# Ecological Economics Criteria for Sustainable Tourism: Application to the Great Barrier Reef and Wet Tropics World Heritage Areas, Australia[1]

*Sally Driml and Mick Common*
*Centre for Resource and Environmental Studies, Australian National University, Canberra, ACT 0200, Australia*

**The paper examines the extent to which tourism in the Great Barrier Reef and Wet Tropics World Heritage Areas can be said to be sustainable. To do this it provides a definition of sustainable tourism for protected areas, in terms of ecological economics criteria. Tourism, and its management, in the two World Heritage Areas is described, and the outcomes are assessed against the definition of sustainable tourism. The available data is not sufficient to permit a definitive overall assessment. However, a favourable interim verdict appears justified against environmental criteria in the case of the Great Barrier Reef. There is in both cases a dearth of suitable data for proper assessment against economic criteria. The criteria proposed and the assessment exercise reported provide a contribution to developing ways to evaluate sustainable tourism.**

## Introduction

North Queensland, Australia, has two adjacent World Heritage Areas (WHAs). The Great Barrier Reef WHA is based upon the world's largest coral reef system. The Wet Tropics WHA preserves the majority of Australia's remaining tropical rainforest. These two protected areas are major attractions for a large and rapidly growing tourist industry in North Queensland.

This paper examines the extent to which tourism in these protected areas can be said to be sustainable. It begins by offering a definition of sustainable tourism for protected areas which is drawn from an ecological economics approach to resource use assessment. Then we describe the main features of tourism to and in the two WHAs. Next we outline the management regimes in place, and in the following section we assess those regimes against our definition of sustainable tourism. The final section offers some conclusions.

## Defining Sustainable Tourism in Protected Areas

There has been considerable debate over the concept and meaning of 'sustainable development' since the term was popularised in the 'Brundtland Report' (otherwise *Our Common Future*, World Commission on Environment and Development, 1987). That report defined it as development that:

> seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future.

In Australia a number of working groups were set up in 1990, to report to the Prime Minister on the implications of the pursuit of ecologically sustainable

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development for several sectors of the economy. One of these looked at tourism. Its report (Commonwealth of Australia, 1991) did not attempt a definition of sustainable tourism development, but did enunciate a number of arising principles and characteristics, which included:

> *Improvement in material and non-material well-being*: An ecologically sustainable tourism industry will be one which considers carefully the quality of experiences offered, as well as simply numerical outcomes…
>
> *Intergenerational and intragenerational equity*: An ecologically sustainable tourism industry would not diminish the range of educational, recreational and environmental activities available to present or future generations … Species diversity and ecosystem integrity cannot be replaced or substituted … tourism ventures should deal cautiously with risk…
>
> *The protection of biological diversity and the maintenance of ecological processes and systems*: Tourism development should occur in such a way which maintains biodiversity and supports the maintenance of ecological processes…

Several authors have provided definitions of sustainable tourism, or discussed actions required to approach sustainable tourism, which address the full range of environmental, social, cultural and economic aspects of this complex subject (for example Pigram, 1990; Butler, 1991; Hunter, 1995). We propose a definition of sustainable tourism that draws on ecological economics, a relatively new interdisciplinary branch of study that addresses 'the relationships between ecosystems and economic systems in the broadest sense' (Costanza, 1989: 1). The purpose of this is to focus on the proper measures of benefits and costs of tourism, and on the critical relationship between investment in management of tourism and sustainable use of natural environments.

We are concerned here only with tourism in protected areas, i.e. areas such as National Parks or WHAs where legislation controls private sector commercial, and individual recreational, activity in the interests of conservation. In such areas, we propose that sustainable tourism can be defined relatively simply in terms of two criteria:

(1) Tourism must be compatible with the conservation of the existing natural environment
(2) Tourism must provide a non-declining stream of net economic benefits

Considering only protected areas simplifies one area of dispute in the debate over the meaning and implications of sustainable development, and leads directly to the first of these criteria. The dispute concerns the possibilities for substitution between natural and man-made capital. Most economists take it that such substitution is possible so that sustainability/sustainable development requires that the size of the total, man-made and natural, capital stock is constant or increasing. However, some argue that the substitution possibilities are quite limited, so that sustainability requires that stocks of natural capital are maintained intact (see Pearce *et al*., 1989 for example). The matter is actually quite complicated as it involves not only, as is often implied, substitution in

production, but also substitution in consumption (see Common, 1995). It is conceivable that an area of the natural environment could be converted to a range of 'Disneyland' type developments which could provide a stream of economic benefits equal in size to, or greater than, that based on the original natural environment. However, in the case of protected areas the dispute is effectively resolved. For protected area natural environments, a clear social decision has been made that such substitutions are not acceptable. Sustainable tourism in protected areas, by definition, requires the maintenance of constant levels of natural capital.

The two criteria together mean that the pursuit of economic benefits from tourism is constrained by the need to avoid environmental damage. It is important that it is net economic benefits that are considered. The distinction between gross and net benefits involves two dimensions. First, economic benefit measurement should take into account investment in management to maintain natural capital; that is, to avoid and repair environmental damage to the protected area. The relevant benefit stream is that arising after such costs have been met. Second, there is a distinction between financial flows associated with tourism and the economic benefits to be properly attributed to it. The economic benefits of tourism are often, incorrectly, discussed in terms of total tourist expenditure. This includes the costs of the inputs to the tourism industry, which are not available for alternative uses by virtue of use in the tourism industry, and so overstates tourism benefits. Total tourist expenditure, on the other hand, understates economic benefits in so far as it is an incomplete measure of the satisfaction that tourists derive from their experiences. However, as discussed in Driml & Common (1995) the data for the proper measurement of the net economic benefits from tourism are rarely available.

According to standard economic criteria, the objective for managing some part of the natural environment is the maximisation of the present value of the sum of the net benefits arising from *all* uses of the area: see Driml & Common (1995) for example. In figuring the implications of pursuing such an objective, the relative values of uses are to reflect consumer sovereignty criteria. The fact that private recreation and conservation benefits are not, generally, fully registered in markets does *not* mean that they are treated as irrelevant in standard economics. In the last two decades economists have done a lot of research into methods for measuring non-marketed environmental benefits, with the objective of having them included in this sort of planning (for example, Pearce *et al*., 1989; Dixon & Sherman, 1990). The costs to be measured include the actual costs incurred in making the benefits available, plus any losses to one class of benefit arising as the consequence of delivering some other class of benefit. To the extent, for example, that commercial tourism reduces the benefits of private recreation, that reduction is properly treated as a cost attributable to commercial tourism.

The management plan emerging from such a standard economic approach could involve ongoing environmental deterioration. In relation to use of the area for tourism, it would not, therefore, satisfy the definition of sustainable tourism given above. Meeting that definition would require that the maximisation objective be constrained by the condition that natural capital stocks be maintained intact. Insistence on such constraints arises from the ecological economics

approach. In protected areas there are, by definition, constraints in place which are intended to serve the conservation criterion. Whether the constraints in place in any area are sufficient to realise the conservation objective is an empirical question.

The context for tourism in protected areas is as an activity in competition with other potential uses. To the extent that tourism is considered more environmentally benign than other potential uses, it becomes a favoured use. This is evidenced in the many protected areas where extractive uses are banned or limited and tourism is allowed to continue. In such situations, investment in management to avoid or repair damage is the only way to provide for sustainable use where the tourism activity potentially causes impacts. Critical to the whole issue is whether impacts are able to be ameliorated by adequate management or are irreversible. The impacts of tourism are likely to fall into both categories. Where impacts are considered irreversible, satisfaction of the conservation criterion will require constraints that prevent such impacts.

## Tourism to the Great Barrier Reef WHA and the Wet Tropics WHA.

The Great Barrier Reef Marine Park was established in 1975 and the area was inscribed onto the World Heritage List in 1981. The Great Barrier Reef WHA covers an area of 344,000 square kilometres adjacent to the north-east coast of Australia. The rainforests of mainland north-east Australia are represented in the Wet Tropics WHA. This WHA came into effect in 1988. It is 9000 square kilometres in size. Amongst the features which cause this area to be of World Heritage status are the occurrence of representatives of 13 of the world's 19 families of primitive flowering plants. At some places on the coast, where the rainforest meets the fringing reefs, the two WHAs lie side-by-side. Both areas satisfied all four of the criteria of outstanding universal value for inclusion in the World Heritage List.

In both WHAs protection of the natural environment is the primary management objective. The Great Barrier Reef WHA is managed as a multiple use area, with the major uses being commercial tourism, private recreation and commercial fishing. The Great Barrier Reef Marine Park Authority is a Commonwealth Government agency with responsibility for managing the area, in association with the State of Queensland's Department of Environment and Heritage. With the creation of the Wet Tropics WHA, logging of the rainforest was banned. The current major activities in the area are commercial tourism and private recreation. A number of transport, water storage and municipal functions continue. The Wet Tropics Management Authority is a government agency of the State of Queensland and operates in association with the State's Department of Environment and Heritage and the Department of Primary Industries' Forest Service.

The congruence of the attractive and interesting natural environments of reef and rainforest, in a tropical setting, has made the region of coastal north-east Australia a very popular tourist destination. When interviewed, tourists to the area nominate the climate, the Great Barrier Reef, and increasingly, the rainforest as the major attractions of the area. Domestic tourism from other parts of Australia is the backbone of the tourist industry. The most popular months to

visit are in the Australian winter, as the majority of Australians live south of this tropical area. Visitors from overseas are making up an increasing percentage of visitors (Driml, 1994).

Most visitors to the Great Barrier Reef WHA visit by boat on day trips departing from coastal towns in North Queensland. Boat sizes range from those carrying less than ten passengers, providing SCUBA diving, sailing or game fishing trips; to vessels which carry 300 to 400 passengers on day trips to permanently moored pontoons at reef sites. These trips offer the activities of snorkelling, SCUBA diving and reef viewing from glass-sided semi-submersible vessels. In addition, there are tourist resorts on a number of the islands within the Great Barrier Reef WHA. Recreational fishing and boating is popular with local residents, using a fleet of over 24,000 small privately-owned boats.

People who visit the Wet Tropics WHA also mainly visit on day trips. They may drive themselves (in their own cars or hire cars) or take a commercial tour. Transport on commercial tours is provided by 4WD vehicles, minibuses, coaches, river boats and a scenic train. The commercial tours generally feature commentary on the natural environment and opportunities to walk in the rainforest or cruise on rivers flowing through it.

Tourism to both WHAs has increased dramatically in the last decade. The number of visitor days spent on the Great Barrier Reef and the number of vessels supplying commercial trips have doubled in ten years. Around two million visits were made on commercial tours in 1994 (Driml, 1994). It is estimated there were 4.7 million visits to individual sites in the Wet Tropics WHA in 1993 (Manidis Roberts, 1994). The city of Cairns is the most used departure point for reef trips and is the largest source of accommodation for visitors to the Wet Tropics WHA. Predictions for tourism to the Cairns region are for a doubling over the years from 1993 to the year 2001 (Office of the Co-ordinator General, 1993).

Given the current state of data availability, the most reliable indicator available of the 'value' of tourism is gross expenditure by tourists. It is estimated that tourists and local residents visiting for recreation spend approximately $A776 million per annum in the local economies so that they can visit the Great Barrier Reef WHA. An additional $A377 million per annum is spent by visitors to the Wet Tropics WHA. These estimates are based on expenditure on commercial trips and private recreation trips into the WHAs plus accommodation in adjacent areas: they do not include the cost of travel to North Queensland. Together, the WHAs provide a resource base for an industry worth over $A1.1 billion in gross expenditure terms (Driml, 1994).

The financial value of tourism is much greater than other competing active uses in these two WHAs. Some other active uses have been prohibited in both areas; mining and oil drilling in the Great Barrier Reef WHA and logging in the Wet Tropics WHA. The catalyst for the establishment of the Great Barrier Reef Marine Park was a concern that prospective exploratory drilling for oil would damage the reef. As a result, the potential oil reserves have not been investigated, so that the opportunity cost of prohibiting oil exploration and possible production is not known.

The continuation of logging of rainforest in the Wet Tropics WHA was not seen as compatible with conservation and so logging was banned in the area in

1987. The gross value of sales of sawn timber from the region was in the order of $A25 million per annum at the time (Driml, 1991). Logging quotas were anyway due to decline as a result of scientific advice that yields from virgin rainforests were declining, so there was little prospect for timber industry growth. The growth in rainforest tourism in the last decade has resulted in the situation where today the annual gross expenditure on tourism is ten times the gross value of timber production in 1987, in real terms.

Tourism in the Great Barrier Reef WHA currently co-exists with commercial fishing. Commercial fishing in the Great Barrier Reef WHA has a gross turnover of approximately $A128 million per year (Driml, 1994). The returns to fishing are relatively constant. The area supports a multi-species fishery which is probably operating near its maximum sustainable yield, within constraints which include areas closed to fishing. It is possible that in the future, demands for the expansion of tourist use will bring tourism and commercial fishing into conflict, if the tourist industry wants more reefs closed to fishing or available for recreational fishing only.

## Management of the WHAs

The creation of the Great Barrier Reef Marine Park in 1975 and its listing as a World Heritage Area in 1981 predated the popularisation of the notion of sustainable development by Brundtland (World Commission on Environment and Development, 1987). Management of the Great Barrier Reef as a protected area has worked towards similar aims to those promoted via this newer terminology (Kelleher & Driml, 1988). The Wet Tropics WHA is a more recent creation but prior to listing, much of the area was managed as National Park or State Forest and the management of tourism in these areas also had similar aims. An integrated set of management approaches has been developed and is constantly evolving. Some of the main features of these approaches are as follows.

### Prohibited uses

Underpinning management of these two WHAs is legislation that promotes multiple-use within a sustainability constraint. However, as already noted, some uses of the areas are banned by legislation — mining or oil drilling in the Great Barrier Reef WHA and logging in the Wet Tropics WHA. Some activities in which reef tourists may wish to indulge are banned by legislation; these are spear fishing on SCUBA and taking fish over a certain length. The relevant legislation requires all other uses to be controlled so as to be consistent with conservation of the natural environment.

### Zoning plans

For both WHAs, zoning is used as a primary management tool. Zoning plans are developed in consultation with users and other interested members of the community. The entire Great Barrier Reef Marine Park has been divided into four sections and zoned, with reviews of zoning occurring every five to ten years. The draft of the first zoning plan for the Wet Tropics WHA was released for public

comment in October 1995. The following discussion is therefore largely based on experience with the Great Barrier Reef Marine Park.

Zoning controls tourism by delineating where it is excluded and where it is an allowed activity, subject to commercial tour operators obtaining a permit. Some areas of the Great Barrier Reef Marine Park are set aside as Preservation and Scientific Research Zones and are not to be entered for general tourism and recreation. Some areas are closed on a seasonal basis to protect nesting birds and turtles. Some areas are zoned for no commercial or recreational fishing and therefore are the equivalent of terrestrial National Parks in Australia. These areas are open to tourism and recreation of the 'look but don't take' type. Other areas allow fishing with controls and are thus available for fishing by tourists and local people. In some areas tourist infrastructure, mainly consisting of permanently moored pontoons, is allowed. Other areas are zoned for 'no structures' and are therefore open only to vessels anchoring on a daily basis. The net result of zoning is that tourism is potentially allowed in the majority of the Great Barrier Reef Marine Park, but is further controlled by the requirement for operators to obtain a permit and abide by permit conditions.

### Management plans

Management plans provide a further level of control between broad zoning and individual operator permits. The need for management plans to guide decisions on use has arisen mainly due to increased demand for tourism to specific sites, in both WHAs. Management plans can specify sites available for particular uses, and limits on numbers of people and activities. Management plans have been developed for some individual reefs and islands, or groups of such, for the Great Barrier Reef, and more are scheduled. Draft plans are being developed for areas within the Wet Tropics WHA. Public participation is a feature of plan development in both WHAs. In both cases, the management plan is the place where issues have to be faced about reducing current levels of tourism or at least restricting future growth. Delays have been experienced in finalising management plans in both WHAs due in part to the need to take hard decisions, often in the absence of conclusive information on ecological or amenity limits.

### Permits

All tourist operations in both WHAs require permits. Permits are the means by which precise control is exercised over actual sites of operation, numbers of people allowed at sites, and conditions of operation.

In the Great Barrier Reef WHA, permit requirements have evolved over time and reflect scientific knowledge about actions that can be taken to minimise environmental impact. The conditions on any individual permit reflect the complexity of the operation and potential impacts. Examples of permit conditions include requirements that permanent moorings be installed at sites to prevent the damage done when vessels use anchors on a daily basis. Another condition is a requirements for larger vessels to have holding tanks for sewage so that there is no discharge at reef sites. Such conditions are being applied where relevant.

Proposals for larger tourism operations that involve permanently anchored structures require formal environmental impact assessment before any approval

is given. Operators may be required to post performance bonds that cover the cost of removal and rehabilitation should the structure be damaged or abandoned. Operators may also be required to fund scientifically designed monitoring programmes. In the Great Barrier Reef WHA, permits for tourist operations have a life of six years and are transferable, subject to the operation remaining substantially the same.

In the Wet Tropics WHA, permits are required for tourist operations, which are mainly bus tours. Permits are issued for one year to three years and are non-transferable. Permit conditions specify the number of passengers that may be carried and the sites which may be accessed.

### Entry fees

Entry fees charged on commercial tourist operations are used to collect funds for management. They are not intended to ration use, and at 1 to 2% of average trip price, are not high enough to have this effect. In the Great Barrier Reef Marine Park, the charge is $1 per head. In the Wet Tropics WHA, the charge is $1.15 per visitor who spends up to three hours in the protected area and $2.30 for visits of more than three hours. Fees collected in the Great Barrier Reef Marine Park are allocated in a transparent manner between park management and research. Tourist industry representatives form the majority on the board that allocates the research funds.

### Industry participation

Tourist industry participation in management takes a number of forms. Individual operators and industry associations have input into the development of Zoning and Management Plans, industry is represented on Consultative Committees, and the Wet Tropics WHA has an informal tourism liaison group that meets regularly with managers. Within industry, moves are being made towards developing self-regulation and accreditation schemes. The tourist industry as a whole supports the principles of conservation and minimising environmental impacts. There is, however, a general expectation that the industry will expand.

### Education

The education of tourists and tour operators, about the natural environment and how to behave to minimise impact, is facilitated by the dissemination of printed material, information displays at or near sites, and training courses for tour operators.

### Research and monitoring

The management agencies for both the Great Barrier Reef WHA and the Wet Tropics WHA have budgets and programmes for research and monitoring. Additional research is undertaken in universities, the Australian Institute for Marine Science and the Commonwealth Scientific and Industrial Research Organisation. Recently, Cooperative Research Centres (CRCs) were established for both the Great Barrier Reef WHA and the Wet Tropics WHA. These centres have strong links with the tourist industry. This should facilitate industry

involvement in conducting research into minimising impacts of tourism and communicating results back to operators. Prior to the establishment of the CRCs, research and monitoring of tourism was not a priority and was done on an *ad hoc* basis.

### Facility provision

A major management tool in the Wet Tropics WHA is the provision of infrastructure which allows access to sites of interest but which contains impacts to 'hardened' sites. Over the last five years, a sum of $A10 million has been invested in capital works to bring facilities up to standard for current visitor numbers, whilst minimising environmental damage. The infrastructure provided includes new or improved boardwalks, tracks, day use areas, camping grounds, roads and visitor information centres. On the Great Barrier Reef, a programme of installing public boat moorings at sensitive sites has commenced. Much of the infrastructure for tourists at reef sites is provided by commercial tour operators.

### Incorporating the views of traditional owners

The inclusion of indigenous aboriginal people in land and resource use decision making is in very early stages in the two WHAs. Systems have recently been set up to consult aboriginal people on the issue of permits and development of zoning and management plans in the Great Barrier Reef. Discussions are being held with aboriginal people with an interest in the Wet Tropics WHA on possible joint management agreements for areas within the WHA. The implications for the management of tourism are not clear at this stage.

## Evaluation against Criteria for Sustainable Tourism

We now review the management of these two WHAs against the two criteria introduced in the section on 'Defining Sustainable Tourism in Protected Areas' above. In both cases the environments are among the most diverse and complex on earth, and have been managed for a relatively short time, so that comprehensive and definitive evaluation is impossible. Rather, we present an overview and summary of current assessments, noting gaps in knowledge.

### Conservation of the existing natural environment

For both WHAs, the physical area actually used for tourist activities is a small proportion of the total protected areas. For example, the Great Barrier Reef WHA contains 2900 individual reefs and 950 islands. There are resorts on 22 islands. The number of vessels with permits to conduct tourist operations is around 540. The operations of these vessels are concentrated on reefs which are at a return day trip distance from major ports. The Draft Wet Tropics Plan identifies current tourism infrastructure nodes at less than 1% of the area and areas surrounding roads at less than 2% of the area (WTMA, 1995).

A recent review of the impacts of tourism in the Great Barrier Reef WHA brought together published information and the observations of users and scientists (Carey, 1993). The information available is the result of a number of projects conducted over the last decade.

The facilities and activities associated with tourism may potentially cause a variety of types of impact. A list of those identified by Carey for the Great Barrier Reef WHA include:

- site impacts from structures, moorings and anchoring
- coral damage from diving and reef walking
- removal of coral and shells
- garbage disposal and littering
- sediment disturbance and dredging
- water pollution — nutrients
- heavy metal pollution
- oil pollution
- sewage discharge from vessels
- sewage discharge from island resorts
- impacts on bird and turtle nesting
- fishing impacts
- fish feeding impacts
- impacts of research and monitoring

This review shows that tourism does have a range of impacts and that the severity of the impacts depend upon the level of control exercised. Carey noted that there are solutions to many of these impacts but they require investment in technology (e.g. sewage treatment, permanent moorings) or operational actions to avoid impacts (e.g. banning the use of anti-fouling paint on vessels, avoidance of fish feeding). The review did not reveal any evidence of widespread or serious biophysical impacts attributable to tourism. The impacts observed are localised and are chronic rather than acute. Potentially ecologically significant impacts such as disruption to the nesting of rare bird species have largely been avoided through management. Impacts such as coral damage by swimmers are cumulative and can reduce the aesthetic appeal of sites even if not ecologically significant.

In the Wet Tropics WHA, tourism is concentrated in a few areas with road access and within a return day trip distance from Cairns. This includes some of the last coastal rainforest remaining (after clearing for agriculture and residential use) and there is concern that this area may be vulnerable to impacts exacerbated by tourism, including road kills of the fauna and minor clearing inadvertently reducing the populations of rare flora. There is only one reported study on impacts of tourism — on impacts of walking tracks (Graham, 1994) — and minimal ongoing scientific monitoring of sites. No comprehensive assessment has yet been conducted of the impacts of tourism in the Wet Tropics WHA.

The most realistic approach to the maintenance of natural environment conditions is to focus on the processes of avoiding impacts. These include; environmental impact assessment, insistence on adoption of proven avoidance techniques (regardless of cost), research into minimum impact technologies and operations, and monitoring of activities with the ability to take action if conditions are deteriorating. These steps are well developed for the Great Barrier Reef WHA but less so for the Wet Tropics WHA. The 25-year strategic plan for the Great Barrier Reef WHA (GBRMPA, 1994) promotes the application of the precautionary principle which places the burden of proof on proponents of new activities, but it is too soon to assess the effectiveness of implementation of this principle.

## A non-declining stream of net economic benefits

In order to historically evaluate tourism against this criteria, one would need time series data on net economic benefits for the two WHAs. Such data are not available. A full data set would identify: economic benefits to tourists and commercial operators, costs of running commercial operations, expenditure on management, and estimates of the economic value of any environmental damage that is not ameliorated. Only with this information can the full social benefits and costs of tourism, and trends in these, be assessed.

In respect of future tourism, several actions would need to be taken in order to at least establish the conditions for non-declining net benefits. Due to the presence of external effects of tourism on the environment, and on other tourism, the market cannot be relied on to deliver net economic benefits and so management action is warranted. Two actions are suggested.

The first is to ensure adequate investment in management of the type described in the section on 'Management of the WHAs' so that all the constraints to minimise environmental impact are maintained. Adequate investment in management to maintain the quality of the protected area both for natural environment values and as a resource for tourism, is critical to sustainability. The criteria of non-declining net economic benefits requires that attention be paid to costs of management (whether funded by the private or public sector). Better documentation of who pays for management, and who benefits, will allow more informed assessment of the most equitable and efficient ways of funding management. Currently, Government provides over 95% of the funding for management of the WHAs (Driml, 1994). This funding may not be adequate to maintain environmental quality. The Great Barrier Reef Marine Park Authority is concerned that funding is not keeping up with the management demands resulting from increases in levels of use (GBRMPA, 1993).

Opportunities exist for a greater contribution from tourists and the tourist industry to management costs. However, it should be recognised that the imposition of regulation to avoid environmental damage has the effect of internalising many costs to tourist operators. Thus tourists and operators already pay through higher costs of operation in the managed areas. The requirement for operators to take out performance bonds is an economic instrument which requires them to bear a greater proportion of the true risk of operating in a protected area.

The entry fees currently charged are nominal and neither regulate use nor raise a significant proportion of management funds. There may be scope for raising entrance fees without reducing visitor numbers. Research into demand functions would provide managers with information on the likely effects of different levels of fees on visitor numbers.

The managers of the WHAs have not yet made any move to capture resource rent by other means, for example, by auctioning permits. All operators have been awarded permits on application or have purchased permits along with businesses (allowing the original operators to capture any rent). In an environment where there are increasing limits being placed on use and increasing demand for use, the potential for generation of resource rent exists. The option of capturing resource rent and using this for management should be investigated.

The second action suggested is to pay attention to the nature of demand for tourism in the WHAs with a view to managing for quality of experience. In the case of the two WHAs, it can be expected that the interest in nature-based tourism that is evident internationally and in Australia (Commonwealth Department of Tourism, 1994) will continue to support tourism demand for these areas. Demand for particular destinations can change, however, if affected by perceptions of the destination as crowded, excessively developed or suffering environmental damage (Butler, 1980).

The issue of maintaining the attractiveness of sites is important to maintaining non-declining net benefits. The negative effects of crowding and excessive infrastructure development are generally externalities to individual tour operators and so market processes cannot be depended upon to optimise tourism development. In addition to, or instead of, controls for environmental conservation *per se*, management agencies together with tourist operators might need to set limits on use and development in order to retain attractiveness. It is likely that there is a range of demands from tourists for different 'settings', from wilderness to more intensive use. The Draft Wet Tropics Plan incorporates a recreational opportunity spectrum (Clarke & Stankey, 1979) which describes appropriate settings and activities in areas designated to different opportunity classes.

The management agencies of both WHAs have recognised the need to maintain attractiveness to visitors. Several research projects currently underway are aimed at better understanding the demands and perceptions of visitors and how they might react to different levels of visitor numbers or infrastructure. It is important to note that it is not only the number of visitors to an area that is relevant to net economic benefits. The price visitors are prepared to pay is also relevant. Some visitors will be prepared to pay a premium to visit 'wilderness' or secluded sites, so limiting numbers does not necessarily limit revenue earned.

Projections of tourism to the Cairns region based on econometric modelling of past trends is for a doubling in visitor numbers by the year 2001 over 1993 levels. The question of whether tourist use of the WHAs should be allowed to grow in concert with this expected growth rate should take into account the possibility that increasing tourist numbers could lead to increased costs or decreased revenues over time if the attractiveness of the area is diminished. Environmental constraints will also determine opportunities for expansion of tourism. This question of growth will be the greatest challenge to managers in the coming years. Dealing with it will require good information on the nature of net benefits from tourism, and on the management costs involved in accommodating the growth to the environmental conservation constraints.

## Conclusions

The Great Barrier Reef and Wet Tropics WHAs are internationally recognised for their natural environmental values, and maintenance of these values is the primary aim of management of these areas. It is imperative that any tourism allowed in these areas be sustainable in terms of the natural environment and very desirable that it be sustainable in terms of net economic benefits. As Australia is a developed country, with a commitment to ecologically sustainable development and considerable scientific expertise available, it should have an

advantage in getting management of tourism in protected areas 'right' in terms of sustainability. When management of tourism in the Great Barrier Reef and Wet Tropics WHAs is judged against the criteria for sustainability put forward in this paper, no conclusive findings can be made. The intention is clearly there to manage tourism to minimise impacts while allowing visitors to enjoy access. The wide range of techniques adopted for management have been outlined in this paper. However, evaluation of outcomes is limited.

If the first criteria for sustainability put forward in this paper is to be applied, it is critical that management agencies have the information to manage so as not to deplete natural capital. Monitoring and research on environmental impacts of tourism has to date been *ad hoc*, though better progressed in the Great Barrier Reef WHA. There is evidence that the situation will improve through the research efforts of the new Cooperative Research Centres. At a broad level, it seems that tourism in the Great Barrier Reef WHA is sustainable in terms of natural capital. There is very little objective evidence in respect of the Wet Tropics WHA. However, the facts of the small area actually visited and the recent large investment in infrastructure to minimise biophysical impacts, could be taken as suggesting that the area's natural capital is not currently threatened. Questions remain in respect to both areas, and vigilance through adequate monitoring over time is required.

It has been proposed that a non-declining stream of net benefits is the second important criteria for sustainable tourism. Information is not being collected to allow an assessment of whether the benefits of allowing tourism outweigh the costs, or what the trends are in this respect. A critical feature for meeting both criteria is adequate investment in management, including research and monitoring, to support tourism. If the costs of necessary management begin to outweigh the benefits of tourism, the desirability of tourism should be questioned. Similarly, if net benefits decline due to reductions in amenity, management agencies should take action to find a better balance. Currently the agencies are not collecting the information to assess the net economic outcomes of their investments and policies.

The ecological economics approach put forward in this paper utilises two criteria as a fairly simple test for sustainability in the specific context of protected areas. The approach highlights the need for better evaluation of outcomes of tourism management, and could be usefully applied to other protected areas.

## Note

1. This is a revised version of a paper presented at the Third Conference of the International Society for Ecological Economics, Costa Rica 24 to 28 October 1994.

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