If such unrealistic ideas were to be reflected in government policies, it would open the way for uncontrolled access to areas of major ecological significance, with no management measures in place to control visitors' use and ensure maintenance of tracks.

Woodley (1993) suggested that the tourism industry should be treated in the same way as other industries, such as mining. Some level of monitoring and control is essential in order to ensure that impact is minimized and greed for short-term profit does not lead to more unsustainable environmental exploitation. Further, the use of walking tracks can be a sustainable activity, as long as they are properly managed. Adequate monitoring not only ensures that impact is minimized, but also creates a feedback loop to allow the establishment of any necessary mitigating measures, such as reducing the number of visitors allowed at any given time. Moreover, the use of signs and

displays can provide useful and interesting information, while educating people and encouraging them to be environmentally conscious.

Thus, in the case of the state of Rio de Janeiro, it is necessary to ensure that sustainable practices are in place, not only to minimize the environmental impact in areas of conservation significance, but also to secure future generations access to such locations—especially since other important conservation areas in the state are already threatened by tourism, such as Parque Estadual da Ilha Grande (Alho et al., 2002). In the case of city of Rio de Janeiro, urban forest remnants of considerable size are still present, despite its large population.

Importantly, one cannot underestimate the socioeconomic value of



Figure 4—Examples of the recovery work carried out by volunteer groups at Floresta da Urca. Photo courtesy of authors.

such areas. The experience of visiting native forests would likely be widely beneficial, particularly since Rio's forest remnants are accessible to a relatively large low-income population that would otherwise be unable to afford the costs associated with ecotourism.

The main obstacle is that similar levels of scientific and administrative input as those adopted in countries such as New Zealand are unlikely to occur in Brazil and in other developing countries. As a result, unsustainable growth of ecotourism in the form of unmanaged and increasing visitor frequency to areas of conservation significance could cause considerable environmental impact, without bringing any social or economical benefits to local communities. Ecotourism in the form of walking tracks has the potential to attract tourists and bring positive outcomes to developing nations, but an adequate management plan needs to be adopted to mitigate possible ecosystem impacts. It is likely that such plans would need to be developed on a case-by-case basis, as it would be at Floresta da Urca. This would be necessary to ensure that the local needs are met, and that the locally relevant issues are given the appropriate consideration.

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