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Environmental carrying capacity and tourism development in the Maldives and Nepal

KATRINA BROWN[1,2*], R. KERRY TURNER[2], HALA HAMEED[2] AND IAN BATEMAN[2]
[1]*School of Development Studies, University of East Anglia Norwich, NR4 7TJ, UK, and* [2]*Centre for Social and Economic Research on the Global Environment, University of East Anglia and University College London*
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Summary

Tourism is regarded by many countries, particularly resource-poor countries, as a potential stimulus to the economy. Yet tourism, by the nature of the activities involved, is constrained by the natural resource base and infrastructure, and by the pollution and other environmental and social impacts of tourist numbers. Tourism development strategies of national governments have been diverse in the face of this complex relationship between the economic costs and benefits of tourism. This paper examines tourist development based on concepts of open access and renewable natural resources. The experiences of two economies highly dependent on tourism, the Maldives and Nepal, are compared and contrasted. Although these countries offer very different attractions to tourists, they are faced with similar problems in terms of adverse environmental impacts of tourism. The dominant impacts in both areas are those associated with solid waste disposal and water resources, compounded by the depletion of natural resources. Both countries are currently employing 'dispersal' techniques to overcome the adverse impacts of tourism, but such strategies do not address the fundamental problem of maintaining tourism revenues whilst minimizing environmental damage. Even if an ecological carrying capacity can be defined, the experiences of these two countries indicate that impacts on local communities may well exceed so-called cultural carrying capacity.

Keywords: ecotourism, carrying capacity, open access

Introduction

Large volume international tourism is primarily a phenomenon of the last fifty years, and global mass tourism to developing countries, including the two countries discussed in this paper, has developed on a large scale in the last two decades only. At a global level, the number of tourist arrivals has risen from slightly over 25 million in the 1950s to 443 million in 1990 (World Tourism Organization 1991). The World Tourism Organization (WTO) reports that tourist activity in terms of numbers of visits, has risen by 7% each year, with an increase of 12.5% in receipts, excluding international air fares. During the past decade there has been an average growth rate of 4% despite the world recession. The WTO has also estimated that global receipts will see an annual increase of 9% between 1990 and 2000. During these years, Asia and Oceania are expected to gain a larger proportion of global tourist demand, from 14.7% in 1989 to 21.9% by 2000. The volume of tourists is still increasing, an increase which looks likely to continue over the next few decades (see Hameed 1993).

This mass tourism is not without disadvantages. The impacts of tourism, on the environment and on local social, economic and cultural life, are often detrimental. This has been documented in a range of countries, both in the north and south, rich and poor nations. We will discuss some of these impacts and possible remedies. 'Alternative' tourism, highlighting the diversity of local cultures and their environments, has been suggested as a more appropriate form of tourism development for those parts of the developing world where 'mass' tourism has often been favoured by governments. Alternative tourism is seen as smaller scale, with more local opportunities, less economic leakage, and fewer undesirable impacts. However, as pointed out by Dearden and Harron (1994), the tourists undertaking this type of tourism are often interested in specific attractions, be they particular animals, mountains, cultural sites, or indigenous peoples. The sustainability of tourism is hence directly tied to maintaining the integrity of that attraction and mediating the interaction between the tourists and the attraction over time, such that interest is maintained. Therefore, it is important to assess not only the nature of the motivations and attraction, but also the feedback between them. If motivations, for example, demand a pristine tourism resource, yet the attraction cannot be maintained in such a condition due to the visitation itself, the resulting negative feedback loop may ultimately limit the number of visitors. This situation is reflected in the tourism life-cycle concept, as articulated by Butler (1980) and others.

This paper explores the relationship between tourism and natural resource degradation. The following section presents a theoretical analysis of tourism and the environment from an economic perspective as an open access problem, relating tourism to the concept of sustainability. The policies pursued

* Correspondence: Dr Katrina Brown Tel: +44 (0)1603 593529 Fax: +44 (0)1603 451999 email: k.brown@uea.ac.uk

in attempts to overcome them are then discussed in relation to two case studies, namely those of the Maldives Islands and Nepal. These two countries may appear to have very little in common, apart from being in the same continent. Indeed, their physical environments are starkly contrasting. The Maldives consist of more than 1100 tiny, low-lying islands dispersed in 26 atolls in the Indian Ocean. Nepal is a small, land-locked country containing the world's highest mountain (Mount Everest, or Sagamartha) and highest range, the Himalayas. They hold very different attractions for tourists. On the one hand, the Maldives offer coral reefs, watersports and beach resorts, whilst on the other hand, Nepal is famous for spectacular highland scenery, mountaineering, trekking and cultural tourism. In both cases, however, the tourists are attracted to the natural resources of the country. They have a number of other aspects in common: the rapid rise in visitor numbers, the importance of tourism revenue to the national economy, the apparent fragility of their environments, instances of degradation resulting from tourism, and some of the policy responses to increased tourism pressures.

Tourism and the environment: a conceptual framework

In the global tourism industry, nature tourism is becoming increasingly popular in terms of numbers of visitors. But part of this apparent increase is the result of the reorientation of marketing of tourist destinations to stress their charismatic environmental assets. A number of terms are used to describe such travel, with nature tourism and ecotourism being most widely used. *Nature tourism* consists of travel to a particular natural site largely for amenity and recreational purposes, and is, as we have said, a rapidly growing sub-component of global tourism. *Ecotourism* is distinguished from nature tourism as it includes some aspects of conservation or enhancement of the environment, a strong commitment to nature and a sense of social responsibility. The Ecotourism Society defines ecotourism as 'responsible travel to natural areas which conserves the environment and improves the welfare of local people' (Lindberg & Hawkins 1993, p. 8). This implies that some attempts are made to balance the needs of tourism, conservation and culture, that it is more pro-active in terms of not only stemming negative impacts to the environment, but also in some way trying to enhance the local environment.

Carrying capacity is generally used in ecological analysis to describe the population of a given species that can be supported indefinitely in a defined habitat without irreversibly altering the habitat. The term is controversial when brought into the sphere of the social sciences, particularly when used in the context of human carrying capacity at the global level (e.g. Zaba & Scoones 1993; Rees & Wackernagel 1994). Indeed the concept has been much criticized in its restricted view of human-environment linkages, and in largely ignoring the role of institutions. The term is increasingly used, as *tourist carrying capacity*, in the context of tourism and the environment. The most well known interpretation is that by Pearce (1989): 'carrying capacity is commonly considered as the threshold of tourist activity beyond which facilities are saturated (physical carrying capacity), the environment is degraded (environmental carrying capacity) or visitor enjoyment is diminished (perceptual or psychological carrying capacity)' (Pearce 1989, p. 169).

Within this narrow perspective on carrying capacity it is possible to isolate ecological, socio-economic and cultural carrying capacity, and this will be discussed in relation to our chosen case studies. Some aspects of carrying capacity are discussed below to test the usefulness of the concept in assessing the impacts of tourism.

In a wider sense, tourism, like any other activity with large-scale environmental impact, is linked to the concept of sustainable development. If sustainable development is regarded as a constraint on the present impact of economic activity (such as suggested in World Commission on Environment and Development 1987), then in the tourism sector, sustainability poses the question of whether thresholds of tourist numbers and impacts can be defined. From an economic perspective, can a 'safe minimum standard rule' be applied? Safe minimum standard is an economic concept encompassing the idea that natural resources can be utilized at a sustainable level, up to thresholds, which are often unknown. When these thresholds are crossed, irreversible impacts occur which constitute non-sustainable development and threats to livelihoods then occur. Such concepts have been used to describe the viability of protected areas in maintaining biological diversity (Hohl & Tisdell 1993), and the environmental and health impacts of pollution. We discuss the applicability of carrying capacity in the context of the tourism sector, but also in the wider context of sustainable development.

Tourism and open-access use of resources

Sites which attract tourists due to their ecological or landscape interest naturally possess significant economic value, in the form of both use and non-use value. However, because they are often also open access resources from the perspective of their use by tourists, the local population and even the national government concerned find it difficult to capture much of the site's scarcity value. Open access problems arise because of the difficulty of excluding visitors from sites and these lead to 'congestion' costs as visitation rates increase and each additional user reduces the welfare of other users (e.g. beach facility tourism or 'wilderness' park tourism). Existence values are even more troublesome in terms of local value appropriation and have most recently been recognized through such mechanisms as debt-for-nature swaps (e.g. Brown *et al*. 1993, p. 21). The overall effect of open access is such that the odds are against sustainable use and management of tourist sites and surrounding areas.

In those cases where a tourist site is essentially open access and is also free at the point of entry, usage will increase well

beyond the economically efficient level. In economic theory, the lack of entry price will mean that the scarcity value of the site will not naturally accrue to the locals or even to the national government. Instead it will be captured by the tourists as consumer surplus and by international tour companies who repatriate their profits abroad. When local suppliers try to increase their market-share the competition stimulated and lack of barriers to entry into the ecotourism market mean that prices get forced back down to a level equal to marginal costs. Thus local tourism profits and wage levels are kept at a relatively recessed level.

If, in addition, as is the case in our Nepal example, the tourist industry is conditioned by seasonal climatic variation, then usage rates and pricing will exacerbate the concentration of tourists during short seasons. An excess capacity of resources exclusively devoted to tourism in the 'off-peak' season compounds the processes resulting in leakage of the revenue and economic benefits, brought about by open access and general price competition.

Given these general conditions, the pressure on policy-makers in the countries that possess the tourism sites is to allow maximum utilization of the resource during the peak season, but then the questions of tourism congestion costs and unsustainable environmental damages and costs become pertinent. An increasing total volume of tourists utilizing the resource means more net profits, but these accrue at a diminishing rate of increase because of congestion costs which individual tourists impose on each other. As congestion becomes more intense, tourist demand (willingness to pay) falls and the marginal costs of tourism supply increase. Nevertheless, the tourist suppliers are encouraged to continue to expand 'theoretical' capacity, since the environmental damage costs are shared by all suppliers, while profits from each tourist are retained by the individual supplier. The process continues until profits are no longer positive, but by that time there is the very real danger that irreversible environmental damage effects and interrelationships will have been set in motion.

The end result is often heavily over-utilized local areas with severe pollution and resource degradation. In-built pressures further combine to push local and national policy-makers into a tourist trade which is based on 'high-volume and low-value added' packaged holidays. The sustainability potential both in environmental as well as in financial terms of such an industry is unlikely to be very high.

Nature tourism and ecological carrying capacity

Most natural sites and their supporting ecosystems (coral reefs, forests, mountain terrain and grasslands) are renewable resources in the sense that they can maintain their 'health' and 'integrity' in the face of external shocks and disturbance. The 'integrity' of an ecosystem is more than its capacity to maintain healthy functioning; it also relates to the notion of 'total diversity' (Norton 1992), which is the species and interrelationships that have survived over time at the landscape level. The maintenance of diversity therefore requires protection from irreversible impacts at the landscape level.

There is still, however, the thorny problem of rationally deciding the 'scale' from which to manage these natural sites and their supporting natural systems. What is required is a more or less precise idea of the tourist carrying capacity of an area: the degree and extent of stresses and shocks related to tourist activities that can be inflicted without destabilizing the 'integrity' of the natural systems.

This issue of 'scale' of tourist development is, to a large extent, in most cases, a public policy decision taken through planning regulations and the granting of concessions. This process may be assisted by the provision of information on the critical linkages between tourist numbers and environmental impacts. However, all scientific information contains inaccuracies and uncertainties such that it is often impossible to specify minimum viable populations and minimum habitat sizes for the protection of species (Hohl & Tisdell 1993), or to be predictive concerning other environmental impacts. Biodiversity conservation decisions always have to be based on a range of considerations, including ethical ones. Thus, it has been concluded that 'society may choose to adopt the safe minimum standard, not because it results from a rigorous model of social choice, but simply because individuals in the society feel that the safe minimum standard is the "right thing to do" ' (Bishop & Ready 1991).

Undue natural system stress and shock may be caused by the spatial and temporal peaking pattern that is so characteristic of the tourist trade. In Nepal, the vast majority of trekkers visit in the October to April period, and visits are concentrated in a small number of selected locations, such as the Annapurna Conservation Area and other mountain national parks. Given the issues outlined in this section, strategic options for tourism planners include adopting a strategy which disperses tourists both spatially and temporally, or alternatively relying on targeted 'honeypot' site concentration. Concentration usually takes place where the sites are relatively 'robust' in ecological terms and where carrying capacity can be augmented by human-capital investments.

Sustainable tourism management options

Open-access problems can be mitigated via a two-tier policy approach. In the first tier, basic questions of resource ownership have to be settled. Ownership with access control can be vested in the state (as in national parks), in the local community or in private agencies. In the second tier, a range of enabling policy instruments can be deployed in order to control access efficiently, and to safeguard ecological carrying capacities effectively, thereby ensuring sustainable utilization.

State ownership of land and marine national parks have historically charged only token entrance charges and have been subject to 'infrastructure' underinvestment. In many parts of the world, parks have been designed following notions of management imported from North America or Europe which are inappropriate for either conservation

(Adams & McShane 1992) or the integration of tourism. The results of protected-area designation have often been deterioration in the conservation of biological diversity and lack of integration into the local economy, signified by encroachment and by negative attitudes to such areas, particularly where there is wildlife which poses a threat to local life and livelihood (e.g. Newmark *et al*. 1993). Private ownership can prove to be more successful, both in financial and environmental terms, in certain specific circumstances. Rwanda's Parc National des Volcans provides an example (Boo 1990) where the entrance charge is sufficient to finance the operating costs of the park, and, as far as is possible, local goods and services are utilized in order to minimize the leakages from the local economy.

Given that nature tourism sites encompass human cultural and not just natural capital assets and value, ownership vested in the local community has much to recommend it. Such an arrangement also helps to sustain local livelihoods and to reduce value conflicts. A number of co-operative schemes for ecotourism have recently been established, for example Zambia's LIRDP scheme, Botswana's Chobe Enclave, and Indonesia's Siberut project (see Western & Wright 1994). Clearly, to be successful, the one prerequisite for a local community-based scheme is the prior existence of strong local institutions and capability.

The choice of enabling policy instruments to control access and manage sites sustainably should not be seen as a 'regulation versus pricing' choice. However, a tourist tax can provide revenue for sustainable management investments, but they are most efficient when levied at the local level, as site entrance fees which are collected and retained locally, rather than a nationally administered tax, such as tourist hotel room taxes, or airport taxes. The regressive nature of a flat rate tax can be modified by introducing price discrimination, with 'local' tourists paying a lower rate than 'international' tourists.

Quantity controls will still, however, play a significant role in any sustainable tourism management strategy. Barriers to entry in the tourist trade could be encouraged in order to stabilize supplier profitability. Thus prices may be deliberately set above marginal cost, or tourist capacity limits can be imposed. The overall control strategy must be to limit both the aggregate damage impact related to the total volume of tourists and the damage done by individual tourists.

This paper discusses the application of these concepts in the development of tourism in two countries, the Maldives and Nepal. This discussion is based on primary data collected from a tourism survey in the Maldives and on secondary data from published sources for Nepal. The analysis aims to demonstrate the utility of the conceptual framework outlined above in analysing the relationship between tourism and the environment, and in understanding the policy reponses to dilemmas of integrating tourism into sustainable development strategies. We have chosen these two countries as they provide highly contrasting physical environments and attractions for tourism, and yet they illustrate similar problems in terms of natural resource degradation and apparent conflicts between tourism development and sustainability.

Methods

In our case study of the Maldives, ecosystem stress was assessed through both quantitative analysis and through on-site questionnaire surveys with both resort operators and tourists. This information was then augmented by interviews with relevant officials. Estimates of ecosystem stress were related to the concept of carrying capacity. In order to assess whether the natural capital stock in the Maldives is being degraded by tourist pressure, three carrying capacity indicators were assessed: solid waste disposal (physical capacity); water quality (environmental capacity); and tourist perceptions (perceptual or psychological carrying capacity). Data for this exercise were gathered through three surveys as follows (questionnaires are reproduced in full in Hameed 1993):

- a survey of tourist resorts: mail questionnaires were sent to the 64 resorts operating between November 1991 and January 1992, with a relatively low response rate of 23%;
- a survey of tourist opinions: 100 questionnaires were distributed to tourists in the Maldives in May 1992, with 62 usable responses;
- interviews with officials and resort operators: 43 interviews, arranged with the assistance of the Ministry of Tourism, were conducted during May and June 1992.

Published sources were utilized to investigate similar issues in the case of Nepal.

Results

Tourism in the Maldives

Overview

Tourism in the Maldives provides a typical example of the clash between the financial rewards which tourists can bring to developing economies and the stresses which such tourist demand can impose on fragile ecosystems. In financial terms, tourism in the Maldives has been the main economic success story of the past few decades. From less than one thousand visitors in 1972, the collection of coral atolls which forms the tiny Indian Ocean state received over 178 000 visitors in 1991. Growth in tourist nights has exceeded an annual rate of 30% over this period and presently stands at over 1.7 million (see Fig. 1).

This massive growth in demand (which derives almost exclusively from Europe and Japan) has been met by a similar increase in capacity supply which has risen from just two pioneering resorts in the early 1970s, to 67 resorts spread over five atolls today. The impact of such growth upon the Maldive economy has been hailed as a great achievement (Maldive Ministry of Planning and Environment 1988; World Bank 1980, 1991). Total receipts have risen from US$ 15 million in 1981 to US$ 94 million in 1991, representing

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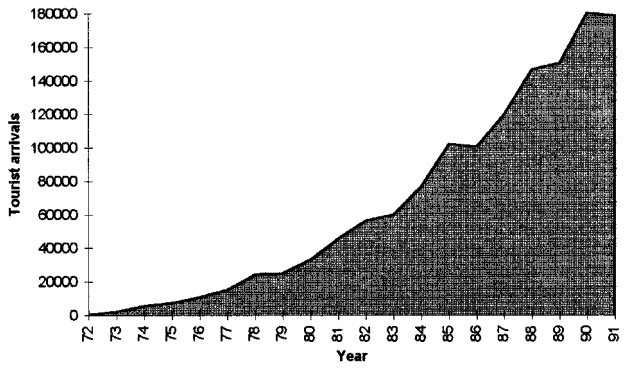

Figure 1 Tourist arrivals in the Maldives 1972-91. Source: Maldive Ministry of Tourism (1990).

some 60% of the country's foreign exchange earnings. Since 1985, tourism has consistently been the largest sector in the economy with a sectoral contribution of about 18%. There has been a direct employment benefit of roughly 81% of the labour force, and indirect benefits in the form of increased building construction activity and, to a lesser degree, a revival of local handicrafts (Hameed 1993). However these latter benefits are relatively small and, because of significant leakages and high import demands, tourism is not thought to generate a particularly high overall multiplier effect (Hameed 1993). For example, 91% of tourists in 1991 were on package tours, and overseas tour operators dealt with all but 0.6% of tourists whose arrangements were made through domestic Maldives tour operators. This indicates how much control overseas tour operators have over the tourism industry in the Maldives (see Hameed 1993).

Ecosystem stress: carrying capacity

Different aspects of tourism carrying capacity were assessed by examining waste production and management, tourist perceptions of environmental quality, and water availability and quality. The environmental impact of tourism, it should be noted, is disproportionate to tourist numbers, when compared to local inhabitants. Solid waste production by resorts was found to be considerable and, in per-capita terms, much higher than the Maldivian average, with resorts producing up to 16.5 kg of solid waste per visitor per week (Table 1).

Interviews with officials at the Ministry of Health indicate that resort waste production has been rising with tourist demand and is expected to expand at an increasing rate over the next decade. At present the majority of resort waste is either dumped at sea or incinerated. Evidence regarding the impact of such sea dumping is anecdotal. Domroes (1990, p. 69) notes that beaches are becoming polluted by waste from neighbouring tourist resorts, which has been washed ashore during the night.

Interviews with officials at the Ministry of Tourism confirm that such complaints are becoming increasingly common, while the resort survey indicates that operators are currently forced to spend US$ 300–500 per month on beach cleaning. However the problem does not seem sufficient to prevent loss of amenity and deterioration of local environment, a conclusion supported by responses to our survey of visitor opinion.

Table 2 shows that tourists generally perceive the resorts, beaches and the sea to be of high quality. In every case the 'very good' and 'good' categories were the two highest frequency groups of responses. These findings suggest that, at least in terms of tourist perceptions, resorts have adequately internalized the external waste stream costs of their operation.

However, considerable evidence exists to suggest that water availability and quality has declined as tourist demand has risen. Traditionally water was supplied both from groundwater wells and from rain-fed cisterns. The freshwater lens under the capital island of Malé was reduced from a thickness of 20 m in 1973 to stand at between 6–8 m currently (United Nations Environment Program 1986; Maldive Ministry of Health 1990). Furthermore, as indicated in Table 3, while concentrations of ammonia and nitrate have fallen somewhat between 1983 and 1990, the mean salinity of this depleted water-source has more than doubled during this period. Consequently, traditional sources now have to be supplemented by desalinated and imported bottled water.

The tourist opinion survey suggests that while a median group felt that the water quality was good (40%), some 28% described it as 'satisfactory', and 17% as 'poor' or 'very poor'. This is significantly worse than the trend for the cleanliness questions and suggests that certain respondents do perceive some problem with water quality.

Table 1 Waste production at three resort sizes by average population. Population estimates include tourism staff and assume mean occupancy rate of 62.9%, following Maldive Ministry of Tourism (1990). Source: Hameed (1993).

Resort size	*Bed capacity*	*Average population*	*Solid waste (tonnes per week)*	*Solid waste (tonnes per year)*
Small	75	100	0.77	40.15
Medium	150	200	1.50	80.13
Large	376	300	3.92	204.40

Table 2 Perceptions of tourists to the Maldives regarding resort cleanliness. Source: survey in 1991, reported in detail in Hameed (1993).

Aspect	*Excellent*	*Good*	*Satisfactory*	*Poor*	*Very Poor*
General cleanliness	39	41	14	4	<1
Beach quality	46	38	12	3	<1
Quality of lagoon (coastal waters)	63	30	6	<1	<1
Quality of diving site and reefs	56	37	6	<1	0

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Table 3 Potable water quality of private wells in Malé, 1983–1990. Source: Maldive Ministry of Health (1990).

	Year	*No. of samples*	*Range*	*Mean*	*Change 1983–1990(%)*
Electrical	1983	82	660–51000	3465	+66
conductivity	1990	82	780–22000	5764	
(microsiemens cm^{-1})					
Chloride (mgl^{-1})	1983	82	50–19500	750	
	1990	82	50–19600	1883	+151
Nitrate (mgl^{-1})	1983	77	1.3–106	26.3	
	1990	82	1.0–110	16.7	-37
Ammonia (mgl^{-1})	1983	82	0.01–95	8.16	
	1990	82	0.05–70	4.10	−50

Policy responses

Strategies to develop and regulate tourism were initiated in 1978 with the creation of the Department of Tourism and Foreign Investment. The present policy objectives of the government of the Maldives can be summarized as: open the industry to new entrepreneurs; increase accommodation capacity; standardize and improve the quality of services in the industry; protect the local population from negative social impacts; training, skill development and replacement of expatriate professionals; increase revenue from tourism; and promote the Maldives, tap new markets, and attempt to break the seasonal pattern in the industry. A number of important regulatory measures under this policy include a building code, sanitation code, electricity code and carrying capacity limitations for resorts.

However, Maldive policy currently addresses only one aspect of carrying capacity and refers only to land space. To maintain the natural beauty of the island environment, regulations state that the built environment should utilize no more than 20% of the total land area. Two-storey buildings are allowed only if there is enough vegetation to screen them from view. Water bungalows are allowed only to enhance the appeal of the resort and not as an alternative to lack of space on the island. This requires that, for every room built on the lagoon, equivalent space should be left aside on the island. As the Maldives markets beach tourism, the regulations require that there be five metres of beach for every room, every room be facing the beach, and 68% of the beach length be utilized for guest rooms in this way. Of the remaining beach space, 20% is allocated for general facilities, like the jetty, reception, and restaurants, and 12% has to be left as empty space between the guest rooms. The capacity of each island, according to the tourism authority, has to be determined individually, given the land area and the layout and design of the resort.

Tourism in Nepal

Overview

Nepal opened its borders to foreigners in 1951, but it was not until the 1960s that many westerners visited the country. The rise in Nepal's popularity as a destination for so-called 'adventure travel' began in earnest during the 1970s, when Kathmandu was the terminus for overland trips from Europe. Figure 2 shows this rise in foreign tourists, increasing from only 6179 in 1962, to almost 300 000 in 1991, with increases in recorded numbers of visitors almost every year. The majority of these visitors are attracted to Nepal's natural resources: in 1988, approximately 20% of visitors came exclusively to trek in the mountains, and an additional 60% came for some combination of trekking, jungle safaris, river rafting or ethnic tourism (Zurick 1992).

This rise in absolute numbers is paralleled by a rise in revenue from tourism, as shown in Figure 2. As in the Maldives, tourism is the largest foreign-exchange source for Nepal. Official figures indicate that receipts have risen from approximately US$ 78 000 per year in the late 1960s, to more than US$ 68 million in 1989. However, there are a number of negative aspects to this phenomenon. First, there are substantial leakages from the economy; little of the revenue is captured locally. Secondly, as illustrated in Figure 2, the revenue generated from tourism has decreased in the years since 1989.

There is some secondary evidence to suggest that the tourism cycle is being observed in Nepal. Zurick's study (Zurick 1992) of variations in the number of trekkers to various parts of the Himalayas shows a sequence similar to that proposed by Butler (1980). For example visitors to Annapurna, the most popular trekking destination, increased from 52% of all trekkers in 1980 to 68% in 1986. However, 1990 saw a drop in numbers back to 60% of the total, and Zurick claims this is because the area is commonly perceived to be overcrowded. Perception of environmental degradation and negative social and cultural impacts are reported and have perhaps affected people's decisions about which areas they visit and how long they stay in the country.

Impacts of tourism

Evidence from a number of studies indicates that severe degradation of the environment has occurred in some parts of Nepal as a result of tourism. Particular problems involve deforestation, solid waste management, sanitation and water supply, overgrazing (by pack animals), and erosion of paths and trails (see Zurick 1992; Brower 1991; Stevens 1991). These studies indicate that perhaps the ecological carrying capacity of these fragile mountain ecosystems has been exceeded. Whilst such impacts are fairly direct, and are caused by the increasing pressure of burgeoning numbers of tourists, other impacts may be more indirect. For example, Yonzon and Hunter (1991) discuss the habitat destruction caused by unsustainable farming practices used to produce cheese, a high-value product demanded by tourists in Lantang National Park. Table 4 summarizes some of the impacts of tourism in the three most-visited protected areas in Nepal: Sagamartha National Park, Annapurna Conservation Area, and Royal Chitwan National Park.

The needs of tourism often conflict with the needs of local people, and detrimental impacts on local society, in terms of economics and culture, have been reported by Zurick (1992). The increasing monetization of the Sherpa economy as a result of tourism development has meant that religious life appears less attractive. According to Zurick (1992), while tourism may help to safeguard the artefacts of culture (it has financed the reconstruction of local religious sanctuaries, for example), it may destroy the spirit that initially created them. The limit to what a culture can 'absorb' before social inequity and cultural decay occur is difficult to measure because it depends on the resilience of the culture, but the effects of exceeding that limit include increases in social inequity, changes in values, shifts of lifestyle, and increased frustration and antagonism. Zurick (1992) maintains that these conditions increasingly apply in some of the most frequented trekking routes in Nepal, where villagers frequently complain of inappropriate tourist behaviour and where reports of theft and violence to trekkers have increased.

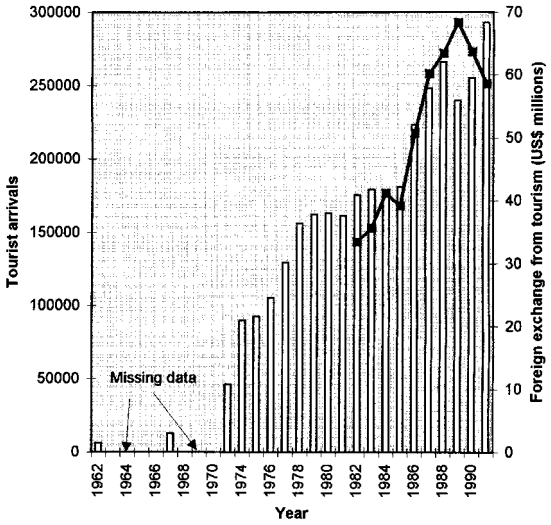

Figure 2 Foreign tourist arrivals, 1962–91, and foreign exchange earnings in Nepal, 1982–91. Source: Nepal Central Bureau of Statistics (1993).

Although there is consensus that a central objective of tourism in Nepal is to maximize revenue, little consideration has been given to whether government revenues from tourism should be substantially increased through higher fees and charges to state-owned protected areas, or through tourist taxes (Wells 1993). Despite some recent increases, the government of Nepal has not increased direct fees, possibly because of uncertainty as to the response of visitor numbers (the price elasticity of demand).

By providing large numbers of visitors with low-cost travel opportunities, Nepal has adopted an approach which contrasts with neighbouring Bhutan. Visitor numbers are strictly controlled in Bhutan, with visitors required to spend US$ 200 per day, compared with the average US$ 32 per day spent by visitors to Nepal (Wells 1993). Bhutan therefore captures much a greater share of the economic value of each tourist, with the added advantage of limiting the environmental and cultural impacts of tourism.

Although the Nepal government makes attempts to control the numbers of trekking parties visiting the mountains, there have been two main policy responses to these problems in Nepal. The first response is dispersal, opening new areas for trekking, such as Mustang, first opened to foreign visitors in 1992. The second response has been to try to capture more of the benefits of tourism at a local and national level, and to tie tourism to conservation of the environment and community development. This perhaps constitutes an overt attempt at ecotourism development (following the definition we outlined earlier) whereby human welfare, environmental concerns and tourism are explicitly linked in multiple objective projects. The Annapurna Conservation Area Programme covers one of the most popular areas of the Himalayas, and one which was suffering some classic negative impacts of tourism. The policy responses are now briefly described.

Policy responses

The classic 'dispersal' response: opening new areas to tourism. Government policy, as articulated through its Five Year Plan, calls for the diversion of tourists to newly-opened areas. This is seen as one way of overcoming the problems associated with overcrowding, as described above. However, this method of dispersal may simply shift problems to new areas, and little is known about the threshold level of tourism which can be sustainably maintained in fragile mountain ecosystems, such as those in Nepal Himalaya.

A cautionary tale comes in the form of a recent study by Shackley (1994) of tourism impacts in Mustang in the north of Nepal. This area was first opened to tourists in 1992, and initially tourist numbers were limited, with only 200 permits per year (March 1992). This was increased to 600, then 1000 permits by November 1992. The cost is set at US$ 700 for 10 days. However, even at current levels, after only eight months of tourism and despite strict enforcement of environmental regulations, Shackley's findings indicate that the cultural carrying capacity has already been exceeded with minimal economic benefits. There have been environmental impacts, even at this low level of visitors, and Shackley notes an increase in the amount of firewood collected, deposition of litter on trails, and other forms of visual pollution. There have been social and cultural impacts, including changes in local behaviour and possibly thefts of artwork. Local people have seen few benefits of these developments, and currently virtually none of the revenue generated through tourism is captured locally, although there are plans for the possible recycling of royalties through a conservation project. These impacts have led Shackley to the conclusion that cultural carrying capacity may be so sensitive that the threshold number of tourist visitors which do not substantially disrupt local livelihoods and cultural practices may be as low as fifty visitors per year (Shackley 1994, p. 23).

Linking tourism, conservation and development: the Annapurna Conservation Area Programme (ACAP). An

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Table 4 Tourism in Nepal's most visited national parks. Source: adapted from Wells (1993).

	Sagarmatha National Park	*Annapurna Conservation Area*	*Royal Chitwan National Park*
Area	1150 km^2	2600 km^2	900 km^2
Year established	1976	1986	1973
Terrain	High Himalaya	Foothills and high Himalaya	Lowland sub-tropical forest
Resident population	3000	4000	<1000 in park 250 000 outside boundary
Number of foreign visitors (1990/1991)	10 000	36 000	50 000
Principal visitor activity	Mountain trekking and mountaineering	Mountain trekking and mountaineering	Wildlife viewing
Environmental problems	Deforestation, poor sanitation and waste disposal linked to tourism and lack of infrastructure	Deforestation, poor sanitation and waste disposal linked to tourism	Excessive levels of tourism linked to ineffective management and high population growth outside park
Trends/ extent	Significant increases in future visitor numbers (though disputed) /deteriorating environment	Moderate future increase in visitor numbers/Prospects for a stable physical environment	Significant increases with deteriorating environment

alternative strategy is also being pursued by the Nepal government, which attempts to combine the objectives of promoting tourism, stemming environmental degradation and enhancing local livelihoods. The first large-scale programme was initiated in Annapurna, where the impacts of high levels of tourism had become very evident and internationally known. The Annapurna Conservation Area was designated a Multiple Use Conservation Area (a new designation of the Nepal government) in 1986. The designation covers an area of more than 7000 km^2, which has long been recognized as one of the world's most spectacular landscapes. The region harbours an outstanding array of both biological and cultural diversity, the attributes which have attracted so many visitors. More than 40 000 people live in the area, and the population is swelled by approximately 40 000 trekkers a year, who, when accompanied by their guides and porters, result in more than 80 000 visitors. These are not spread evenly through the year, however: the majority, over 60%, visit in four months of the year, namely October, November, March and April (Gurung & de Coursey 1994).

The project aims to increase revenue generated and set an entrance fee of 200NR (approximately US$ 10) in 1989, which was subsequently increased to 650NR (US$ 32) in 1991. This raised approximately US$ 200 000 in 1991, and the ACAP retains the revenue from entry fees. Trekking permit fees, amounting to approximately US$ 140 000 in 1991, are retained by the central government Department of Immigration. Local economic benefits are mainly restricted to lodge owners. There is some investment in community development projects, and community participation is facilitated through Village Development Committees. A number of environmental regulations have been put in place, on firewood collection and garbage disposal for example, and assistance is available to encourage lodge owners to install more efficient stoves and back boilers to heat water, and solar panels and heaters, and micro hydro projects are underway (see Gurung & de Coursey 1994; Pye-Smith *et al*. 1994).

Overall, the programme is perceived externally, and by the local population, as a radical attempt to capture locally more of the benefits and revenue generated by tourism, and to encourage environmental conservation (Parker 1997). A similar model is being adopted in other areas, notably in the Makulu-Barun Conservation Area in the Himalayas.

Discussion

The two case studies presented, although representing very different environmental conditions, have shown a number of common problems related to tourism development and the environment. In both case studies, environmental degradation accompanied a rapid rise in tourist numbers. Specifically, problems of waste disposal are common to both case studies, though the impacts of tourist waste on water quality are difficult to determine. A related problem involves a failure to capture the revenues of tourism, either locally or nationally. Both countries are highly dependent on tourism as a source of foreign exchange and have been committed to developing their tourist industries. Both countries seek to increase numbers of visitors, but also to increase the revenue from each visitor.

To date, the common strategy to try to overcome some of the local problems of environmental degradation, has been that of dispersal. In the Maldives, this has meant developing new atolls for tourism. In Nepal, new regions of the mountains have become available for trekking. Evidence suggests that environmental degradation continues, and looks likely to continue, despite the regulations which have been enforced in both countries. We conclude that the ecological carrying capacity has been exceeded in both instances.

In the Maldives, the economic impact of such degradation

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is difficult to assess but should eventually show in reductions in visitor rates most immediately amongst repeat visitors. As a rough estimate we can assume that one quarter of those who would otherwise visit again would decide not to. Currently over 178 000 tourists visit the Maldives annually, of whom almost 45 000 are repeat visitors. A reduction of approximately 11 000 visitors would imply a revenue loss of approximately US$ 7.9 million annually (based on the average revenue to the Maldive economy of US$ 79/day and an average stay of 9.7 days in 1991). Such an estimate may be rather high, as only 45% of respondents in the survey reported here perceived the beach, lagoon or dive site quality as crucial to their holiday experience. Deflating by such a proportion reduces the fall in repeat visitors to about 5000 annually implying a revenue loss of some US$ 3.6 million per year.

Although regulations are now in place which restrict the nature of tourist development in the Maldives, the expansion of the tourist industry is planned, and this will only occur through developing new areas, and exploiting new atolls. The indicators which we have examined suggest that the carrying capacity of the islands may have been reached, and that the environmental impacts of expansion of the industry may soon take their toll. One issue is whether policy can be implemented which enables revenue from tourism to continue to increase, whilst visitor numbers are restricted, a stated aim of the Maldives government.

In the Nepal case study there were also indications that so-called social and cultural carrying capacities have been exceeded, although these concepts are difficult to define and measure. For example, Stevens (1993) maintains that many reports have exaggerated the severity of tourism impacts in Khumbu, and have underestimated Sherpa adaptiveness, ingenuity and cultural resilience. Adaptation is highlighted by Dearden and Harron (1994) who report changes taking place among hill tribes in northern Thailand, where high visitation rates have caused a reduction of 'authenticity' of villagers (in terms of dress and other cultural icons), which have resulted in 'adaptive strategies'. These have been initiated by trekking guides and tour companies and have affected a transformation from primarily ethnic tourism to cultural tourism with a strong recreational emphasis. Similarly, negative social impacts are evidenced in Nepal. In the Sagarmatha Himalayan region, for example, Sherpas are becoming more wealthy, contrasting sharply with the living standards of nearby people who have not become involved in tourism (Stevens 1993). Increasing regional differentiation in wealth, in local inflation, out-migration, and changes in pastoralism and forest use may have long-term adverse effects, and threaten the possiblity of attaining more sustainable development goals.

Conclusions

In summary, we have found that the concepts of carrying capacity and open access are useful in the analysis of the environmental and social impacts of tourism. The case studies both demonstrate that an expansion and dispersal response to increasing tourist numbers is likely to lead to environmental degradation. In addition, defining a carrying capacity for tourism development, by identifying critical thresholds for particular indicators is difficult, but not impossible. However, it may be more difficult to assess the social and cultural impacts of tourism; these may be extremely critical in certain areas. Further, there is an overwhelming need to capture more of the revenues from tourism at the local and national level and thus avoid leakages. From an economic perspective the open access nature of many resources which attract tourists to scenic areas prevents the capturing of significant parts of the potential revenue locally. Even if it were possible to capture revenue effectively and limit numbers to some well defined ecological carrying capacity, the impacts of tourism on local cultures and social maldistribution of the benefits of tourism are likely to remain critical.

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