

Recreational carrying capacity in hiking trails. Three case studies in protected areas in Nicaragua

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To accomplish the goals of nature conservation, the protected area management may need to generate economic benefits through non-extractive use such as ecotourism, even though this is not the primary purpose of a protected area. Therefore, it should be considered the number of visitors that can be accommodated. As Shelby and Heberlein (1986) defined it, Recreational Carrying Capacity is “the level of use beyond which impacts exceed standards”. In this study the aim is to provide a range capacity that will maintain the standards for the wilderness experience by applying a minimum regulation of tourists on the trails. The ecological or economic carrying capacity is not within the scope of this paper.

Methodology

Estimation of the carrying capacity of hiking trails in protected areas takes into account the specific physical conditions of the trails, the tourists' opportunities to experience the natural attributes of the site, and the management capacities of the protected area. The different components of RCC can be identified and estimated based on the particular conditions previously mentioned. The steps to estimate the carrying capacity starts out from Cifuentes (1992) and Somarriba et al. (2006) and are modified by the authors.

Spatial capacity (SC)

The spatial capacity (SC) is the theoretical maximum number of persons that can be admitted during a day, considering the space available along the trails. Used in the meaning of “number of people occupying specific areas or lengths” (USDI Bureau of Reclamation, 2004), but not considering their impacts like Shelby and Heberlein (1986). The figure is given by the relationship between the available space in the hiking trail and the number of hours available to visit the site (Cifuentes, 1992).

Social Carrying Capacity (SCC)

The social carrying capacity is the maximum number of visits that is possible considering the factors that could restrict the possibilities for appreciation of the area by the tourists under the critical minimum conditions of the site. There are limiting factors such as difficulty to walk on steep slopes or on inundated sections of the trail. These factors are defined according to the particular characteristics of the site. The SCC is estimated after applying the limiting factors to the SC.

Recreational Carrying Capacity (RCC)

The RCC is the maximum number of visitors that should be allowed considering the social carrying capacity of the hiking trails and the managing capacity of the reserve. This

is the critical level for recreational purposes, because it considers the social variables that will affect the tourists' enjoyment of the area. It is a function of the social carrying capacity and the managerial capacities of the protected area to provide the minimum conditions for the tourists and the maintenance of the trails and associated facilities in the site.

Management Capacity (MC) of the Nature Reserves

The management capacity is defined as the possibilities the administrators in a protected area have to develop tourism activities which meet the objectives of the protected area management plan (Cifuentes, 1992). The MC considers the infrastructure within the area, the equipment available, and managerial skills among the staff to implement and maintain tourism activities. For the estimation of the MC, variables such as legal authority, policies, equipment, competence of the staff, funding, infrastructure, and existing facilities are included in the rationale for assignment of values.

Main results

The results are presented in table 1, indicating each of the factors estimated, the two figures in Spatial Limiting factor correspond to 50 meters and 100 meters distance between groups of tourists. Giving a range of SCC and RCC estimated for each trail evaluated.

Conclusions

One of the main criticisms of applying carrying capacity is the difficulty to determine how much impact or change should be allowed (Manning et al. 2005; Papageorgiou and Brotherton 1999). As has been pointed out by Manning and Lawson (2002), managers need to be informed as much as possible by scientific data on the relationships between visitor use and resulting impacts. This type of information for protected areas in developing countries such as Nicaragua is not always available.

This RCC methodology allows identifying the physical factors that affect visitor impacts and the main constrains for the protected area management. It is an instrument for the administrators to improve the physical conditions and the management capacities of a protected area for tourist management. The methodology applied in this study is recommended for small protected areas. The sum of the trails' RCC does not provide the total RCC for the area. On the contrary, the lowest RCC rank is the one that limits the tourism operation.

Table I. Summary of Recreational Carrying Capacity (RCC) for the hiking trails in the Nature Reserves Mombacho Volcano, Datanlí-EI Diablo and Cosigüina Volcano

Nature Reserve	Mombacho Volcano		Datanlí-EI Diablo			Cosigüina Volcano		
Hiking trails	El Crater	El Puma	El Congo	El Leon	Campanero	Guacamaya	San Luis	El Humedal
Spatial Capacity (SC)	9436	6045	8236	9229	10603	2292	4187	6000
Limiting Factors	The spat LF has two values, as explained above, providing a SCC and eventually a RCC range.							
Spatial: spatLF (* include dead end correction)	0.09 0.17	0.09 0.17	0.09 0.17	0.09 0.17	0.09 0.17	0.05 * 0.09 *	0.05 * 0.09 *	0.09 0.17
Inundation: inunLF	0.99	0.99	0.99	0.97	0.99	1.00	1.00	0.96
Temporal closing: closLF	0.86	0.86	1.00	1.00	1.00	1.00	1.00	1.00
Precipitation: precLF	0.69	0.69	0.75	0.75	0.75	1.00	1.00	1.00
Social Carrying Capacity (SCC)	510 930	320 580	560 1030	610 1200	720 1320	110 210	200 380	520 960
Management Capacity (MC)	74 %		62 %			54%		
Recreational Carrying Capacity (RCC) persons per day	From 380 to 690	From 240 to 430	From 350 to 640	From 380 to 690	From 450 to 820	From 60 to 110	From 110 to 210	From 280 to 520

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