EcoLogically Sustainable Visitor Use of Australia’s World Heritage Areas

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ECOLOGICALLY SUSTAINABLE VISITOR USE OF AUSTRALIA’S WORLD HERITAGE AREAS

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SUMMARY

Objectives
This report is one of a series in the Sustainable Tourism Corporative Research Centre’s overall project to develop a framework, guidelines and tools to enhance assessment, evaluation and reporting of visitor use in protected areas. In this report we review the approaches management agencies have taken to research and assess ecologically sustainable visitor use of Australia’s World Heritage Areas. We also review how they assess performance in managing visitor use. World Heritage Areas are popular tourism and recreation destinations with internationally significant conservation values. Research, assessment and reporting processes for World Heritage Areas are better resourced than for other protected areas. Therefore, how agencies research, assess and evaluate the pressures and threats associated with visitor use should represent Australian best practices.

Methods
We review the approaches taken by management agencies using published literature, predominantly organisational documents and reports, and academic publications including book chapters and conference papers).

In Chapter 1 we describe the characteristics of Australia’s World Heritage Areas including location, size, tenure and management.

In Chapter 2 we review key pressures and threats to Australia’s World Heritage Areas and identify the extent to which management agencies report visitor use as a threat/pressure to natural values. This includes direct impacts from activities and visitor infrastructure, as well as impacts such as the introduction and spread of exotic species which are facilitated by visitor use.

In Chapter 3 we identify international and national requirements for reporting on the state of conservation and integrity of Australia’s World Heritage Areas. The requirement for agencies to report to the World Heritage Commission has led to the development and implementation of research and assessment programs. However assessment approaches vary greatly and all agencies are in the process of improving their research and assessment.

In Chapter 4 we review the research and assessment approaches undertaken by management agencies for the conservation and protection of World Heritage Areas. This includes research into World Heritage values; as well as research and assessing the status or condition of species, populations and ecosystems; identifying and assessing the status of threats and pressures; and measuring the effectiveness of management programs/plans/strategies. In the main, the current focus of such research into the sustainable management of visitors involves identifying and quantifying biophysical and social impacts of visitors, assessing visitor numbers and patterns of use. There is limited assessment of the effectiveness of visitor management plans and strategies, however there is increasing awareness of the need for such processes.

From the review (Chapter 4) we identify four agencies which are currently the most advanced in Australia in developing and implementing research programs on visitor use, and in some cases, long term monitoring programs of visitor use. In Chapters 5 to 8 we report on these agencies and their approaches in terms of how visitor use is managed, what indicators are used in assessment, what types of collaborative research arrangements there are with external research organisation/s, and if managers used evaluation data for adaptive management that is, to improve conservation management. The Tasmanian Parks and Wildlife Service appears to be the most advanced in using research and assessment to improve decision making and therefore improve conservation (adaptive management) (Chapter 5). The Great Barrier Reef World Heritage Area illustrates Australian best practice in strategic ecological research and assessment, including that of visitor impacts (Chapter 6). However, there is little evidence that assessment programs have been used to provide feedback on the effectiveness of management plans.

The Wet Tropics illustrate best practice in strategic visitor assessment of both social and biophysical impacts (Chapter 7). The Gondwana Rainforests of Australia (formerly known as the Central Eastern Rainforest Reserves, CERRA) illustrate a approach based on compiling ad hoc research data to provide information for World Heritage periodic reporting in four themes—protecting, conserving, presenting and rehabilitating World Heritage values (Chapter 8).
Finally, in Chapter 9 we assess the extent to which agencies have developed and implemented seven key steps required for adaptive management and provide recommendations for achieving ecologically sustainable management of visitor use.

Key Findings

- Sustainable tourism (visitor use) is recognised as an appropriate use of World Heritage Areas, and many World Heritage Areas have very high levels of visitation.
- Agencies report that visitor use is not sustainable for most of Australia’s World Heritage Areas as a result of inappropriate levels of visitation and/or inappropriate activities.
- There are international and national requirements for agencies to monitor and evaluate their performance, including in the management of visitor use.
- Management agencies vary in their approach and even for those with the most advanced approach, visitor impact evaluation is a work in progress. Specifically:
  - Few agencies identify/recognise the full range of potential impacts from visitor use.
  - Few agencies are assessing all identified impacts. None have assessment programs that are adequate to trend in resource condition over time.
- Agencies recognise that they need to implement assessment programs to determine if management plans/strategies are effective.
- Although the introduction and spread of exotic species is recognised as a threat or potential threat for all of Australia’s World Heritage Areas, this process is not recognised in reports as being facilitated by visitor use.
- The literature review indicates that only a few agencies report that they have formal systems in place for implementing adaptive management—that is, utilising the results of assessment programs to improve conservation.

Conclusions

- Visitor use is a key pressure/threat, so sustainable tourism is a target rather than a reality.
- Assessing the ecological impacts of visitors is still limited in all World Heritage Areas.
- Improved processes for collecting, storage, analysis of data as well as reporting and applying results of assessment and research are needed as currently sustainable visitor use of World Heritage Areas is a work in progress.
- Greater investment in research on sustainable tourism development is needed. This was identified as a national priority in Australia’s first periodic report to the World Heritage Commission (EA 2003).
- Many agencies are limited by inadequate financial and staff resources for assessing visitor use including impacts.

Future Action

For ecologically sustainable management of visitor use management agencies should generally:

- know what visitor use is occurring in the Area (who, where and when)
- based on information of visitor use and general and specific recreational ecology research recognise the range of potential biophysical (ecological) impacts of visitor use
- formulate clear, concise statements or objectives for visitor use including recognising that visitor use has biophysical (ecological) impacts which are threats or pressures to natural values
- develop specific management plans and strategies for attaining the identified objectives of ecologically sustainable visitor use
- implement systematic, strategic monitoring to provide data on condition and change in condition as a result of visitor use
- assess and report on the ecological sustainability of visitor use and on achievement of management objectives for visitor use based on information from assessments
- take corrective actions necessary to achieve planned results.
Recommendations

Australian protected area management agencies need to:

- develop a consistent approach to assessment and reporting
- develop greater expertise in assessment and evaluating visitor impacts or utilise external expertise such as in research organisations
- have assessment and evaluation for visitor impacts which are integrated into overall management evaluation frameworks
- have clear funding arrangements for research and assessment to identify threats/pressures, determine baseline condition and measure change in ecological condition over time at prioritised locations
- integrate information obtained from assessment including monitoring programs into management (adaptive management).
Chapter 1

AUSTRALIA’S WORLD HERITAGE AREAS

The World Heritage Convention was established in 1972 by the United Nations Educational Scientific and Cultural Organisation (UNESCO) to identify and protect the world’s outstanding natural and cultural heritage. As of December 2006, there were 830 properties in 138 countries on the World Heritage List, with 644 listed for cultural values, 162 for natural values and 24 listed for both natural and cultural values (UNESCO 2006). The World Heritage Committee, the main body in charge of implementing the World Heritage Convention, has developed criteria for the inscription of properties on the World Heritage List. Countries that have signed the World Heritage Convention are committed to the six major principles of identifying, protecting, conserving, presenting, transmitting to future generations, and, if necessary, rehabilitating the values of World Heritage Areas within their jurisdiction. Since 1995, signatory countries are required to systematically monitor and report on their World Heritage Areas based on the framework identified in the Operational Guidelines for the Implementation of the World Heritage Convention (UNESCO 2005).

Australia has been a signatory to the World Heritage Convention since 1974 and currently sixteen Australian sites of universal natural and/or cultural significance are listed as World Heritage Areas. Three are listed for outstanding natural and cultural values, twelve for outstanding natural values, with one listed solely for cultural values (Table 1).

Listed in order of their year of inscription, they are:

- Great Barrier Reef (1981)
- Kakadu National Park (1981 Stage 1; 1987 Stage 2, and 1992 Stage 3)
- Willandra Lakes Region (1981)
- Tasmanian Wilderness (1982 natural values, 1989 cultural values)
- Lord Howe Island Group (1982)
- Gondwana Rainforests of Australia (formerly known as the Central Eastern Rainforest Reserves) (1986 extended 1994)
- Uluru-Kata Tjuta National Park (1987 natural values, 1994 cultural values)
- Wet Tropics of Queensland (1988)
- Shark Bay, Western Australia (1991)
- Fraser Island (1992)
- Australian Fossil Mammal Sites (Riversleigh/Narcoote) (1994)
- Heard and McDonald Islands (1997)
- Macquarie Island (1997)
- The Greater Blue Mountains (2000)
- Purnululu National Park (2003)
- Royal Exhibition Building and Carlton Gardens, Melbourne (cultural values only) (2003) (EA 2003, DEH 2006a) (Figure 1).

Given their outstanding and universal natural and cultural values, the management of World Heritage Areas should be of the highest standard. In Australia, management is complex due to the variety of tenures under which land is reserved, the often conflicting demands of stakeholders, and the involvement of 11 separate management jurisdictions; six State agencies, two self governing Territory agencies, the Australian Government agency (Parks Australia) and, where multiple land tenure exists and multiple resource uses are pursued, joint Queensland-Australian Government agencies, the Great Barrier Reef Marine Park Authority and the Wet Tropics Management Authority have been established.

Australia is a signatory to other international agreements relating to the environment and conservation which affect the management of its World Heritage Areas. These are the Convention on Biological Diversity, the Convention on Wetlands of International Importance (Ramsar Convention) and the UNESCO Man and the Biosphere Programme (MAB) which also provide for designation of internationally important sites. Biosphere reserves differ from World Heritage and Ramsar sites in that they are not designated exclusively for protection of unique areas. The objectives of management of these reserves include research, monitoring, training and demonstration, as well as conservation (HRSCEH 1995, EA 2003). These conventions are implemented through the Environmental Convention and Protection of Biodiversity Act 1999 in the same manner as the World
The status of most reserves comprising Australia’s World Heritage Areas is that of National Park (Category 2) which is defined by the IUCN as a:

natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible (IUCN 1994) (Table 1).

However, Lord Howe Island, the Great Barrier Reef Marine Park, and the Gondwana Rainforests of Australia are managed for multiple use and Macquarie Island and Uluru-Kata Tjuta National Park are Biosphere Reserves (HRSCEH 1995, EA 2003).
Management is in accordance with principles set out by the IUCN World Commission on Protected Areas (WCPA) and World Heritage legislation under three styles of management arrangement. The Australian government is directly responsible for the two World Heritage Areas located on external island Territories (Table 1). For properties not directly controlled by the Australian government, there are bilateral State-Australia Government arrangements for funding and management, although day to day management and land planning are the responsibility of the State or Territory agency where the property is located. For Kakadu and Uluru-Kata Tjuta National Parks, traditional Indigenous owners hold title and lease World Heritage Areas back to the Australian government for conservation and overall management. However, day to day management is undertaken jointly (HRSCEH 1995, EA 2003). The tourism industry is involved with the management of World Heritage areas in a variety of ways. Tourism interests are represented on the boards of Kakadu and Uluru-Kata Tjuta, on consultative committees in Tasmania and at Uluru-Kata Tjuta and Kakadu, and on liaison groups associated with the Great Barrier Reef and the Wet Tropics World Heritage areas (HRSCEH 1995, EA 2003).

Figure 1: Location of Australia’s World Heritage Areas

(1) Heard and McDonald Islands; (2) Macquarie Island; (3) Tasmanian Wilderness; (4) Australian Fossil Mammal Sites (4a Narcoote; 4b Riversleigh); (5) Lord Howe Island; (6) Gondwana Rainforests of Australia; (7) Willandra Lakes Region; (8) Shark Bay; (9) Uluru-Kata Tjuta National Park; (10) Kakadu National Park; (11) Fraser Island; (12) Wet Tropics of Queensland; (13) Great Barrier Reef; (14) Greater Blue Mountains; (15) Purnululu National Park; (16) Royal Exhibition Buildings and Carlton Gardens (listed for cultural values only).
<table>
<thead>
<tr>
<th>World Heritage Area</th>
<th>Area (ha)</th>
<th>Date of inscription</th>
<th>¹Inscription criteria</th>
<th>Managed by</th>
<th>Tenure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Australian Fossil Mammal Sites (Riversleigh / Naracoorte)</td>
<td>Qld 10 000 SA 300</td>
<td>1994</td>
<td>¹Natural (ii)(iii)</td>
<td>Qld Environmental Protection Agency (EPA); SA Dept of Environment &amp; Heritage (DEH).</td>
<td>Qld National Park, SA Conservation Park.</td>
</tr>
<tr>
<td>3. Fraser Island</td>
<td>181 000</td>
<td>1992</td>
<td>¹Natural (ii)(iii)</td>
<td>Qld Environmental Protection Agency (EPA).</td>
<td>National Park, Wetland Reserve, township areas, Commonwealth land.</td>
</tr>
<tr>
<td>4. Greater Blue Mountains</td>
<td>1,3000,000</td>
<td>2000</td>
<td>¹Natural (ii)(iv)</td>
<td>NSW National Parks &amp; Wildlife Service (DEC, NSW).</td>
<td>Seven National Parks, one Karst Reserve.</td>
</tr>
<tr>
<td>6. Heard and McDonald Islands</td>
<td>Heard Island 36,800 McDonald Islands 1,800</td>
<td>1997</td>
<td>¹Natural (ii) (iii)(iii)</td>
<td>C'Wth of Australia Antarctic Division of the Federal Department of the Arts, Sport, the Environment, Tourism &amp;</td>
<td>IUCN Category Ia (Strict Nature Reserve).</td>
</tr>
</tbody>
</table>

¹Inscription criteria according to the World Heritage Convention.
### ECOLOGICALLY SUSTAINABLE VISITOR USE OF AUSTRALIA’S WORLD HERITAGE AREAS

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<th>¹Inscription criteria</th>
<th>Managed by</th>
<th>Tenure</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Macquarie Island</td>
<td>16,205,975</td>
<td>1997</td>
<td>¹Natural (i)(iii)</td>
<td>Tasmanian Parks &amp; Wildlife Service, C'wlth of Australia.</td>
<td>Tasmanian Parks &amp; Wildlife Service manages MI &amp; smaller islands &amp; reefs &amp; surrounding water to 3 nautical miles. The Commonwealth of Australia has jurisdiction over marine areas from the limit of Tasmania's territorial waters to 12 nautical miles. Biosphere Reserve</td>
</tr>
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### ECOLOGICALLY SUSTAINABLE VISITOR USE OF AUSTRALIA'S WORLD HERITAGE AREAS

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<th>1Inscription criteria</th>
<th>Managed by</th>
<th>Tenure</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. Wet Tropics of Queensland</td>
<td>894,000 ha</td>
<td>1988</td>
<td>1Natural (i)(ii)(iii) (iv)</td>
<td>Ministerial Council; Qld Wet Tropics Management Authority (WTMA) &amp; board; day to day management by Qld Government Departments.</td>
<td>National Park, Environmental Park, State Forest, Timber Reserve, Aboriginal Reserve, leasehold &amp; defence purpose reserves, private freehold land.</td>
</tr>
</tbody>
</table>

**Key:**

1 **Natural criteria**
- (i) outstanding example representing major stages of earth’s evolutionary history;
- (ii) outstanding example representing significant on-going ecological and biological processes;
- (iii) as an example of superlative natural phenomena;
- (iv) containing important and significant habitats for in situ conservation of biological diversity.

2 **Cultural criteria**
- (i) represent a masterpiece of human creative genius;
- (ii) an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;
- (iii) bearing an exceptional testimony to a past civilisation;
- (iv) be an outstanding example of a type of building or architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;
- (iv) directly associated with living traditions of outstanding universal significance (v) as an outstanding example of traditional human land;
- (vi) directly associated with living traditions and beliefs of outstanding universal significance (UNESCO 2005).
Chapter 2

PRESSURES AND THREATS

Australia’s World Heritage Areas face a range of threats and pressures that are the direct result of human activities both within their boundaries and in nearby areas (EA 2003). For some, growth in regional populations has significantly increased demand for access and use of resources such as water and timber. Industrial and agricultural development in nearby areas including use of pesticides and fertilizers, logging and human encroachment on boundaries also threaten integrity. For example, in the Great Barrier Reef the greatest threat is sediment in runoff from the mainland and increased nutrient loads from farming and agriculture which reduce water quality and impact biodiversity of marine ecosystems (GBRMPA 2006). Global warming is an important threat for all World Heritage Areas (EA 2003).

For almost all World Heritage Areas, human actions and activities have had ecological impacts. World Heritage Area Listing does not change current land uses of reserves unless they threaten the universal natural and/or cultural values. For example, on Lord Howe Island the residential community undertakes normal day to day activities, in other World Heritage Areas, grazing, recreational and commercial fishing, mining and tourism continue to operate (HRSCEH 1994, EA 2003).

Managers have identified that inappropriate or increasing visitor use and the development of infrastructure are significant threats to World Heritage values (EA 2003). Other major threats are the introduction and spread of exotic species (weeds, feral animals and pathogens) and uncontrolled or inappropriate fire regimes. A major response to these challenges is to improve the effectiveness of protected area management which will require a significant increase in human and financial resources (Eagles et al. 2002).

Visitor Use

The national parks and protected areas of Australia, particularly World Heritage Sites, are important destinations for national and international nature-based tourists (Driml and Common, 1995, Buckley 2002a). Sustainable tourism and recreation are considered legitimate uses of World Heritage Areas and are the main means by which World Heritage values are presented to the public in keeping with the objectives of the World Heritage Convention (UNESCO 2005). However, one of the greatest threats to World Heritage Areas in developed countries comes from visitor use. There is widespread recognition that tourism and recreation can damage the environment, and that such damage must be avoided if visitor use it to be sustainable (Leung and Marion 2000, Eagles et al. 2002, Newsome et al. 2002, Buckley 2004a, 2004b, Pickering and Hill 2007). Impacts inevitably arise from too many people, in concentrated areas, particularly at peak times. Some effects, such as trampling of vegetation, are limited to specific sites. Other effects, such as weed invasion caused by physical disturbance or by visitors as weed vectors, impacts on biodiversity from water use and pollution or physical alteration to landscape by the construction of roads and infrastructure, occur over wide areas (Sun and Walsh 1998, Leung and Marion 2000).

Agencies apply the concept of sustainable visitor use through developing a range of plans, policies, and strategies to minimise the negative environmental impacts of visitor infrastructure and activities; while maintaining the quality of the visitor experience and maintaining the economic benefits of protected areas (Eagles et al. 2002). This includes managing the supply of tourism opportunities, zoning for types of visitor use, managing demand through restrictions of length of stay or total numbers or type of use, managing the resource by hardening sites or developing facilities; and managing the impact of use by dispersing or concentrating use (Eagles et al. 2002). There is agreement between managers and researchers that strategies to manage visitation which maximise social and economic benefits and minimise impacts are best achieved through strategic planning which includes monitoring impacts, monitoring the effectiveness of plans and implementing adaptive management (Leung and Marion 2000, Eagles et al. 2002, Buckley 2004a, 2004b).
Direct impacts of visitor use

Visitor activities and the construction and use of infrastructure have a range of direct impacts on all ecosystem elements—soil, vegetation, wildlife and water (Sun and Walsh 1998, Buckley 2002b, Buckley 2004a, 2004b). Even low levels of use can have obvious impacts at the level of sites; but impacts also occur over larger areas. The construction and use of built facilities and camping grounds, access roads, tracks and trails, the use of water body edges (lakes, rivers, coast and coral reefs), the use of mountain, littoral, rainforest, marine and freshwater ecosystems, the use of geological features (caves, rock formations), observations of wildlife, and direct extractive use of resources (fishing) all directly impact ecosystem and ecosystem components (soil, vegetation, wildlife and water). Activities such as hiking/walking, horse riding, mountain biking, camping (campgrounds and backcountry areas) have direct impacts such as creation of trails and campsites, loss of vegetation, soil compaction, loss of organic litter, soil, presence of litter, physical damage (e.g. breakage to trees, rocks), reduced visual appeal, changes in hydrology, social crowding, wildlife disturbance, water pollution, user conflicts and cultural vandalism such as graffiti (Eagles et al. 2002, Newsome et al. 2002; Leung and Marion 2000, Buckley 2004a).

Indirect impacts of visitor use

Tourism infrastructure and activities facilitate and exacerbate a number of other threats to the natural values of protected areas. This includes the introduction and spread of exotic plans and pathogens, changed fire regimes increases in abundance of feral animals (foxes, rabbits, hares) around tourism nodes and increased demands for water. More research has been done on plants and pathogens than other indirect impacts of visitor.

The introduction and spread of exotic plant species is directly related to disturbances to natural vegetation which provides habitat for exotic species which would be otherwise unable to compete with natives (Godfree et al. 2004, Pauchard and Alaback 2004). Exotic plant and fungal propagules can be introduced deliberately or accidental. In some cases seed/spores can be attached to machinery and imported material used for road and building construction in protected areas. In other cases, exotic taxa were deliberately introduced as part of seed mixes used for rehabilitation of natural vegetation or in gardens around resorts and other tourism facilities (Macdonald and Frame 1988; McDougall and Appleby 2000). Visitors themselves can be vectors for the spread of weeds and fungal pathogens. Propagules can be carried on vehicles (Lonsdale and Lane 1994) and in clothing or shoes (Whinam and Chilcott 2003, Whinam et al. 2005). Fungal pathogens are widespread in Tasmanian protected areas and in the Wet Tropics World Heritage Area (Environment Australia 2003, Turton 2005). In both cases visitor use has facilitated their spread.

Visitor use has contributed to changes in fire frequency through inappropriate fire suppression practices and accidental and deliberate setting of fires (DEH 2004b). The majority of natural ecosystems have evolved with fire and ecologically sustainable management must consider that the use of fire should meet conservation objectives while also considering public safety and adjoining communities. Agency staff is required to have appropriate fire management skills and knowledge of fire ecology. In many protected areas however, skills and knowledge are lacking and this has resulted in inappropriate fire regimes and uncontrolled fires which are threats to biodiversity (EA 2003).

Key Examples of Visitor Use as a Pressure/Threat

Australia’s World Heritage Areas receive more than 12 million visitors annually. This is concentrated in just four Areas; the Wet Tropics with 5 million visits, and the Great Barrier Reef, the Gondwana Rainforests of Australia and the Blue Mountains which each receive at least 2 million visits per year (Table 2). Sustainable tourism is encouraged in Australia’s World Heritage Areas, both as a revenue opportunity and as a means of presenting World Heritage values to the public. However, if poorly managed, visitor use is a threat to the natural values (EA 2003, UNESCO 2005). Australia’s report to the World Heritage Commission recognised visitor use as a threat/pressure for 13 of Australia’s World Heritage Areas through inappropriate behaviour and activities, increasing demand for infrastructure and inappropriate use levels (Table 2).

Visitor biophysical and social impacts are commonly reported at icons sites with high visitor use (EA 2003). These include deterioration of visitor experience caused by crowding, physical alteration to landscape by the construction of visitor related infrastructure and weed invasion facilitated by physical disturbance or by visitors as weed vectors and water pollution.
For many sites within the Wet Tropics and the high use Gondwana Rainforests of Australia sites in Queensland, visitor use is a direct threat through increasing demand for tourism infrastructure, including roads, trails, visitor centres and walking tracks. Weeds, feral animals and pathogens are also reported as threats over large areas—and in many cases this is facilitated by visitor use. The pattern of visitation in the Great Barrier Reef and the Blue Mountains differs as it is concentrated in a few zones or sites. Only 10% of the Great Barrier Reef Marine Park is zoned for tourism use: however in these areas localised impacts include discharge of waste, litter and fuel from vessels, physical damage to reefs from anchors, snorkelling damage to reefs, impacts of diving and reef walking, disturbance of fauna especially seabirds, impacts of recreational fishing, shell and other marine collecting, marina developments and recreational scuba diving (Harriott 2002, EA 2003, GBRMPA 2006).

Visitor impacts in the Blue Mountains are also localised. Two million people annually visit just two viewing locations, Echo Point and Govett’s Leap. Localised biophysical and social impacts occur through overcrowding at peak visitation times (NPWS 1998). Heavy visitation to the Jenolan Caves causes direct and indirect damage to cave formations through inappropriate behaviour and aging infrastructure (DEC 2006).

Although Fraser Island, Kakadu National Park, the Tasmanian Wilderness and Uluru-Kata Tjuta National Park have fewer visitors, increasing use is considered a threat as it is concentrated in iconic sites (waterfalls, lakes and streams, lookouts, mountain peaks) or occurs in fragile, high values habitats (e.g. alpine vegetation) or is dispersed over wilderness areas (Table 2). For example, the majority of the 400,000 visitors to Fraser Island are attracted to just two or three high profile freshwater lakes. Most visitors swim in the lakes and the intensity of this activity has changed the ecology of the lakes’ ecosystems through increased nutrients (Hadwen & Arthington 2003, Hadwen et al. 2003). Other inappropriate activities such as off-road vehicles and beach camping have damaged the island’s sensitive sand dune ecosystems. In the Tasmanian Wilderness, commercial horse riding on the fragile high altitude vegetation has caused significant damage and walking track impacts are significant over many sections of the extensive track system (EA 2003; Whiman and Comfort 1996).

For the more remote Island World Heritage Areas (Macquarie, Heard and McDonald Islands) visitor numbers are small and highly controlled (Table 2). However, even low levels of visitation are likely to have negative impacts, particularly via their potential to introduce exotic species.
# Table 2: Number of visitors and pressures and threats to the natural values of Australia’s World Heritage Areas (Table 4 lists additional sources for this summary information)

Key: **Bold** text indicates a direct threat from visitor use; *italics* indicate a threat facilitated by tourism; plain text indicates a threat not related to tourism

<table>
<thead>
<tr>
<th>World Heritage Area</th>
<th>Number of visitors</th>
<th>Pressures/threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Fossil Mammal Sites</td>
<td>Riversleigh: 10,000</td>
<td>• Increased visitor pressure (numbers of visitors) causing small scale disturbances</td>
</tr>
<tr>
<td>Riversleigh/Naracoorte</td>
<td>Naracoorte: estimated 800,000 people have participated in guided interpretive tours of Victoria Fossil Cave at Naracoorte since 1969. Visitor access at Naracoorte is controlled to protect the scientific, conservation and aesthetic values of the caves.</td>
<td>• Fluctuations in temperature and humidity in caves from tourism</td>
</tr>
<tr>
<td>EA (2003)</td>
<td></td>
<td>• Exotic plant and animal invasion</td>
</tr>
<tr>
<td>UNEP-WCMC (1994)</td>
<td></td>
<td>• Extraction of fossil material by researchers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fire management</td>
</tr>
<tr>
<td>Gondwana Rainforests of Australia</td>
<td>Qld: 1,400,000. NSW: 600,000</td>
<td>• Increased visitor pressure (e.g. increasing visitation and party size)</td>
</tr>
<tr>
<td>Chester and Bushnell (2005)</td>
<td></td>
<td>• Inappropriate recreation and tourism activities</td>
</tr>
<tr>
<td>EA (2003)</td>
<td></td>
<td>• Incompatible land use adjoining properties (e.g. pressure for tourism development)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Exotic plant and animal invasions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Urbanisation and increasing population in adjacent area—increased visitation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inconsistent local government zoning and inconsistent planning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Global warming</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Uncontrolled bushfire and/or inappropriate fire regimes</td>
</tr>
<tr>
<td>Fraser Island</td>
<td>340,000 concentrated in high profile sites</td>
<td>• Increased visitor pressure in areas of concentrated use</td>
</tr>
<tr>
<td>EA (2003)</td>
<td></td>
<td>• Inappropriate recreation activities (beach campsites, off road vehicle in dune vegetation)</td>
</tr>
<tr>
<td>Hockings (2002)</td>
<td></td>
<td>• Expansion of tourism &amp; support industries</td>
</tr>
<tr>
<td>Hockings et al. (2004)</td>
<td></td>
<td>• Expansion of residential areas and infrastructure within the property—growth in tourism contributes to this</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lack of knowledge due to lack of systematic monitoring</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Exotic plant invasions and pathogens</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Growth in regional population—jobs in tourism industry supports this</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Inappropriate fire regimes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Global warming</td>
</tr>
<tr>
<td>World Heritage Area</td>
<td>Number of visitors</td>
<td>Pressures/threat</td>
</tr>
<tr>
<td>-------------------------------------------</td>
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<td>--------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Greater Blue Mountain Area                | 2,000,000          | - Visitor impacts in areas of concentrated use near urban development  
- Exotic plant invasions and exotic animals and feral animals  
- Adjacent landuse—coal and gas mining  
- Fires and altered fire regimes |
| NPWS (2001)                               |                    |                                                                                                                                             |
| UNEP-WCMC (2003)                          |                    |                                                                                                                                             |
|                                            |                    | Concentrated in 3 locations: Echo Point and Govett’s Leap, & quarter of a million (11%) to the Jenolan Caves                                       |
|                                            |                    |                                                                                                                                             |
| Great Barrier Reef                         | 1,900,000          | - Increased visitor pressure in high use areas  
- Discharge of waste, litter and fuel from vessels  
- Physical damage to reefs from anchors, snorkelling, diving & reef walking,  
- Disturbance of fauna especially seabirds  
- Impacts of recreational fishing on fish stocks  
- Impacts of shell and other marine collecting  
- Tourism & marina developments  
- Impacts of recreational scuba diving  
- Water quality  
- Coastal development—growth in regional population—jobs in tourism industry supports this  
- Global warming  
- Crown of Thorns starfish  
- Increased commercial pressure (fishing effort and impacts) |
| EA (2003)                                 |                    |                                                                                                                                             |
| Green et al. (2001)                        |                    |                                                                                                                                             |
| Harriott (2002)                            |                    |                                                                                                                                             |
|                                            |                    |                                                                                                                                             |
| Heard and McDonald Islands (HIMI)         | Few visitors to three visitor access areas Numbers limited by legislation | - Feral species (introduced via researchers)  
- Global warming  
- Bottom trawling for Patagonian Toothfish |
| Meyer et al. (2000)                        |                    |                                                                                                                                             |
| UNEP-WCMC (2003)                          |                    |                                                                                                                                             |
|                                            |                    |                                                                                                                                             |
| Kakadu National Park                       | 200,000            | - Excessive staff time devoted to tourism  
- Damage to rock art and archaeological sites  
- Introduced & feral animals  
- Altered fire regimes  
- Uranium mill residue  
- Loss of cultural heritage |
| Atech Group (2002)                         |                    |                                                                                                                                             |
| EA (2003)                                 |                    |                                                                                                                                             |
| UNEP-WCMC (2003)                          |                    |                                                                                                                                             |
|                                            |                    |                                                                                                                                             |
| Lord Howe Island Group                     | 300-400 any one time in summer (no figures for annual visitation) | - Increased tourism pressure (e.g. excessive fishing)  
- Pressure on threatened animal species from tourism  
- Exotic plant and animal invasions particularly feral rats and goats  
- Global warming |
| EA (2003)                                 |                    |                                                                                                                                             |
| UNEP-WCMC (2003)                          |                    |                                                                                                                                             |
|                                            |                    |                                                                                                                                             |
| Macquarie Island Commonwealth of Australia | Maximum figure of 500 tourists per year | - Tourists have had limited, environmental impacts (e.g. waste disposal and walking tracks)  
- Potential threat of introduction of serious pest species |
| (1996)                                    |                    |                                                                                                                                             |
| DASETT (1990)                             |                    |                                                                                                                                             |
| TPHA (2003)                               |                    |                                                                                                                                             |
| UNEP-WCMC (2003)                          |                    |                                                                                                                                             |
|                                            |                    |                                                                                                                                             |
| Purnululu National Park                    | 20,000             | - High level of wear on certain tracks and trails  
- Pest animals and weed invasions  
- Soil erosion  
- Erosion of fragile sandstones  
- Fire hazards |
| (EA 2003)                                 |                    |                                                                                                                                             |
| UCESCO World Heritage Committee (2003)    |                    |                                                                                                                                             |
### ECOLOGICALLY SUSTAINABLE VISITOR USE OF AUSTRALIA'S WORLD HERITAGE AREAS

<table>
<thead>
<tr>
<th>World Heritage Area</th>
<th>Number of visitors</th>
<th>Pressures/threat</th>
</tr>
</thead>
</table>
| Shark Bay, Western Australia | 160,000 (UNEP-WCMC 2003) 100,000 per year | • Shell extraction (tourism)  
• Exotic plant invasions and feral animals  
• Global warming  
• Oil spillage  
• Grazing pressure (livestock) and clearing vegetation  
• Fire hazards |
|                           |                     | Come to see wild bottle-nose dolphins which have been coming regularly to feed and interact with people at Monkey Mia beach for 30 years |
| Tasmanian Wilderness      | Cradle Mountain: 200,700; Lake St Clair: 104,000 (EA 2003) | • Increased tourism pressure  
• Management of access (increasing mechanised access to remote areas via all terrain vehicles, quad bike);  
• Fire management  
• Long term management of Gordon River erosion  
• Walking track and campsite erosion and damage  
• The need to control pathogens including Phytophthora cinnamoni. Pathogens are spread along walking tracks by infected mud  
• Development of new facilities and other tourism infrastructure  
• Noise from scenic flights, helicopters and powerboats  
• Exotic plant invasions and feral/introduced animals including potential establishment of new introduced species (esp. foxes)  
• Logging surrounding areas  
• Coastal erosion – loss of Aboriginal sites - (global warming) |
| Uluru-Kata Tjuta National Park | 396,500 (EA 2003) | • Increased tourism pressure  
• Unscheduled access to key visitor nodes  
• Illegal access to restricted areas  
• Environmental damage from vandalism & illegal camping  
• Disruption of dune plains & southern aquifer recharge through poorly planned infrastructure  
• Overcrowding at peak visitation times  
• Exotic animals (6 introduced mammals) and exotic plant invasions (34 exotic weeds)  
• Soil erosion  
• Fire hazards  
• Disruption of dune plain and southern aquifer  
• Damage to rock art from water and vegetation |
<table>
<thead>
<tr>
<th>World Heritage Area</th>
<th>Number of visitors</th>
<th>Pressures/threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet Tropics of Queensland</td>
<td>5,000,000 (WTMA 2005)</td>
<td>• Increased tourism pressure</td>
</tr>
<tr>
<td>EA (2003)</td>
<td></td>
<td>• Pressure on endemic and rare species (from tourism)</td>
</tr>
<tr>
<td>Weston and Goosem (2004)</td>
<td></td>
<td>• Increased regional population growth &amp; development pressure</td>
</tr>
<tr>
<td>Wilson et al. (2004)</td>
<td></td>
<td>• Exotic plant and animal invasions</td>
</tr>
<tr>
<td>WTMA (2005)</td>
<td></td>
<td>• Habitat fragmentation from roads</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pathogens (forest dieback)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Logging</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fire hazards</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Climate change</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Damage to weirs from changed hydrology</td>
</tr>
<tr>
<td>Willandra Lakes Region</td>
<td>Mungo National Park 40,000</td>
<td>• Erosion from foot traffic</td>
</tr>
<tr>
<td>EA (2003)</td>
<td></td>
<td>• Deflation of ground surface in eroded areas</td>
</tr>
<tr>
<td>Midgley et al. (1998)</td>
<td></td>
<td>• Mining mineral sands</td>
</tr>
<tr>
<td>UNEP-WCMC (2003)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Chapter 3

REPORTING REQUIREMENTS

There are international, national and state requirements for management agencies to report on World Heritage Areas within their jurisdictions. Reports include monthly and quarterly internal reports such as for finance, human resources and other administrative and management processes, annual reports on the achievement of organisational goals and targets, longer term reports identifying change in condition of World Heritage values and reports to the World Heritage Committee which include information on the state of conservation of World Heritage Areas (HRSCEH 1996, EA 2003, Worboys 2005). Most of the management plans that exist for Australia’s World Heritage Areas stipulate some sort of monitoring arrangement. When management plans are periodically reviewed and new plans drafted, a qualitative assessment may be made by the management agency of how well the objectives established in the existing management plan have been met (HRSCEH 1996, Worboys 2005).

Conserving and protecting World Heritage values depends on effective management which in turn depends on factors such as research and monitoring pressures and threats to natural values and monitoring the effectiveness of plans and strategies. The importance of research and monitoring to effective management is recognised internationally, with Article 5c of the World Heritage Convention requiring signatory countries ‘to develop scientific and technical studies and research and to work out such operating methods as will make the State capable of counteracting the dangers that threaten its cultural or natural heritage’ (UNESCO 2005).

However, approaches to research, monitoring and assessing management performance vary widely and while some agencies are attempting to standardise methods, this is still in an early stage of development (EA 2003, Worboys et al. 2005). The following section reviews the major international reporting requirements for World Heritage Areas and how they relate to assessing management of threats and pressures. Chapter 4 reviews approaches to conservation research and monitoring focusing on research and monitoring for sustainable visitor use.

World Heritage Reporting

Periodic reporting

Since 1996, countries that have signed the World Heritage Convention are required to submit six yearly periodic reports to UNESCO’s World Heritage Committee on the World Heritage Areas within their jurisdiction. Periodic reports are based on a standardised format and provide information on the state of conservation of World Heritage Areas and how management agencies have applied the main objectives of the World Heritage Convention. Its main objective is to obtain an assessment of whether the World Heritage value for which an Area was inscribed on the World Heritage List is maintained over time (UNESCO 2005).

Australia’s first periodic report was part of the Asia Pacific Regional Synthesis Report for the period 1996 to 2003 (EA 2003). It provided detailed reports on the 11 World Heritage Areas Listed prior to 1996. Reports updated the information on which World Heritage nominations were made, broadly assessed the state of conservation of World Heritage values, listed improvements to World Heritage policies and legislation, identified threats and assessed the severity of major threats and provided details of the improvements to management, including preventive conservation measures implemented. Reports also included details of monitoring arrangements (EA 2003).

The requirement to report regularly to UNESCO on the integrity of values has put pressure on management agencies to improve monitoring and assessment processes. However, the capacity to undertake broad scale ecological monitoring and evaluation is still being developed and processes for collecting and analysing ecological data and reporting results of monitoring vary widely (HRSCEH 1996, Hockings et al. 2000, 2006; EA 2003, Worboys et al. 2005).
Reactive assessment and reporting

UNESCO requires that reactive assessment and reporting is undertaken to assess the state of conservation of World Heritage Areas considered to be under threat (UNESCO 2005). Countries are also required to submit specific reports and impact studies each time exceptional circumstances occur or work is undertaken which may have an effect on the state of conservation of the World Heritage Areas (UNESCO 2005).

The World Heritage Committee has received reactive assessment reports for Australian World Heritage Areas including:

A report on the GBRWHA for five priority action issues including the management of coastal catchments, management of fisheries, management of shipping and ship based pollution, establishment of representative marine protected areas and resources for research and monitoring (EA 2003).

A report was made on the proposed Naturelink Skyrail development for Gondwana Rainforests of Australia as the IUCN had concerns about the appropriateness of this development impacting on the World Heritage Area (UNESCO 2000).

Comprehensive reactive monitoring for the Wet Tropics identified priority action areas including ensuring adequate resources to effectively implement the Wet Tropics Management Plan, the need to monitor the management of native and introduced species, and the need to ensure complementary management of land use and human impacts within and beyond the boundaries of the World Heritage Area, particularly on industrial and tourism developments (UNESCO 2000, EA 2003).

A report was made for Shark Bay on mineral sands mining and exploration, on visitor management and on control of invasive species (UNESCO 2000, EA 2003).

A risk assessment report was made on the potential for the establishment and spread of cane toads in Kakadu National Park to affect World Heritage values (van Dam et al. 2002).
Chapter 4

APPROACHES TO RESEARCH AND ASSESSMENT SUPPORTING CONSERVATION

Introduction

There is increasing recognition among protected area managers and researchers that effective conservation management depends on well-designed assessment and evaluation systems. Research and assessment provides the information required for making management decisions and for determining if programs/strategies/plans are working (Margoluis and Salafsky 1998, Hockings et al. 2000, 2006, Hockings 2003, Stem et al. 2005). Research and assessment allows managers to understand the extent, nature and causes of threats and pressures to natural values, the damage to values, and identify ways to address threats (Wilkinson et al. 2003). Research and assessment assists managers undertaking resource assessment, identify the status of resources, identify long term trends in resources, identify and quantify large scale disturbances, impact of human activities, evaluate performance, and undertake adaptive management (Margoluis and Salafsky 1998). Stem et al. (2005) reviewed the literature relating to conservation evaluation and identified that conservation research, assessment and evaluation is conducted for four broad (albeit overlapping) purposes. These four purposes are:

- Basic research (knowledge gathering and generating)
- Accounting and certification (is a programme fulfilling its obligations to all stakeholders)
- Status assessment (assessing condition or status of a particular conservation entity such as a species, community or ecosystem at a point in time irrespective of a management intervention/action designed to affect the entity)
- Effectiveness measurement. This is linked to interventions/actions undertaken by agencies to improve conservation and can be divided into effectiveness assessment and adaptive management. Effectiveness assessments are often one-off assessments undertaken when a project is complete to determine how well the programme performed. Adaptive management is an iterative process that systematically examines interventions in order to improve an ongoing project or intervention.

Approaches in Australia’s World Heritage Areas

We reviewed relevant literature (organisational reports, journal articles, books and Web sites) for information on research and assessment undertaken for conservation and protection of World Heritage values. We specifically focused on research and assessment supporting the sustainable management of visitors. We categorised research and assessment into the broad areas defined by Stem et al. (2005) (see introduction section of this chapter) in order to identify the current focus of research and assessment and the limitations in their approaches (Table 3). We did not include research/assessment for accounting and certification purposes. Sources for the summary in Table 3 are listed in Table 4.

All management agencies recognise the importance of assessment and have attempted to develop and implement research and assessment to maintain the values of World Heritage Areas within their jurisdictions. However approaches vary considerably. Some agencies have established the strategic direction of research and assessment through collaboration with external research organisation where the external organisation/s conducts the research and assessment. This is the approach taken in the Wet Tropics and the Great Barrier Reef (Table 3).

Other agencies have collaborated with external experts/research organisations to develop overall assessment and evaluation programs—with most of the assessment undertaken by agency staff or academics. This is the approach taken for the Tasmanian Wilderness. For Fraser Island and the Jenolan Caves (Karst Reserve within the Blue Mountains World Heritage Area) visitor assessment programs were jointly developed between management agencies and university academics. For other World Heritage Areas, for example, Gondwana Rainforests of Australia research has been ad hoc based on the interests of researchers (Table 3).
All research and assessment could be placed in one of the categories defined by Stem et al. (2005) and this is discussed below.

**Basic research: purpose knowledge gathering and generating**

A substantial body of research conducted by various Commonwealth and State agencies, external research organisations and external academics could be identified as basic research. This was defined by Stem et al. (2005) as research gathering or generating knowledge on a subject to gain a better understanding. Numerous studies in all World Heritage Areas have identified and reviewed the significant natural and cultural values which have led to World Heritage Listing (Table 3). However, agencies consider that more research is needed to further identify and review natural and cultural values (EA 2003).

**Status assessment**

Considerable research and assessment effort has been conducted to assess the status of values and threats at a point in time and over the longer term. This includes monitoring populations of native fauna and fauna; rare and threatened species; species of special significance; key species (such as birds, frogs, reptiles and marine birds); and monitoring long term change in vegetation community structure and composition.

Threats and pressures have been identified and quantified including exotic plants, animals and fungal pathogens, changes in fire regimes, and global warming. A range of impacts from visitor activities and infrastructure have been identified and quantified (including from hiking, walking tracks, horse riding, off road vehicles, swimming, fishing, camping, tourism infrastructure and marina developments, recreational scuba diving and fishing, snorkelling, and reef walking). The number of visitors have been roughly estimated for most World Heritage Areas and patterns of visitor use and the attitudes of visitors and local communities have been surveyed for a few World Heritage Areas (Table 3). The approach to visitor monitoring in the Wet Tropics is the most advanced with a recently developed Visitor Monitoring Strategy (VMS) proposing three level hierarchical monitoring of a range of social and biophysical indicators at many sites (Wilson et al. 2005, Bentrupperbäumer et al 2005).

**Effectiveness measurement**

Just as research and assessment is the key to understanding natural and cultural values and to assessing the status of specific variables—it is also essential for determining if interventions and other management plans and strategies are effective (Stem et al. 2005). However, there has been has been much less research and assessment in Australian World Heritage Areas to determine how effective conservation plans and policies are (including visitor management plans).

Our review identified several examples of agencies undertaking effectiveness monitoring. The Tasmanian Parks and Wildlife Service (TPWS) have the most advanced approach to adaptive management. Track monitoring has been conducted over 15 years to determine if the Walking Track Management Strategy has been effective. Monitoring showed that there was continuing erosion and deterioration along the entire track network (Dixon et al. 2004, TPWS 2004). Recently a permit system was introduced for the most heavily used section of track at peak times after extensive negotiations with stakeholders by the Track Assessment Group (TAG 2001, TPWS 2006). This result was achieved based on empirical evidence of continuing degradation. The TPWS recognise that even more effectiveness monitoring is required.

In the Great Barrier Reef World Heritage Area long term water quality monitoring and coral reef health monitoring is conducted to determine if plans for managing regional land use impacts have been effective (GBRMPA 2003, 2006). While the Great Barrier Reef Marine Park Authority state that their management policies and decisions are based on the best available scientific and technical information, they also recognise that even more effectiveness research and monitoring is needed, particularly for determining the effectiveness of current and planned fisheries management strategies and the new Zoning Plan (2003) in protecting coral reefs other habitats, and fish (AG 2005, GBRMPA 2006).
For the Jenolan Caves (Blue Mountains) a Social and Environmental Monitoring Management System was developed to measure social impacts of visitor use and biophysical impacts of recreation on cave ecosystems. A Visitor Monitoring Program has been implemented with social indicators regularly monitored/surveyed and benchmarks to guide future management decision. Monitoring of biophysical impacts has been implemented (Jenolan Caves Reserves Trust 2005; DEC 2006).

Limitations

Management agencies are generally aware of the importance of research and assessment for effective conservation management. They are also aware of the need for monitoring to determine if plans and policies are effective in achieving conservation outcomes. However, they are limited by insufficient staff and financial resources (Table 3). Australia’s periodic report to the World Heritage Commission recommended, as a national priority, that greater investment in collaborative research issues of shared concern was needed—with more research on sustainable tourism specifically mentioned as a need (EA 2003).

Major limitations identified by agencies and our review are:

A lack of baseline data on the condition of natural values (EA 2003). This has rarely been adequately quantified or documented and is an important deficiency as it is not possible to determine change in condition either from natural processes or from human activities without baseline data. This deficiency has also been noted by many ecologists and other academics (e.g. Hockings 2003, Leung and Montz 2006) and also been recognised by managers (EA 2003, TPWS 2004, Worboys 2007).

A lack of strategic direction for visitor impact research and assessment. Research has often been conducted on an ad hoc basis. Consequently, managers do not have relevant information on the status of natural values, and the effectiveness of their management of threats and pressures. This is exemplified in the Gondwana Rainforests of Australia where in spite of considerable academic research, managers lack appropriate information on change in condition of natural values from tourism and recreation (Chester and Bushnell 2005).

Results of research and assessment have often not been applied to improve management (Jones 2000, Green et al. 2001, EA 2003). It is important that research and assessment are linked back to management decisions and actions. Adaptive management is recognised as an important tool for managers but is currently not the reality for most agencies (Lockwood et al. 2006).

Four Examples of Best Practice Research and Assessment of Visitor Use

From the literature review we have identified four examples of the use of research and assessment to improve visitor management. These examples illustrate how agencies are building capacity and moving towards an adaptive management approach, determining strategic research needs and finally utilising research and monitoring to maximise the social and economic benefits of visitor use and minimise impacts. The approaches taken in four popular World Heritage Areas are reviewed in the following chapters (Chapter 5: Tasmanian Wilderness; Chapter 6: Great Barrier Reef World Heritage Area; Chapter 7: Wet Tropics; and Chapter 8: Gondwana Rainforests of Australia.)
Table 3: Summary of ecological research and assessment in Australia’s World Heritage Areas listed relative to the broad purposes for undertaking research and monitoring identified by Stem et al. (2005) (Table 4 lists additional sources for this summary information)

Key: Direct or indirect impacts of visitor use are in bold.

<table>
<thead>
<tr>
<th>World Heritage Area</th>
<th>Major areas of ecological research and assessment</th>
<th>Reporting on condition of natural values and/or management of visitor use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Australian Fossil Mammal Sites</td>
<td>Basic research:</td>
<td>Australia’s periodic report to the World Heritage Commission included a statement on the state of conservation of the Australian Fossil Mammal Sites and a short statement on the management of visitors. Priority recommendations for protecting sites from visitor use impacts and research impacts were to: Secure high public use areas to protect fossils Ongoing monitoring of fossil displacement</td>
</tr>
<tr>
<td>Inscribed on World Heritage List in 1994</td>
<td>• Numerous studies identifying the fossil mammals of Riversleigh and Victoria Fossil Cave (Narcoote) • Diversity of Australia’s prehistoric mammals • Changes in the structure of Australia’s Cainozoic terrestrial mammal communities • Biocorrelative framework for Australia’s Cainozoic mammal-bearing sediments • Palaeobiogeographic history of Australia’s mammals • Understanding the changes through time in communities to determine appropriate conservation strategies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Status assessment:</td>
<td>Australia’s periodic report to the World Heritage Commission included a statement on the state of conservation of the Australian Fossil Mammal Sites and a short statement on the management of visitors. Priority recommendations for protecting sites from visitor use impacts and research impacts were to: Secure high public use areas to protect fossils Ongoing monitoring of fossil displacement</td>
</tr>
<tr>
<td></td>
<td>• Mapping sites for fossil material removed by researchers • Surveying to protect sites from researchers and other visitors</td>
<td></td>
</tr>
<tr>
<td>2. Gondwana Rainforests of Australia</td>
<td>Numerous reserve specific studies including: Basic research:</td>
<td>Priority recommendations in the report regarding protecting the natural values from visitor use were: the development of a coordinated programme to monitor the status and condition of the 50 reserves which comprise Gondwana Rainforests of Australia the development of systems for storage and distribution of research results</td>
</tr>
<tr>
<td>Inscribed on World Heritage List in 1986, extensions in 1994 under old name of Central Eastern Rainforest Reserves of Australia (CERRA)</td>
<td>• Many studies identifying the natural values of species and communities • Biodiversity values</td>
<td>Australia’s periodic report to the World Heritage Commission included a statement on the state of conservation of Gondwana Rainforests of Australia (under its old name—CERRA) and a detailed statement on the management of visitors (EA 2003).</td>
</tr>
<tr>
<td></td>
<td>Status assessment:</td>
<td>Priority recommendations in the report regarding protecting the natural values from visitor use were: the development of a coordinated programme to monitor the status and condition of the 50 reserves which comprise Gondwana Rainforests of Australia the development of systems for storage and distribution of research results</td>
</tr>
<tr>
<td></td>
<td>• Weed invasion • Feral animals (foxes, cats) • Fire regimes • Internal fragmentation and habitat clearance • Status of rare and threatened species/communities • Vegetation mapping • Visitation supply and demand indicators (using a limited number of traffic and pedestrian counters)</td>
<td></td>
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<tr>
<td></td>
<td>• Visitor use impacts including • damage from vehicles • human waste disposal • soil erosion • bush campsites • walking tracks • horseriding</td>
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</tr>
<tr>
<td>3. Fraser Island</td>
<td>Basic research:</td>
<td>Australia’s periodic report to the World Heritage Commission included a statement on the state of conservation of Fraser Island WHA, a statement on the management of visitors, and a list of major monitoring programs (EA 2003). The report identified that a long term monitoring programme has been implemented since 1998, but as yet no overall evaluation report based on data from monitoring (EA 2003). Some results published as research studies</td>
</tr>
<tr>
<td>Inscribed on World Heritage List in 1992</td>
<td>• Many studies identifying the natural values</td>
<td>Australia’s periodic report to the World Heritage Commission included a statement on the state of conservation of Fraser Island WHA, a statement on the management of visitors, and a list of major monitoring programs (EA 2003). The report identified that a long term monitoring programme has been implemented since 1998, but as yet no overall evaluation report based on data from monitoring (EA 2003). Some results published as research studies</td>
</tr>
<tr>
<td></td>
<td>Status assessment:</td>
<td>Australia’s periodic report to the World Heritage Commission included a statement on the state of conservation of Fraser Island WHA, a statement on the management of visitors, and a list of major monitoring programs (EA 2003). The report identified that a long term monitoring programme has been implemented since 1998, but as yet no overall evaluation report based on data from monitoring (EA 2003). Some results published as research studies</td>
</tr>
<tr>
<td></td>
<td>• Presence of key plant species • Long term change in vegetation community structure and composition using photo plots and transect monitoring. • Monitoring fauna—small mammal</td>
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<tr>
<td>World Heritage Area</td>
<td>Major areas of ecological research and assessment</td>
<td>Reporting on condition of natural values and/or management of visitor use</td>
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<td>population, rare and threatened species and species of special significance to the island</td>
<td>(e.g. beach camping impacts (Hockings and Twyford 1997) and water quality in freshwater lakes (Hadwen and Arthington 2003).</td>
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<td></td>
<td>• Bird counts</td>
<td>Commercial activities, tourism and visitor use were reviewed by Qld Dept of the Environment (DE 1997).</td>
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<tr>
<td></td>
<td>• Species presence and abundance indices</td>
<td>An assessment of condition of natural resources against benchmarks was made by Qld Dept of the Environment (DE 1998).</td>
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<td></td>
<td>• Records of road kills</td>
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<td></td>
<td>• Effects of fire on flora and fauna (long term change)</td>
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<td></td>
<td>• Effects of traffic on wildlife</td>
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<td></td>
<td>• Water quality monitoring in freshwater dune lakes</td>
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<td></td>
<td>• Assessments of condition of natural resources against benchmarks at 78 major sites and 26 routes. Indicators were:</td>
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<td></td>
<td>- Actual conditions compared to desired conditions</td>
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<td>- Changes in condition since 1998</td>
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<td>- Levels of impact</td>
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<td></td>
<td>- Site and route capacity</td>
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<td>- Opportunities and constraints</td>
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<td></td>
<td>Visitor use impact research/monitoring including</td>
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<td></td>
<td>- Coastal camping impacts on dunes</td>
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<td>- Off-road vehicles</td>
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<td></td>
<td>- Increasing numbers of visitors at popular sites</td>
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<td></td>
<td>- Commercial/private tourism supply and demand</td>
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<tr>
<td>4. Greater Blue Mountains Area</td>
<td>Research undertaken by external research and educational organisations in Sydney and elsewhere but no research stations within the park boundaries. The NSW National Parks and Wildlife Service has research programs focusing on conservation issues. Compressive Visitor Management Monitoring for the Jenolan Caves</td>
<td>The Greater Blue Mountains WHA was not included in Australia’s Periodic Report to the World Heritage Commission in 2003 as it was Listed after 1994. Integrity reporting is required for the next Periodic Report due in 2000 and for NSW State of Parks reporting.</td>
</tr>
<tr>
<td>Inscribed on World Heritage List in 2000</td>
<td>Basic research</td>
<td>The Jenolan Karst Conservation Reserve Draft Management Plan stipulates establishment of a Social and Environmental Monitoring Committee, and the development of a commercial visitor services framework which includes continuing monitoring of impact of activities on natural, cultural and recreational values of caves and annual reporting.</td>
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<td></td>
<td>- Numerous single species studies (e.g. the Wollemi pine)</td>
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<td></td>
<td>- Numerous community/ecosystem studies</td>
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<td></td>
<td>- Biodiversity</td>
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<td>Biodiversity assessment</td>
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<td></td>
<td>• Noxious weeds, exotic animals</td>
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<td></td>
<td>• Visitor use of Jenolan Caves (Karst reserve)—social and biophysical impacts of activities</td>
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<td>• Geological movements and change</td>
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<td>• Water quality</td>
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<td></td>
<td>• Fire management</td>
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<td></td>
<td>Effectiveness measurement</td>
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<td></td>
<td>For the Jenolan Caves (Karst Reserve) a Social and Environmental Monitoring Program was developed to measure social impacts of visitor use and biophysical impacts of recreation on cave ecosystems.</td>
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<tr>
<td></td>
<td>A Visitor Monitoring Program/system has been implemented with social indicators regularly monitored/surveyed and benchmarks to guide future management decision (Jenolan Caves Reserves Trust 2005; DEC 2006).</td>
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<tr>
<td>5. Great Barrier Reef</td>
<td>Extensive strategic research and monitoring by external research organisations</td>
<td>Australia’s periodic report to the World Heritage Commission included a</td>
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<td>Inscribed on World</td>
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## World Heritage Area

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<tr>
<th>World Heritage Area</th>
<th>Major areas of ecological research and assessment</th>
<th>Reporting on condition of natural values and/or management of visitor use</th>
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<tbody>
<tr>
<td>Heritage List in 1981</td>
<td><strong>Basic research</strong>&lt;br&gt;• Ecological studies of marine species,&lt;br&gt;• Reef ecosystems,&lt;br&gt;• Reef geomorphology and hydrology</td>
<td>statement on the state of conservation of the GBRWHA, a detailed statement on the management of visitors, and identified major visitor impacts and listed monitoring programs (EA 2003).&lt;br&gt;Annual management reports are required from Commonwealth management agency (Great Barrier Reef Marine Park Authority) (e.g. GBRMPA 2004, 2005, 2006).&lt;br&gt;Regular reports on the state of the Great Barrier Reef are required from GBRMPA. These have been published in 1998 and 2003 and included more detailed statements of the management of visitors in terms of (i) economic value of tourism (ii) outcomes of actions undertaken to manage tourism in environmentally sustainable way and (iii) future actions to mitigate impacts of visitors (GBRPMA 2003, 2006).</td>
</tr>
<tr>
<td>6. The Heard and McDonald Islands Group (HIMI Marine Reserve) &lt;br&gt;Inscribed on World Heritage List in 1997</td>
<td>Research on the McDonald Islands has been very limited.&lt;br&gt;<strong>Basic research</strong>&lt;br&gt;A research station on Heard Island operated by Australian National Antarctic Research Expedition (ANARE) conducting a spasmodic, research programme covering biological and earth sciences studies (e.g. glaciers, volcanoes), marine mammals, birds and vegetation communities.&lt;br&gt;HIMI was not included in Australia’s Periodic Report to the World Heritage Commission as it was Listed after 1994. Integrity reporting is required for the next (2009) Periodic Report to World Heritage Commission.&lt;br&gt;Report by Australian Antarctic Division giving status of knowledge of the regions, and directions for research and conservation (Meyer et al. 2000).&lt;br&gt;</td>
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<tr>
<td>7. Kakadu National Park &lt;br&gt;Inscribed on World Heritage List in 1981, extensions in 1987, 1992</td>
<td>Extensive research by government agencies including Parks Australia, Supervising Scientist, and CSIRO Tropical Ecosystem Research Centre in several areas.&lt;br&gt;<strong>Basic research</strong>&lt;br&gt;• Single species studies of flora and fauna&lt;br&gt;• Cultural values&lt;br&gt;<strong>Status assessment</strong>&lt;br&gt;• Exotic species monitoring (cane toads)&lt;br&gt;• Long-term landscape change using aerial photography&lt;br&gt;• State of rock art sites&lt;br&gt;• Environmental radioactivity monitoring programme for bush foods,</td>
<td>Australia’s periodic report to the World Heritage Commission included a statement on the state of conservation of Kakadu National Park and a statement on the management of threats, including visitor use and and what was described as a ‘monitoring matrix’—which is an extensive table listing monitoring/research projects relative to the appropriate world heritage value and then relative to threats. The matrix shows that there is very little monitoring of direct impacts visitor use and some monitoring and research of introduced plants and</td>
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<tr>
<td>World Heritage Area</td>
<td>Major areas of ecological research and assessment</td>
<td>Reporting on condition of natural values and/or management of visitor use</td>
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</tbody>
</table>
| 8. Lord Howe Island Group           | • Baseline data on aquatic systems potentially at risk from mining  
• Effects of fire  
• Many monitoring programs for impacts of uranium mining focus on off-site aquatic impacts on streams and waterfalls.  
•单单 species studies of flora and fauna  
• Weed control strategies and long term monitoring and mapping  
• Revegetation plans—identification of priority habitats  
• Threatened species recovery plans  
• Monitoring key species  
• Groundwater monitoring                                                                 | Australia’s periodic report to the World Heritage Commission included a statement on the state of conservation of Lord Howe Island and a statement on the management of threats, including visitor use and a list of scientific research projects.  
Little research on visitor use.                                                                                   |
| Inscribed on World Heritage List in 1982 |                                                                                                                                  |                                                                                                                                                                                                                 |
| 9. Macquarie Island                | Active programme is conducted by ANARE (Australian National Antarctic Research Expeditions) by an over wintering staff with visiting university and government scientists.  
A meteorological station was established in 1948 and is still maintained.  
Basic research  
Research has recently has focused on seabird and mammal ecology, causes of erosion and the effects of introduced animals and their control.  
Status assessment  
The Department of Parks, Wildlife and Heritage carries out long-term monitoring programs covering changes in the distribution and abundance of individual species and also association composition (DASET 1991). | Macquarie Island was not included in Australia’s Periodic Report to the World Heritage Commission as it was Listed after 1994. Integrity reporting is required for the next (2009) Periodic Report to World Heritage Commission.                                                                 |
| Inscribed on World Heritage List in 1997 |                                                                                                                                  |                                                                                                                                                                                                                 |
| 10. Purnululu National Park        | Together with Willandra Lakes - the most neglected—values not properly identified. Limited research on World Heritage values. Few visitors so no monitoring strategy.  
Basic research  
Numerous studies on natural and cultural World Heritage values  
Status assessment  
Events assessment  
The Department of Parks, Wildlife and Heritage carries out long-term monitoring programs covering changes in the distribution and abundance of individual species and also association composition (DASET 1991). | Purnululu NP was not included in Australia’s Periodic Report to the World Heritage Commission as it was Listed after 1994. Integrity reporting is required for the next (2009) Periodic Report to World Heritage Commission.                                                                 |
| Inscribed on World Heritage List in 2003 |                                                                                                                                  |                                                                                                                                                                                                                 |
| 11. Shark Bay, Western Australia  | Basic research  
• Floristic survey Peron Peninsula  
• Terrestrial ecology  
Status assessment  
Annual monitoring Loggerhead turtles  
Baseline marine water quality  
6-yearly Dugong surveys  
Visitor surveys  
Fire buffer zone monitoring  
Long term climatic data  
Ongoing marine, terrestrial, and Landsat Satellite monitoring programs.  
Australia’s periodic report to the World Heritage Commission included a statement on the state of conservation of Shark Bay a statement on the management of threats, including visitor use and a list of scientific research projects (EA 2003).  
The periodic report identified gaps in monitoring include impact of human activities and threatening processes (EA 2003)s. |                                                                                                                                                                                                                 |
| Inscribed on World Heritage List in 1991 |                                                                                                                                  |                                                                                                                                                                                                                 |
| 12. Tasmanian Wilderness           | Comprehensive overall management evaluation report based on research and monitoring. Visitor use assessed under objective of protecting natural values. Monitoring is built into plan of management—major reports every 5 years with the first in 2004.  
Basic research  
Numerous studies on natural and cultural World Heritage values  
Status assessment  
Priority recommendations included (1) provision of targeted funds for ongoing monitoring and evaluation | Australia’s periodic report to the World Heritage Commission included a statement on the state of conservation of the Tasmanian Wilderness and a statement on the management of threats, including visitor use and a list of scientific research projects (EA 2003).  
Priority recommendations included (1) provision of targeted funds for ongoing monitoring and evaluation. |
| Inscribed on World Heritage List in 1982 extensions in 1989 |                                                                                                                                  |                                                                                                                                                                                                                 |
### World Heritage Areas

<table>
<thead>
<tr>
<th>World Heritage Area</th>
<th>Major areas of ecological research and assessment</th>
<th>Reporting on condition of natural values and/or management of visitor use</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Research and monitoring has been undertaken for visitor use impacts by measuring change in condition compared to baseline.</td>
<td>(EA 2003). In 2004 the management agency released a report evaluating their management of the Tasmanian Wilderness. Visitor use was identified as a threat and management of visitor use was evaluated in terms of protecting natural values (TPHA 2004, Jones 2000, Jones and Dunn 2000).</td>
</tr>
<tr>
<td></td>
<td>- Extent of exotic plant coverage (at tourism nodes)</td>
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<td></td>
<td>- Spread of fungal pathogen <em>Phytophthora cinnamoni</em> along tracks</td>
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<td>- Condition of sensitive native plant communities (e.g. alpine vegetation)</td>
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<td></td>
<td>- Spread of high altitude dieback plant pathogen</td>
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<td></td>
<td>- Condition of hardened walking tracks</td>
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<td></td>
<td>- Erosion along hardened walking tracks</td>
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<td></td>
<td>- Condition of backcountry campsites</td>
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<td></td>
<td>- Formation of unplanned new tracks</td>
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<td></td>
<td>- Condition of lakes and streams in terms of presence of exotic fish (trout) illegally introduced for recreational fishing</td>
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<td></td>
<td>- Sustainable carrying capacity of walkers in different vegetation types</td>
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<td></td>
<td>- Impacts of commercial cruise boat operators</td>
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<td></td>
<td>- Horse-riding on central Plateau</td>
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<td></td>
<td>- Water quality and ecology of streams in karst areas</td>
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<td></td>
<td>Management agency identified lack of research in several key areas including:</td>
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<td></td>
<td>- Inadequate knowledge of fire regimes</td>
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<td></td>
<td>- Inadequate understanding of long term impacts of plant diseases such as <em>Phytophthora</em>.</td>
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<td></td>
<td>- Inadequate knowledge of visitor impacts and visitor management.</td>
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<td></td>
<td>- Inadequate methodology for monitoring subtle change in high quality wilderness areas</td>
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<td></td>
<td><strong>Effectiveness measurement</strong></td>
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<td></td>
<td>- Monitoring to determine effectiveness of the Walking Tracks Strategy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Monitoring to determine if management of tourist boats on Gordon River is effective</td>
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</tr>
<tr>
<td>13. Uluru-Kata Tjuta National Park</td>
<td>A management evaluation strategy was developed based on identifying World Heritage values and pressures on values and then listing monitoring and surveying projects implemented to determine condition/change in condition of values as a result of identified pressures. This is required for State of the Environment reporting.</td>
<td>Australia’s periodic report to the World Heritage Commission included a statement on the state of conservation of Uluru-Kata Tjuta National Park. The report includes, what was described as a ‘monitoring matrix’ – which is an extensive table listing monitoring/research projects relative to the appropriate world heritage value and then relative to threats (EA 2003). This was similar to the table presented for Kakadu NP, and in the same way the matrix shows that there is very little monitoring of direct impacts visitor use and some monitoring and research of introduced plants and animals (EA 2003).</td>
</tr>
<tr>
<td>Inscribed on World Heritage List in 1986 extensions in 1994</td>
<td>The following key areas are monitored:</td>
<td></td>
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<tr>
<td></td>
<td><strong>Basic research</strong></td>
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<tr>
<td></td>
<td>- Traditional Aboriginal tracking techniques</td>
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<tr>
<td></td>
<td><strong>Status assessment</strong></td>
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<tr>
<td></td>
<td>- Vertebrate and invertebrate monitoring in permanent sites in range of habitats</td>
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<td></td>
<td><strong>Weed infestations</strong></td>
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<td></td>
<td>- Burning practices</td>
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<tr>
<td></td>
<td>- Water consumption</td>
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<td></td>
<td><strong>Introduced animals</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Fire risks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Fine-scale soil mapping and erosion hazard</td>
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</tbody>
</table>
# ECOLOGICALLY SUSTAINABLE VISITOR USE OF AUSTRALIA’S WORLD HERITAGE AREAS

<table>
<thead>
<tr>
<th>World Heritage Area</th>
<th>Major areas of ecological research and assessment</th>
<th>Reporting on condition of natural values and/or management of visitor use</th>
</tr>
</thead>
</table>
| 14. Wet Tropics of Qld  
Inscribed on World Heritage List in 1988 | Strategic and collaborative approach to research and monitoring. Extensive strategic research and monitoring by external research organisations.  
**Basic research**  
- Functional ecology  
- Biodiversity  
- Numerous single species studies  
**Status assessment**  
- Rainforest visitation and business  
- Environmental planning and management of tropical rainforests  
- Monitoring and managing visitors (development of a visitor monitoring system—VMS)  
- Rehabilitation and restoration  
- Aboriginal and collaborative management  
- Vegetation mapping: 1: 200,000 vegetation mapping considered essential to conservation  
- Environmental impact studies  
- Mapping patches of rainforest dieback  
- Impacts of recreation activities and infrastructure on flora and fauna  
- Community landholder and neighbour surveys  
Proposed status monitoring  
- Implementation of the Visitor Monitoring System—VMS | Australia’s periodic report to the World Heritage Commission included a statement on the state of conservation of the Wet Tropics and an evaluation of the management of threats, and a list of scientific research projects (EA 2003).  
Annual management reports are required from Commonwealth management agency (Wet Tropics Management Authority) (e.g. WTMA 2004a, 2005). Annual reports always describe visitor use in terms of economic value. Visitor impact management assessed more comprehensively in 2004 report.  
Considerable body of research by external research organisation (Reef CRC). Reports relevant for visitor use impacts include:  
- Wet Tropics Visitor Monitoring System (3 volumes) (Wilson et al. 2004).  
- Environmentally sensitive infrastructure design  
- Visitor use impacts on water quality and ecology  
- Stream biodiversity and stream health |
| 15. Willandra Lakes Region  
Inscribed on World Heritage List in 1981 | **Basic research**  
- Numerous single species fossil studies  
- Numerous cultural heritage archaeological studies  
**Status assessment**  
- Mapping and surveying near burial sites  
- Photographic monitoring and surveys of sites for vegetation change  
- Kangaroo population change  
- Monitoring erosion points near burial locations  
- Visitor numbers collected since 1983 by road and pedestrian counters  
Proposed status monitoring  
- Threatened species and their habitats  
- Integrity of geomorphologic and fluvial features  
- Retention of giant extinct marsupial species  
- Integrity and state of preservation of archaeological sites  
- Retention of archaeological material | Australia’s periodic report to the World Heritage Commission included statement on the state of conservation of the Willandra Lakes region and a statement on the management of tourism (EA 2003). The report identified gaps in monitoring include impact of human activities and threatening processes such as removal of fossils and loss of integrity of archaeological sites. |
### Table 4: Sources used to review ecological research and assessment for each Australian World Heritage Area

<table>
<thead>
<tr>
<th>World Heritage Area</th>
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3. Fraser Island


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<th>World Heritage Area</th>
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Jenolan caves Visitor Impact Monitoring Programme  
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<td>World Heritage Area</td>
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## Evaluation of World Heritage Sites

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Chapter 5

TASMANIAN WILDERNESS WORLD HERITAGE AREA: BEST PRACTICE ADAPTIVE MANAGEMENT

The Parks and Wildlife Service of Tasmania evaluated their performance in managing the Tasmanian Wilderness World Heritage Area; with the report released in 2004 (TPWS 2004). This included evaluating their effectiveness in protecting the natural and cultural values. Protection was defined as ‘identifying and taking appropriate action to avert or actively manage impacts, threats and risks so as to avoid the loss or degradation of natural or cultural values’. Visitor use was identified as a threat and management performance was assessed as the extent to which plans and actions were effective in protecting values from visitor impacts. Findings of evaluations were used to guide and improve ongoing management (adaptive management) (TPWS 2004). We consider the evaluation of visitor use to be the current best practice approach in Australia.

Context

The Tasmanian Wilderness World Heritage Area (TWWHA) was inscribed on the World Heritage List in 1982 on the basis of all four natural criteria and three cultural criteria. It covers 1.4 million hectares (about one fifth the area of Tasmania). It comprises large areas of pristine temperate wilderness and includes Tasmania’s four largest national parks (Table 1, Figure 1) (EA 2003, TPWS 2004).

The TWWHA is managed under joint arrangements between the Australian and Tasmanian governments with day to day management the responsibility of the Tasmanian Park and Wildlife Service (TPWS). A statutory management plan (first plan 1992–1999, second plan 1999–2009) provides the policy, strategic and operational framework for management. The management plan articulates management objectives based on the principle objectives of the World Heritage Convention: to identify, protect, conserve, rehabilitate and present the natural and cultural heritage. The management plan defines the management actions needed to realise objectives and also establishes a monitoring system to determine if objectives are being achieved (TPWS 2004).

Visitor Use

To manage the 400,000 people who visit the Tasmanian Wilderness each year, the TPWS have adopted a zoning system which identified four main zones: Wilderness; Self-Reliant Recreation; Recreation; and Visitor Services Zones and Sites. Each zone has specific management objectives and prescriptions for management and together they provide a range of recreation opportunities (TPWS 2006). Popular activities include bushwalking, hiking, camping, boat use, anglers, rafters, and climbers. Infrastructure includes visitor centres, roads, toilets, camping areas, cabins, parking areas, walking track, picnic areas, and an extensive walking track system (EA 2003). More detailed plans have been developed to manage specific aspects of visitor use. For example the extensive walking track system is managed under the Overland Track Draft Recreation Zone Plan (TPWS 2006) and the Walking Track Management Strategy (Hawes 1998).

Evaluating Overall Management Effectiveness

The Parks and Wildlife Service evaluated its management of the Tasmanian Wilderness under the first management plan 1992–1999. The evaluation was distinguished by a collaborative approach between staff and a consultant who provided advice on identifying appropriate management outcomes and performance indicators. The first evaluation report, published in 2004, provided information on the extent to which the key objectives of the World Heritage Convention has been achieved: to identify, conserve, protect, present and where necessary to rehabilitate World Heritage values. The achievement of defined management outcomes was, in many cases, based on evidence from research and monitoring programs. The report is considered to be a baseline dataset from which long term changes can be assessed (Jones 2000, Jones and Dunn 2000, EA 2003, TPWS 2004, Jones 2005). The agency reports that the process of undertaking the first evaluation has increased their capacity to monitor and evaluate (EA 2003).
Evaluating Management of Visitor Use

The TPWS identified visitor use as a threat and assessed their management performance in terms of protecting the values of the Tasmanian Wilderness. The principle objective for the management of visitor use was protecting natural and cultural heritage. Sustainable tourism was identified as an appropriate activity, but visitor activities visitor facilities and other infrastructure were identified as threats to natural values over particular areas as a result of ‘unsustainably high numbers which have exceeded the capacity of the system to withstand or readily recover from the pressure’ (TPWS 2004). In particular, visitor use was seen as damaging fragile alpine vegetation, spreading root rot disease, damaging cave formations, eroding soils (boat wakes and walker activities), polluting backcountry areas through disposal of human waste, disturbing already endangered species, and damaging Aboriginal sites from walker impacts. In most cases impacts were exacerbated by unsustainably high numbers. The development of new facilities and other infrastructure is also reported as a threat or potential threat (TPWS 2004).

Research was undertaken to determine carrying capacity for several activities including horseriding on the Central Plateau, and tramping by walkers in alpine areas. Monitoring programs were established for high impact activities such as walker impacts on the walking track system and erosion from boat wakes on the Gordon Rivers. Performance in managing these two high impact activities was assessed using data from long term monitoring based on a six step process (Jones 2000, Jones and Dunn 2000):

- The TPWS clearly identified visitor use (walker impacts and erosion from boats) as high priority threats and assessed their management in terms of the objective of protecting natural values.
- They clearly articulated the desired ‘on ground’ management outcomes that were expected if the management objectives were fully realised.
- They defined core performance indicators (for each desired outcome) that could potentially reveal whether management was achieving desired outcomes.
- Monitoring programs were established for or the highest priority indicators. Research studies provided data for other impacts.
- Findings of the evaluations were used to guide and improve ongoing management (adaptive management).
- Findings of monitoring programs were collated and published.

Indicators for assessing management effectiveness

The TPWS stated that they lacked sufficient funds to monitor impacts of all visitor activities therefore they only conducted long-term monitoring for activities with the highest impacts. The following sections show how the TPWS used performance indicators for assessing management of two high impact activities—cruise ship tourism on the lower Gordon River and people on the walking track system (Jones and Dunn 2000, TPWS 2004). Two types of indicators were used, condition indicators and pressure indicators. Condition indicators can show change in ecological condition (e.g. rate of river bank erosion) while pressure indicators show change in factors affecting condition (e.g. number of visitors).

River bank erosion from cruise ship in the lower Gordon River

Research had demonstrated that wakes from tourist boats had caused serious ongoing erosion of the banks of the lower Gordon River. Management goals included re-establishing the stability of the riverbank and allowing natural recovery (Table 5). Desired management outcomes included ‘no detectable vessel induced erosion’ (Table 5). Condition and pressures indicators were selected and monitoring programs established. Monitoring of condition indicators consisted of twice-yearly measurement of 250 erosion pins at 50 sites along river included bank profile, plan surveys, landslip activity. Rate of erosion on trafficked alluvial banks in high use area were compared with similar undisturbed banks. Monitored pressure indicators included maximum and total wave wake power, maximum wave height not exceeding 75 mm (measured in deep water 50 m from vessel). This was monitored through license returns. Private vessel use was difficult to monitor (TPWS 2004).
Table 5: The use of performance indicators for assessing effectiveness of management of tourist boat operations in the lower Gordon River in the Tasmanian Wilderness World Heritage Area (TPWS 2004)

<table>
<thead>
<tr>
<th>Performance indicators and target</th>
<th>Management actions</th>
<th>Assessment of change in condition</th>
</tr>
</thead>
</table>
| **Condition indicator:** rate of bank erosion  
**Target:** no detectable vessel induced erosion. | Vessel speed limits were introduced and access restrictions were applied to most vulnerable stretches or river.  
Licence conditions were introduced that required new vessels to have lower hulls. | Erosion decreased in some areas following cruise vessel speed reduction in 1994. |
| **Condition indicator:** revegetation of destabilised banks.  
**Target:** return of stability as appropriate. | | Bank retreat essentially stabilised since removal of cruise traffic reduction in 1994. |
| **Pressure indicator:** wake characteristics.  
**Target:** targets for wave height and power are met. | | |
| **Pressure indicator:** frequency of wave disturbance.  
**Target:** adaptive management response required if condition targets not achieved. | | No change in frequency. |

Walker and camper impacts on the walking track system

There are over 1000 km of tracks in the TWWHA attracting 20,000 walkers each year who are spending 35,000 nights in wilderness areas (RPDC 2003). The substantial increase in numbers over the last two decades has led to a rapid deterioration of walking tracks over some areas and to other user related problems such as crowding and unplanned track formation. The problems are exacerbated by the fragility of the alpine and subalpine landscape, the steepness of tracks and poor drainage. Although not all tracks are degraded, there is serious damage on some heavily used sections (TAG 2001).

Environmental degradation has been monitored for more than 15 years at over 500 monitoring sites (Table 6). The on-ground measurement together with aerial photographs (purpose flown 1:5000 scale colour aerial photos) has helped to establish the extent of impacts and rates of change (TPWS 2004). At each site information is gathered on a number of condition indicators including depth of erosion, loss of vegetation cover, and evidence of frequent water flows.

Monitoring showed that there was continuing erosion and deterioration along the entire track network. Many areas have heavy erosion as well as track braiding and widening. Depth and width on some sections have been increasing yearly (Dixon et al. 2004). Monitoring has helped identify existing and potential trouble spots, and predict future track conditions. Monitored pressure indicators include the number of walkers on the track network which was determined using log book and track counters (Dixon et al. 2004).

Although there have been achievements including stabilising tracks and hardening walking tracks, and camping sites, tracks are generally not sustainably managed as many have continued to erode and unplanned tracks have continued to develop. As well, backcountry campsites used by overnight walkers continue to expand and deteriorate (TPWS 2004).

The TPWS identified that a key management action was to limit the number of walkers by using a permit system. Recently, this recommendation was implemented for the Overland Track (TPWS 2006). There had been strong opposition from people to limiting use (TPWS 2004). A recent track assessment report recommended a combination of strategies including best practice codes, developing Limits of Acceptable Change (LAC) for priority areas of the track in consultation with stakeholders and, limiting use at peak times (Track Assessment Group 2001). Monitoring has shown that without a permit system, other strategies were not effective in preventing degradation. Based on empirical evidence of continuing degradation a permit system was finally introduced. The TPWS recognise that even more effectiveness monitoring is required.
## Assessing indirect impacts of visitor use

The introduction and spread of exotic plants and animals is a threat/pressure to World Heritage values. Their management was assessed under the key management objective of protecting natural and cultural heritage (TPWS 2004, Jones 2005). However, the role of visitors and associated infrastructure in causing disturbance and acting as vectors was not recognised as contributing to the introduction and spread of exotics. While it was recognised that the spread of *Phytophthora* was a threat facilitated by visitors, this threat was not assessed under the specific section ‘tourism and visitor activities and use’.

The broad ecological impacts from the development of new and existing visitor infrastructure were also reported but there were no monitoring. Impacts from several other visitor activities were also identified but not specifically evaluated. These include human waste from backcountry campers polluting the environment, visitors damaging limestone caves by breaking formations and acidic solution of limestone from increased carbon dioxide in cave air, visitors damaging Aboriginal sites, and noise from visitors disrupting already endangered species (TPWS 2004).

### Limitations of the Overall Management Evaluation

Data on which to assess management effectiveness were patchy due to a lack of overall strategic planning for many areas of management responsibility (TPWS 2004). In particular there was:

- a lack of overall coordination and strategic planning, with the selection of monitoring programs largely left to the initiative of individuals
- inconsistent data records and reporting formats
- inadequate or inefficient data storage and management systems
- low management priority for performance evaluation and reporting
- lack of consistency in purpose and design of visitor surveys (TPWS 2004).

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<table>
<thead>
<tr>
<th>Performance indicators and target</th>
<th>Management actions</th>
<th>Assessment of change in conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Condition indicator</strong>: rate of change of tracks. <strong>Target</strong>: re-measurement at 2–3 year intervals of more than 450 established monitoring sites along the entire track network. <strong>Condition indicator</strong>: extent of unplanned track formation. <strong>Target</strong>: no unplanned track extension, degree and extent are consistent with Walking Track Strategy.</td>
<td>Intensive track stabilisation and hardening works of use tracks. In many areas this response is incompatible with wilderness values and changes the recreational opportunity. Other options include education and limiting numbers. The latter has only recently (2005) been implemented due to resistance from user groups.</td>
<td>Continuing erosion and deterioration along all of track network. Depth increased by 11% per year. Average width increase 4%. Some track widths increased by 40–50%. Although a sound basis for has been established but high uncontrolled usage means that tracks continue to erode.</td>
</tr>
<tr>
<td><strong>Condition of campsites indicator</strong>: location and condition of all campsites in the walking areas encompassed by the track Monitoring System have been noted. Level of detail noted by surveys ranges from allocation of a categorical. Condition class to the detailed mapping of site boundaries. Historic data from surveys over the last 5–10 years provide a basis and are available for many campsites. Resurveys are planned 5-yearly. <strong>Target</strong>: adequate number of stable campsites, no unplanned expansion in area or number consistent with the track network prescriptions specified in Walking Track Management System.</td>
<td></td>
<td>Around 150 km of unplanned track formed since 1980, including 50 km in previously untracked country. Active deterioration of campsites (vegetation loss, expansion /and or erosion has been noted in a number of areas.</td>
</tr>
<tr>
<td><strong>Pressure indicator</strong>: walker numbers/usage. <strong>Target</strong>: usage levels that maintain or improve condition targets.</td>
<td></td>
<td>Numbers have increased by about 30%.</td>
</tr>
</tbody>
</table>
Limitations of the Evaluation of Visitor Use

- lack of baseline data for priority visitor threats and pressures, for example carrying capacities for horseriding in sensitive areas (TPWS 2004)
- lack of knowledge of walker impacts in alpine areas. Lack of monitoring for change in condition due to walkers (TPWS 2004)
- lack of research of long term impacts of plant diseases such as *Phytophthora* (root rot)
- inadequate understanding of visitor impacts and visitor management (TPWS 2004)
- inadequate methodology for monitoring subtle change in high quality wilderness areas (TPWS 2004).

Best Practice in the Evaluation of Visitor Use

- The extent of visitor use is objectively measured in some areas.
- Visitor use was identified as a threat or pressure to World Heritage values and specific biophysical impacts were identified.
- Clear objectives for visitor use were formulated based on recognition that visitor use has biophysical (ecological) impacts and is a threat or pressure to natural values.
- Plans for attaining visitor use objectives were developed.
- Systematic, strategic monitoring programs were developed to measure the achievement of objectives of visitor management plans.
- Adaptive management was undertaken based on monitoring data.
- The TPWS assessed and reported the ecological sustainability of visitor use.
Chapter 6

GREAT BARRIER REEF WORLD HERITAGE AREA: BEST PRACTICE STRATEGIC RESEARCH AND ASSESSMENT

The management agency for the Great Barrier Reef has the best practice approaches to strategic planning including planning for ecological research. For many years, external organisations (universities, cooperative research centres, Australian Institute for Marine Science etc) have provided information for managers on the values and fragility of ecosystems and the range of threats to ecosystems including from impacts of visitor use. Strategic planning for managing human use of the Great Barrier Reef was based on advice from such research. Recently, ongoing strategic research needs were identified through consultative processes between management agencies, researchers and stakeholders. This process has identified that research and assessment is needed to understand if visitor management plans are effective in achieving conservation objectives.

Context
The Great Barrier Reef World Heritage Area (GBRWHA, Figure 1) extends for 2000 km from the top of Cape York to just north of Fraser Island: from the low water mark on the Queensland coast to the outer boundary of the Area (GBRMPA 2003). Covering more than 38 million hectares, it is the world’s largest World Heritage Area. It comprises complex and biologically diverse coral reefs, lagoons, sea grass habitats and mangrove and estuarine communities (EA 2003, GBRMPA 2006) (Table 1). The original park (Great Barrier Reef Park) was proclaimed in 1975 and together with adjacent coastal areas and islands was inscribed on the World Heritage List in 1981 based on outstanding natural features and ecological integrity (all four natural criteria) (EA 2003).

The Reef is managed under joint Australian and Queensland government arrangements under the 25-year Strategic Plan. The Strategic Plan was developed by more than 60 user and interest groups, Indigenous peoples and government agencies and focuses on multiple use and maintenance of values (Worboys et al. 2005). Management of the Reef is coordinated by the Australian Government through the Great Barrier Reef Marine Park Authority (GBRMPA). Day to day management of the Marine Park is predominantly through the Qld Parks and Wildlife Service with other State agencies, such as Qld Boating and Fisheries Patrol and Qld Water Police also involved (EA 2003).

The park agencies’ corporate management goal is ‘providing for the protection, wise care, understanding and enjoyment of the Reef in perpetuity through the care and development of the Great Barrier Reef Marine Park’ (GBRMPA 2006). This goal is based on the key objective of the World Heritage convention—to identify, protect, conserve, rehabilitate and present World Heritage values.

The Reef is not only ecologically significant, but socially culturally and economically important as well. It is a multiple-use protected area supporting diverse human uses including tourism and recreation, shipping, commercial fishing, research and education, and cultural activities (Moscardo and Ormsby 2004). The park agency is required to provide equitable access to all users while ensuring that World Heritage values are protected. The Reef faces many threats the most important of which are increased commercial and recreational fishing pressure, coastal development impacts on water quality, growth in regional population, biodiversity loss, increasing visitor pressure, global warming, and the Crown of Thorns Starfish (Harriott 2002, EA 2003).

Visitor Use
Tourism is the principle commercial use of the Reef generating $5.1 billion annually from over 1.9 million visitor days (Harriott 2002). Major sectors of the marine tourism industry are pontoon based tourism operations (day use for snorkelling and diving); vessel based tourism (vessels carrying 10–400 passengers on day trips or extended trips to specific sites such as islands and moorings, or roving); bareboat charters (yachts for rent within restricted areas); cruise ships (large ships passing through or anchoring overnight); aircraft based operations (e.g. helicopters and seaplanes); and resort and shore based operations (Harriott 2002).
The numbers of tourists increased rapidly in the 1980s but appears to have stabilised more recently (Harriott 2002). However, recreational demand from coastal residents is high and numbers for this are largely unknown. The Environmental Management Charge (EMC) which was introduced in 1993 for each reef visitor on a commercial tour, provides funding for management and research and also provides information on the extent and location of use by visitors traveling within permitted commercial reef tourism operations. There is less information on patterns of use by independent visitors (Harriott 2002, Moscardo and Ormsby 2004).

Major visitor use impacts are from coastal tourism development (population pressures, construction activities), island based tourism (marinas, sewage discharge, construction), marine based tourism infrastructure (pontoons, moorings, fish feeding), boating induced damage (anchoring, ship grounding, litter, waste discharge) and wildlife interaction (seabirds, turtle-watching, whale-watching) (Harriott 2002, EA 2003). Research shows that people perceive tourism activity to be one of the three greatest threats to the Reef, however scientific research shows that inshore water quality, over-fishing, the Crown of Thorns Starfish and coral bleaching are of greater concern. Visitor use impacts are considered to be localised and small in magnitude compared with these environmental concerns (Harriott 2002). Visitor use is considered a critical issue in the management of the Marine Park as it is the major commercial activity within the World Heritage Area (Harriott 2002).

The main tool for managing all types of human use is zoning. A new Zoning Plan was implemented in 2004 which specifies a broad framework for all human use by designating zones where specific types of activities may take place. Most tourism and recreation is concentrated in just 10% of the Park in the Cairns and Whitsunday areas (GBRMPA 2005, 2006). Visitor use is also managed through legislation, permit systems, plans of management, the Environmental Management Charge and other strategies and policies including best practice codes, training and enforcement (TRRAC 2002). While operators are encouraged to adopt best practice behaviour and undertake training and accreditation, the extent of compliance is unknown (Harriott 2002).

A recent strategy for improving tourism and recreation management was the establishment of the Tourism and Recreation Reef Advisory Committee (TRRAC) with a range of members reflecting the different stakeholder groups. This committee recognised that more effective management was required particularly in high use areas and sensitive sites. The committee framework for the Sustainable Management of Visitor Use advocates a triple bottom line approach to sustainable development—environmental, economic and social/cultural sustainability. The committee advocates use of management plans as area specific tools which include specific strategies for dealing with impacts in each area. In particular, the committee supports the development of tourism standards applying to all users, limiting use at popular or sensitive sites, developing indicators of ecological and social change, and an ongoing environmental and social research and associated monitoring programs to determine the effectiveness of management plans (TRRAC 2002).

**Ecological Research and Assessment**

The Reef has one of the highest levels of research and assessment of any World Heritage Area and the park agency state that their management policies and decisions are based on the best available scientific and technical information (Tables 3 and 4) (GBRMPA 2006). Overall coordination of research and assessment needs is the responsibility of the Science and Technology and Information Group. External research organisations such as the Australian Institute for Marine Science (AIMES) and the Cooperative Research Centre for the GBRWHA (Reef CRC) have also been closely involved in research on the Reef over many years. The Reef CRC was the major provider of applied research into the ecologically sustainable use of the Reef from 1999–2006 and is being replaced by the Marine and Tropical Sciences Research Facility (GBRMPA 2006).

In 2001 the park agency developed a comprehensive list of research needs and identified research priorities. The approach was based on determining priority management issues and the information required to address those issues and then identifying specific research tasks that would address those needs (Green et al. 2001). The strategic direction and scope of research was reviewed in 2005 and the 2001 research needs report was superseded by a Research Information System with key research themes and priorities summarised in the ‘Research Needs for the Protection and Management of the Great Barrier Reef Marine Park 2005’ report (Australian Government 2005). Research needs are presented as 22 research themes, and summarised as 274 specific research questions. Research questions were prioritised for importance and timeframe of the information need, and scored against the National Research Priorities, the park agency’s Key Performance Indicators, and key legislative or policy requirements. Twenty-one research questions are...
considered to be critically important and most were assessed as relatively urgent, with information, or at least baseline information needed within one to three years. Priority research needs include developing performance indicators, monitoring baseline values and long term trends in marine ecosystems, determining acceptable limits of change and acceptable use and appropriate management response to these.

Research has been conducted and/or is required in the following areas (Australian Government 2005):

- conservation and protection of biodiversity and other World Heritage values. Research and assessment for understanding and protecting marine species, reef ecosystems, reef geomorphology and hydrology, threatened species is needed. This includes monitoring potential direct, indirect and cumulative impacts of human uses on key marine species, marine park resources and World Heritage values. As a priority research is needed on the effectiveness of marine park planning and management arrangements, including the overall health of the ecosystem, and the effectiveness of the new Zoning Plan (2004)
- coastal development and water quality issues. This includes developing technologies for monitoring water quality, assessing land based threats and impacts including nutrient supply fluxes. A priority is to determine the effectiveness of the Reef Water Quality Protection Plan in halting and reversing declining water quality
- fisheries issues. Research is needed into ecological sustainable fisheries, including, as a priority, the effectiveness of current and planned fisheries management strategies
- tourism and recreation issues. Research and assessment is required including understanding demographic, economic and sociological issues of visitor use including level of use by identified user groups interactions and motivations and perceptions of users
- effective management issues including program delivery issues. A key priority is to determine the effectiveness of the new zoning plan (2003) in protecting coral reefs and other habitats, and fish
- research and assessment issues
- impacts and mitigation of climate change
- communication and education issues.

Research and Assessing Visitor Use

Acute impacts of visitor activities and infrastructure on the marine ecosystems of the Reef have been relatively well studied and have given managers important information on the nature and scale biodiversity, the types of uses and potential effects of use on reef and island ecosystems (Harriott 2002, Moscardo and Ormsby 2004). The best studied tourism impacts are those associated with pontoons, anchoring, and diving. A series of extensive impact studies has found that impacts of pontoons on surrounding reef areas are minimal. However, anchoring of both tourism and recreational boats is a significant issue in heavy use areas. Management actions that have been implemented to mitigate impacts include the installation of private and public moorings, no-anchor areas in heavily used places, and an education program for boaters and promoting codes of practice (Harriott 2002). Although impacts of diving and snorkelling have been well-studied, managers consider that diving has not impacted sites because of the large choice of dive locations. This decision was reached based on overseas research on carrying capacity. However, snorkellers may have more impact on corals and recommendations to reduce diver and snorkeller impacts have been taken up by the dive industry.

In contrast to ecological studies of visitor impacts, social use of the GBR has been less studied and is considered to be poorly understood. In order to better understand the relationship between natural and social systems and achieve a balance between use, enjoyment and biophysical sustainability, a ‘Social Indicators Monitoring System for Visitor and Recreational Use of the Reef was recently developed (Moscardo and Ormsby 2004). The proposed system aims to provide information to managers on numbers of users and on patterns of use. Although this type of usage can be determined for commercial tourism via the Environmental Management Charge, it cannot be determined for independent recreational users. The Social Indicators Monitoring System proposes methods to ensure data collection is based on standard protocols and is available for managers.
Visitor use research and monitoring has been conducted and/or is required in the following areas (Green et al. 2001, GBRMPA 2006).

- monitoring potential direct, indirect and cumulative impacts of tourism and recreation on dugongs, turtles, whales, dolphins and seabirds
- studies of human use patterns, including demographic, economic and sociological issues of visitor use; Specific information on the level of use of specified user groups, interactions and motivations and perceptions of users. This information will assist with understanding the core issues leading to displacement of use. Priorities are to understand community attitudes, perceptions, concerns and needs with respect to the use and management of the Reef
- understanding trends in population growth of local communities and the impacts of such growth on the direct and indirect pressures on the Reef
- research to determine thresholds of acceptable change, acceptable levels of use, and appropriate management responses for threats including from visitor use and areas threatened by visitor use. Protocols and methods to determine threshold limits of acceptable change on a site specific basis, based on consideration of social, cultural, economic and environmental values are required. For example, monitoring to determine the effectiveness of high use site management (e.g. campsites) on soils and vegetation, monitoring for impacts and changes at high use dive sites, impacts of humans on roosting and nesting sea birds, (e.g. critical approach distances), research to determine the effectiveness of existing management actions aimed at improving seabird and turtle breeding, including vegetation restoration, fencing, exclusion and invasive species control
- research tracking and measuring cumulative impacts on the environment and stakeholder groups of new developments including aquaculture, marinas, research stations, whale watching tourism etc

Evaluating overall management performance

There are legislative requirements for the park agency to annually report on the achievement of organisational goals and targets, including finances; human resources and key issues including conservation and heritage; water quality and coastal development; fisheries; tourism and recreation; park management; information for park management; and reef education and communication. The park agency is also required, under the Biodiversity Protection and Conservation Act 1999, to report how they have contributed to ecologically sustainable development.

The park agency report on how they have achieved their corporate management goal of providing for the protection, wise care, understanding and enjoyment of the Reef using seven Key Performance Indicators. The report assesses the extent to which defined outputs have been achieved for each of the seven performance indicators, relative to the three main components of the corporate goal (protect the Reef, wise use of the Reef, and understanding and enjoyment of the Reef (GBRMPA 2004, 2005, 2005)) (Table 7). For example, for the goal “protecting the Reef” there are a wide range of systematic monitoring programs and other periodic assessments are used to evaluate and report achievement of outputs against the stated objectives. One major output of protecting the Reef is a new Zoning Plan (2004) which is expected to provide an adequate network of ‘no-take’ fishing areas that represents examples of all habitat types and considers social, economic and cultural information. There has been no assessment of the effectiveness of the new Zoning Plan as yet, but park agency recognise that research and monitoring is needed for this (AG 2005).
Table 7: Seven Key Performance Indicators used by the Great Barrier Reef Marine Park Authority since 2004 to assess the extent to which they have achieved their corporate management goal (GBRMPA 2006)

<table>
<thead>
<tr>
<th>Corporate Management goal</th>
<th>Desired outcome</th>
<th>Key Performance Indicator (KPI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protect the Reef</td>
<td>Conservation of biodiversity</td>
<td>1. Healthy Reef. The overall number of reefs that are ‘healthy’ compared with ‘not healthy’ as assessed by the Australian Institute of Marine Science long term monitoring program. The measured indicator was the area (percent cover) of the Reef structure occupied by living coral.</td>
</tr>
<tr>
<td></td>
<td>Improved water quality</td>
<td>2. Trends in chlorophyll concentration in the GBR lagoon. In future years this will be changed to measuring nutrient, sediment and pollution loads in mouths of 10 major rivers draining into the GBR.</td>
</tr>
<tr>
<td>Effective Park Management</td>
<td>4. The number of bioregions with adequate no take zones.</td>
<td></td>
</tr>
<tr>
<td>Understanding and enjoyment of the Reef</td>
<td>High quality tourism and recreation opportunities that are ecologically sustainable</td>
<td>5. The number of scientific and technical publications published about the GBR by the GBRMPA and the Reef CRC.</td>
</tr>
<tr>
<td></td>
<td>Improve community understanding of GBR</td>
<td>6. Trends in the number of tourists to the GBRWHA and their satisfaction with their experience.</td>
</tr>
<tr>
<td></td>
<td>7. Increasing public understanding of the main threats to the Reef.</td>
<td></td>
</tr>
</tbody>
</table>

Evaluating Management of Visitor Use

Although visitor use is identified as a threat or pressure to the World Heritage values of the Reef (EA 2003, GBRMPA 2006), the park agency did not assess their management of visitors under goal of ‘Protecting the Reef’ or the goal of ‘Wise use of the Reef’. Visitor use was assessed under the goal of ‘Understanding and enjoyment of the Reef’. This approach is in contrast to the assessment by the Tasmanian Parks and Wildlife Service of visitor use as a threat to the values of the Tasmanian Wilderness (see previous section).

The two key performance indicators for the goal of ‘Understanding and enjoyment of the Reef’ are (i) ‘Trends in the number of tourists to the GBR, and (ii) Visitor satisfaction with their experience’. The prescribed output is that tourism opportunities are high quality and ecologically sustainable (Table 7) (GBRMPA 2006).

The park agency assess management of visitor use based on reporting (i) trends in the number of tourists and (ii) the development (and implementation) of specified outputs (policies/plans and actions intended to contribute to sustainable use) (GBRMPA 2006).

Examples of outputs used to assess ‘Understanding and enjoyment of the Reef’:
- determine numbers of tourists visiting the Marine Park and if their levels of satisfaction are maintained or increased
- all expiring permits for limited opportunities are reviewed for latency.
- there are systems in place to recognise and reward high standard tourism operators.
- information and training for industry and other stakeholders is provided.
- there is continued involvement of stakeholders and high level of community engagement (DEH 2006a).
- management initiatives for tourism and recreation were developed and implemented in partnership with the tourism industry, recreational users and other key stakeholders. They consider that partnership arrangements are of a very high standard.
- planning and regulatory systems provide transparency and certainty.
- tourism and recreation opportunities in the Marine Park provided in an efficient and equitable manner as rated by industry satisfaction measures (DEH 2006a).
Currently, quantitative evidence of the effectiveness of plans for managing the sustainability tourism and recreation is lacking. This has been recognised in the most recent ‘Research Needs for Protection and Management of the Great Barrier Reef’ report (GBRMPA 2005) which identified as the highest priority research on management effectiveness including:

- determining the effectiveness of the new Zoning Plan (2003) in protecting coral reefs and other habitats, and fish
- determining the effectiveness of current and planned fisheries management strategies.

However, these are not directly assessing tourism and recreational use.

**Limitations of the Evaluation of Visitor Use**

Currently, assessment of management performance (managing visitor use) is not based on qualitative evidence of the effectiveness of plan/policies/strategies/action. This was recognised in the GBRMPA report titled ‘Research Needs for Protection and Management of the Great Barrier Reef’ (GBRMPA 2005). That report specifically called for research to determine effectiveness of key management plans—such as the Great Barrier Reef Marine Park Zoning Plan 2003 (GBRMPA 2005). It is of even greater concern that the park agency does not evaluate visitor use as a threat to the Reef, and hence evaluate how successful they are at ameliorating it as a threat, as is done for Tasmania Parks and Wildlife Service. Assessing and reporting the ecological sustainability of visitor use has not been implemented to date.

**Best Practice in the Evaluation of Visitor Use**

- The extent of visitor use is objectively measured in some areas.
- A range of biophysical impacts of visitor use has been identified.
- Clear objectives for visitor use have been identified based on biophysical (ecological) impacts of visitor use and recognition that visitor use is a threat/pressure to natural values.
- Plans for attaining visitor use objectives have been developed.
- It is recognised that monitoring to measure achievement of the objectives of visitor management plans is needed. Some long term monitoring is underway.
- It is recognised that adaptive management is needed. From the literature review, it does not seem that this has been implemented. Adaptive management involves taking corrective actions to achieve planned objectives.
Chapter 7

WET TROPICS OF QUEENSLAND: BEST PRACTICE VISITOR USE RESEARCH AND ASSESSMENT

The Wet Tropics Management Authority, like the management agencies for Tasmania Wilderness and the Great Barrier Reef have recognised that visitor use can be a threat with a range of biophysical impacts. It has also made use of research collaboration particularly with the Rainforest Cooperative Research Centre to design assessment strategies for visitor use and impacts. So far, it has not progressed as far as the other two World Heritage Areas in detailed monitoring and then assessing the success of management strategies. Currently it is a work in progress which is limited by funding.

Context

Wet Tropics World Heritage Area is located between Townsville and Cooktown on the north-east coast of Queensland (Figure 1). Covering an area of approximately 894,000 hectares it conserves the largest rainforest wilderness in Australia and is the world’s oldest continually surviving rainforest (Watkinson and McColl 2005, DEH 2006a). The Wet Tropics was inscribed on the World Heritage List in 1991 on the basis of all four natural criteria and includes private freehold land, leasehold, national parks, State forests, Crown lands and Aboriginal land.

The Wet Tropics is managed as a multiple use area under joint Australian and Queensland government arrangements under the Wet Tropics Management Plan (1998). The primary objective for the management of the Wet Tropics as stated by the Wet Tropics World Heritage Protection Act 1993 (Reprint No. 4a 2007. p. 53) is ‘To provide for the implementation of Australia’ s international duty for the protection, conservation, presentation, rehabilitation and transmission to future generation of the Wet Tropics of Queensland World Heritage Areas’. The Wet Tropics Management Plan was developed with the involvement of stakeholders including indigenous groups and gives the Wet Tropics Management Authority (WTMA) overall responsibility and power to act in the interest of the World Heritage Area with direct responsible for developing and implementing policies and programs, preparing management plans, administering funding, and research and monitoring. Day to day management is undertaken by several Qld State government departments (EA 2003).

The Wet Tropics Management Plan regulates land use across the Wet Tropics. Priority management issues are the management of invasive species, water extraction, tourism development and Indigenous involvement. Specific environmental management plans have also been developed including the Nature Based Tourism Strategy (2000), the Natural Resources Management Plan (2002) and the Wet Tropics Conservation Strategy (2004b). The Wet Tropics Management Authority is advised by the Community Consultative Committee and the Scientific Advisory Committee and also collaborates with key stakeholder liaison groups including the Tourism Industry Liaison Group (EA 2003).

Although human impact is considered low compared with tropical forest regions elsewhere in the world, large parts are affected by selective logging, with many areas also affected by exotic plants, animals and diseases particularly forest dieback. Other severe threats are growth in the regional population, regional landuse (agricultural expansion and clearing), altered drainage patterns (hydro power), construction of dams and weirs (terrestrial habitat modifiers), internal fragmentation from roads and access easements, changes to fire regimes in non rainforest areas, climate change and increasing tourism and recreation in localised areas (EA 2003, WTMA 2004a).

Visitor Use

The Wet Tropics receives 5 million visits annually; more than any other World Heritage Area in Australia (WTMA 2005). The substantial increase in visitation over the last decade was driven by growth in the regional population of Cairns and surrounding areas. This has created demand for recreational experiences within the WHA which, in turn has created demand for infrastructure such as more road access, walking tracks, developed visitor sites, camping grounds, picnic areas, lookouts, and other facilities (Table 2) (Bentrupperbäumer and Reser 2002, EA 2003).
The principle tool for managing visitor use is zoning under the Wet Tropics Management Plan which regulates activities which may impact World Heritage values. The management of visitor use has been strategically directed by the Wet Tropics Nature Based Tourism Strategy which specifies broad policies based on collaboration and partnership between management agencies, the tourism industry, local government and conservation groups. The Strategy focuses on sites which can be accessed by vehicles and encompasses independent visitors and commercial tourism (WTMA 2001a, Watkinson and McColl 2005). Visitor use is also managed through legislation, a permit system for commercial use, best practice codes and specific plans and strategies. For example, the Wet Tropics Walking Strategy (2001) identifies over 200 managed walks and potential walks in the region and aims to provide a coordinated approach (WTMA 2001b, EA 2003, Weston & Goosem 2004).

Both the Nature Based Tourism Strategy and the Wet Tropics Walking Strategy highlighted the need for a visitor monitoring system (VMS) for ongoing monitoring of environmental conditions. Recently a VMS was developed in collaboration with the Rainforest CRC (Cooperative Research Centre for Tropical Rainforest Research and Ecology) for monitoring 180 recognised visitor nodes and sites in the Wet Tropics (Wilson et al. 2004a). This is currently being trialed.

Research and Assessment

Research

The substantial body of research on the Wet Tropics has identified World Heritage values, major threats and pressures and impacts to values (Tables 3 and 4). The Rainforest CRC was established 1993 as a major centre for understanding rainforest ecology and management and has been the major provider of research and assessment projects for the region (EA 2003). Prior to 2000 research was not strategically directed and information was not synthesised or used to improve management (WTMA 2000a; Weston and Goosem 2004). This was addressed in the Wet Tropics Research and Information Needs Report (RAIN Report 2000) which identified strategic areas for research to assist in making informed decisions and priority knowledge gaps are linked to the annual reporting requirements of the WTMA (WTMA 2000a). Based on the research priorities identified by the RAIN Report eight core reporting themes were identified supported by seven research programs (EA 2003). These seven research programs conducted between 1999–2006 by Rainforest CRC are:

- Environmental planning and management of tropical rainforests
- Functional ecology
- Rainforest visitation and business
- Rainforest access
- Rehabilitation and restoration
- Conservation principles and management
- Aboriginal and collaborative management

Monitoring

Monitoring by the Rainforest CRC was conducted between 1999–2006 to support the annual reporting requirements of the WTMA (EA 2003). Core landscape level ecological indicators were developed to measure change in natural values for the set of eight core reporting themes (Table 9) (EA 2003). These were solely ecological indicators. More recently, socio-economic and cultural indicators have been developed as a result of collaboration between the WTMA and the Rainforest CRC. These are explained in the following section in relation to visitor use of the Wet Tropics.

Visitor use research and assessment

Ecological research and assessment relevant for management of visitors to the Wet Tropics has been conducted in several key areas (EA 2003, Bentruppenbäumer and Reser 2000, 2002):

- Rainforest dieback research
- Environmentally sensitive infrastructure design
- Environmental goods and services produced by waterways
- Visitor use impacts on water quality and ecology
- Stream biodiversity and stream health
- Visitor activities and behaviour patterns
ECOLOGICALLY SUSTAINABLE VISITOR USE OF AUSTRALIA'S WORLD HERITAGE AREAS

- Presentation of the World Heritage Area

The number of visitors to the Wet Tropics and their patterns of use have been estimated in three surveys since 1993. The most recent survey (2001–2002) gathered data using visitor observations, questionnaire surveys and visitor counters at 10 representative sites (Bentrupperbäumer and Reser 2002). This provided data for 10 sites on social impacts and visitor supply and demand including demographics, patterns of visitor use and visitor satisfaction (Bentrupperbäumer and Reser 2002). The most obvious direct impacts at intensively used sites and tracks were compaction, soil exposure, rock and root exposure, decreases in canopy cover (slight), vegetation cover, litter cover, seedling density, and plant diversity (Bentrupperbäumer and Reser 2000, 2002).

Visitor Monitoring System (VMS)
Researchers and the WTMA agreed that more visitor use research was needed, particularly monitoring of more sites both within and outside the Wet Tropics region (WTMA 2003, Weston and Goosem 2004). This has also been called for in the Wet Tropics Nature Based Tourism Strategy and the Wet Tropics Walking Strategy which identified the need for a visitor monitoring system to provide information relevant for policy, planning, monitoring and reporting. In response, the Rainforest CRC developed of a Visitor Monitoring System (VMS) which integrates visitor use and management evaluation (Wilson et al. 2004a). The three volume report identifies a range of monitoring approaches at site and regional scales. The objective is to identify whether visit management objectives were being met so that appropriate management responses could be made. The WTMA is testing the Visitor Monitoring System in collaboration with the Rainforest CRC (WTMS 2005) however implementation appears to be delayed.

The Wet Tropics VMS included both biophysical impacts of visitation and use as well as the impacts of settings and experiences on visitors. Adaptive management is recommended through correcting adverse trends impacting visitors and the environment (Bentrupperbäumer and Reser 2004). A key to the approach is use of hierarchical monitoring. Tour operators/guides would be required to fill out weekly rapid assessment proformas on the condition of sites. More intense monitoring would be required from rangers four times a year through filling in rapid assessment proformas for data including:

- inappropriate visitor behaviour
- the status of infrastructure
- need for signs or fenced off areas
- waste disposal problems
- disturbance to flora/fauna
- soil erosion
- decline in health of vegetation

The most intensive monitoring would be conducted by researchers twice yearly. However, results of field testing indicate these results may be site specific and not comparable across sites due to the high level of natural variability (Bentrupperbäumer and Reser 2004).

Evaluating Overall Management Performance
The WTMA are required under the Wet Tropics World Heritage Management and Protection Act 1993 to report annually on their management performance and on the state of the Wet Tropics (Table 8). Annual reports give information on measures taken to conserve and protect World Heritage values as well as the achievement of organisational goals and targets, including on finances and human resources (EA 2003, WTMA 2004a, 2005). Every six years the WTMA is also required to provide a detailed report as part of Australia’s overall Periodic Report to the World Heritage Commission. Annual State of the Wet Tropics Reports and the Periodic Report provide (1) summaries of the condition/state of natural World Heritage values (particularly biodiversity) and the integrity of the World Heritage Area; (2) identified threats and pressures impacting the World Heritage Area (Table 9); and (3) listed the management responses taken to address pressures (plans, policies strategies etc.) (Table 9).
The most recent State of the Wet Tropics Report 2004–2005 reported the management of pressures/threat under eight core themes: climate change, regional growth, landuse activities, infrastructure, altered fire regimes, pest plants, pest animals, and pathogens. Visitor use was briefly reported under landuse activities. The Periodic Report to the World Heritage Commission reported management of threats/pressures as five core themes with visitor use identified as a separate core theme. Reports describe pressures and threats, identify causes and in some cases effects using a range of indicators (Table 9). Specific data provided include regional trends in population, tourism numbers, land clearing and levels of community infrastructure. Climate change has recently been given particular emphasis. Management responses addressing threats/pressures are reported. These are a range of plans, policies strategies as well as staffing and financial resources provided to the WTMA (Table 10). Responses include management of community service infrastructure, clearing, fragmentation and of pests, fire and visitation (EA 2003, WTMA 2003, 2004, 2005). However, the WTMA do not assess the effectiveness of any of their responses to managing threats including effectiveness of plans/strategies etc. Nor do they identify that this is needed.

Table 8: Summary of core themes and indicators used to report management of threats/pressures to biodiversity

<table>
<thead>
<tr>
<th>Direct threats and pressures affecting biodiversity</th>
<th>Direct pressure indicators</th>
<th>Management actions to mitigate threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clearing</td>
<td>Linear service corridors</td>
<td>Statutes</td>
</tr>
<tr>
<td>• Regional clearing external to property</td>
<td>Impoundments</td>
<td></td>
</tr>
<tr>
<td>• Clearing within property</td>
<td>Patch clearings</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Boundary anomalies</td>
<td></td>
</tr>
<tr>
<td>2. Fragmentation</td>
<td>Powerlines</td>
<td>Policy</td>
</tr>
<tr>
<td>• External fragmentation</td>
<td>Roads</td>
<td></td>
</tr>
<tr>
<td>• Internal fragmentation</td>
<td>Railways</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Impoundments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cableways</td>
<td></td>
</tr>
<tr>
<td>3. Habitat alteration</td>
<td>Forest dieback</td>
<td>Land ownership</td>
</tr>
<tr>
<td></td>
<td>Altered fire regimes</td>
<td></td>
</tr>
<tr>
<td>4. Environmental Pests</td>
<td>Environmental weeds</td>
<td>Aboriginal interest in land</td>
</tr>
<tr>
<td></td>
<td>Vertebrate pests</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Invertebrate pests</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Exotic diseases</td>
<td></td>
</tr>
<tr>
<td>5. Altered flow regimes</td>
<td>Drainage of swamps etc</td>
<td>Rehabilitation</td>
</tr>
<tr>
<td></td>
<td>Water extraction and impoundments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stream fragmentation and environmental flows</td>
<td></td>
</tr>
<tr>
<td>6. Community infrastructure</td>
<td>Powerlines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Roads</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Telecommunications</td>
<td></td>
</tr>
<tr>
<td>7. Tourism &amp; recreation</td>
<td>Visitor numbers and demographics</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Economics of visitation</td>
<td></td>
</tr>
<tr>
<td>8. Regional demographics</td>
<td>Subregional population pressures and trends</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual report in which plan (etc) was identified</th>
<th>Plan/policy/strategy</th>
<th>Key aims of plan/strategy</th>
<th>Results reported</th>
</tr>
</thead>
<tbody>
<tr>
<td>WTMA 2001</td>
<td>Wet Topics Nature Based Tourism Strategy</td>
<td>Basis for tourism management in the Wet Tropics. Zoning plan - 12 tourism precincts recognised. Cooperation between stakeholders encouraged (tourism industry, management agencies, indigenous people, conservation groups and the community). 170 walks in the region are identified and aims of plan are to give a coordinated approach to management of tracks. The aim is to reduce impacts on high use/high profile trails/nodes.</td>
<td>The existence of this plan also mentioned in 2002, 2003, 2004, 2005 but there is no evaluation of effectiveness of plan.</td>
</tr>
<tr>
<td>WTMA 2002</td>
<td>Measuring and Monitoring Impacts of Visitation and Use in the Wet Tropics World Heritage Area 2001–2002 (Bentrupperbaumer and Reser 2002)</td>
<td>Site based survey (10 sites) to quantify/estimate visitation, visitor attitudes and demographics using traffic counts, site observation and questionnaires.</td>
<td>Results of visitor monitoring survey (10 sites) briefly reported in WTMA (2004) in terms of visitor motivations, numbers and demographics. Second visitor survey at same 10 sites undertaken—no results reported yet WTMA (2005).</td>
</tr>
<tr>
<td>WTMA 2003</td>
<td>Wet Tropics Visitor Monitoring System (VMS)</td>
<td>Range of monitoring approaches proposed at regional and site scales.</td>
<td>No results reported—initial trials underway. Funding limiting.</td>
</tr>
<tr>
<td>WTMA 2004a</td>
<td>Forest Dieback Monitoring System (Worboys, S. 2006)</td>
<td>Develop framework to monitor recovery or progression of vegetation dieback including pro formas and indicators</td>
<td>Extensive baseline data on four sites.</td>
</tr>
<tr>
<td>WTMA 2005</td>
<td>The Wet Tropics Visitor Monitoring System (VMS) was finalised Reser 2004a, Volume 1 Bentrupperbaumer and Volume 2 Wilson and Turton 2004, Volume 3 Bentrupperbaumer and Reser 2004b).</td>
<td>Range of monitoring approaches proposed at regional and site scales—involvement of researchers, QPWS, tourism industry and the WTMA. Assess both biophysical and social impacts and trends and monitor the effectiveness of both management agency and tourism industry in matching visitor expectations with visitor behaviour and opportunities.</td>
<td>No results reported.</td>
</tr>
</tbody>
</table>
Performance in Managing Visitor Use

Sustainable visitor use is an objective of the Wet Tropics Nature Based Tourism Strategy and Wet Tropics Conservation Strategy (2004) (WTMA 2000b, WTMA 2004b). Surprisingly, the WTMA do not directly assess (in their annual management reports) the extent to which these plans have contributed to sustainable visitor use (WTMA 2003, 2004, 2005). The State of the Wet Tropics 2002-2003, the most comprehensive annual report to date, identified visitor use as a pressure but briefly reported management only in terms of economic worth and the number of visitors. The most recent State of the Wet Tropics Report (2004–2005) also states that greater demands for recreation and tourism facilities are pressures but again visitor use is reported only in only terms of tourism supply and demand information, for instance visitor numbers and demographics including number of visitors, condition of infrastructure, number of sites visitors visit and visitor satisfaction. These data are from a report on results of visitor surveys at 10 sites during 2001–2002 (Bentrupperbäumer and Reser 2002).

Reporting the management of visitor use of the Wet Tropics also includes identification of management actions taken to mitigate visitor impacts. Actions include plans and actions to manage tourism and recreation include provision of tourism infrastructure (development of walking tracks, visitor centres), visitor impact research and monitoring projects in progress or completed, tourism and recreation management plans and strategies, and best practice visitor behavior approaches (Table 10). However, there is no evidence presented or the effectiveness of plans. Although sustainable visitor use is an objective of the WTMA, no assessment was given of whether visitor use was sustainable based on evidence. It is important to not that this is not identified a limitation of the assessment or a gap in research. For example, Bentrupperbäumer and Reser’s visitor survey findings are not related to the achievement of visitor use management objectives.

Limitations of the Evaluation of Visitor Use

- The strategic direction of research is reported but results of research and assessment usually not publicly reported (even briefly).
- There was little evaluation the effectiveness or shortcomings of visitor use plans and strategies.
- It was not reported whether visitor impact monitoring data has been used to improve management.
- There is no overall assessment of whether visit use is sustainable.
- Forest dieback disease is reported as threat—and the extent of the threat and management actions to mitigate this are reported but this threat is not related to tourism.
- Exotic species are reported as threats—together with an assessment of the extent of the threat and management actions taken but the spread of exotic species is not related to visitor use.
- The WTMA states that visitor management evaluation is limited by lack of information on ecosystem composition structure and function through time including frequency, intensity, duration and spatial patterns of disturbance at multiple scales.
- The WTMA state there is a lack of variables which serves as appropriate indicators of ecosystem condition.
- The WTMA state there is a need for a reference database that describes acceptable and unacceptable ranges for variables water extraction and storage, and for pest animals.
- From the literature review, it appears that the need for adaptive management needs to be better recognised.
- Assessing and reporting the ecological sustainability of visitor use has not been implemented.

Best Practices in the Evaluation of Visitor Use

- The extent of visitor use is objectively measured in some areas.
- A range of biophysical impacts of visitor use has been identified.
- Clear objectives for visitor use have been identified based on recognition of biophysical (ecological) impacts of visitor use and that visitor use is a threat/pressure to natural values.
- Plans for attaining visitor use objectives have been developed.
- There is some recognition that assessment to measure achievement of the objectives of visitor management plans is needed.
Chapter 8

GONDWANA RAINFORESTS OF AUSTRALIA: BEST PRACTICE USE OF AD HOC RESEARCH FOR REPORTING ON VISITOR USE

The approach taken for Gondwana Rainforests of Australia (formerly known as the Central Eastern Rainforest Reserves), is an example of how to make the best of ad hoc research and assessment. Currently there is an overall management evaluation strategy Gondwana Rainforests of Australia based on compiling and organising existing assessment, but no evaluation report—the information will be used for the 2009 Periodic report to the World Heritage Committee and the next NSW State of the Parks Report.

Context
The Gondwana Rainforests of Australia comprises almost 50 individual reserves with a fragmented distribution from near Newcastle in NSW to east of Brisbane in Queensland (Table 1, Figure 1). Management is complex due to the involvement of two State governments and the variety of tenures of individual reserves (including national parks, nature reserves, flora reserves, conservation parks, State forest, Rabbit Board paddock and Queensland prison purpose land: Table 1) (DEH 2000). Individual reserves are managed under the jurisdiction of relevant State government agencies. Overall coordination is directed by a Commonwealth, New South Wales and Queensland government policy document, the ‘World Heritage Central Eastern Rainforest Reserves of Australia Strategic Overview for Management 2000’ which is implemented by three committees, the Gondwana Rainforests of Australia Coordinating Committee, the Gondwana Rainforests of Australia Steering Committee, and the Community and Technical and Scientific Advisory Committee (DEH 2000).

Gondwana Rainforests of Australia faces a variety of threats, the most important of which include: inappropriate fire regimes; exotic plants; exotic animals; vegetation dieback from the exotic fungus Phytophthora cinamonni and localised damage at heavy uses sites due to increased visitation (Table 2, Chester and Bushnell 2005). The NSW DEH has stated that most of these are not specifically addressed in current plans of management for individual reserves (DEH 2000, pg. 24). Many reserves, such as State forests in QLD, lack a plan of management, even though this is a requirement of World Heritage Listing (DEH 2000). Management plans for other reserves are at various stages with many yet to be implemented or developed. Some current plans do not specifically address World Heritage objectives (Chester and Bushnell 2005).

Increasing visitation is a threat across most Gondwana Rainforests of Australia reserves, particularly reserves in Queensland which are adjacent to the most heavily populated part of the State. North east NSW is also experiencing rapid regional growth and development (DEH 2000).

There is no requirement for management agencies to provide assessments of management performance in addition to the World Heritage periodic reporting requirements and NSW State of the Parks reporting requirements (Chester and Bushnell 2005).

Visitor Use
Tourism is one of the key economic values of Gondwana Rainforests of Australia with over 2 million visitors per year, most of which occurs in Queensland reserves (EA 2003, Chester and Bushnell 2005). Tourism provides significant economic benefits particularly for nearby communities contributing directly and indirectly to employment, income and output of the regional economies (EA 2003). Visitor use is identified as a threat at localised areas across most of the parks and reserves of Gondwana Rainforests of Australia.
Ecological Research and Assessment

There has been considerable scientific research and assessment in Gondwana Rainforests of Australia undertaken by many research organisations and individuals including universities, State and Commonwealth agencies and corporate bodies (Table 3). However, the focus of research has not been strategically directed and therefore managers lack appropriate scientific and technical information (EA 2003, Chester and Bushnell 2005). In this respect, the Periodic Report on Gondwana Rainforests of Australia to the World Heritage Commission recommended the development of a strategic approach to assessment both as a whole of property approach and in line with respective State agency objectives (EA 2003). The Periodic Report also identified that among the most significant factors affecting the management of Gondwana Rainforests of Australia were the need to monitor World Heritage values and to develop systems for storage and distribution of resource data and research results.

Because research and assessment has been ad hoc the NSW Department of Environment and Conservation (DEC) commissioned the Rainforest Cooperative Research Centre to develop a Monitoring Strategy which pulled together existing research and assessment to provide information for the 2009 Periodic report to the World Heritage Commission World Heritage and for NSW State of Parks Reporting. The Monitoring Strategy will be reviewed after 2009. The criteria were that the Monitoring Strategy should make use of current monitoring and research with new programs only proposed where significant gaps were identified (Chester and Bushnell 2005).

The Monitoring Strategy was based on a review of the scope of existing research and assessment. Chester and Bushnell (2005) then conducted a ‘Gap Analysis’ to determine what essential new monitoring was needed and then organised current research and monitoring and required monitoring in a table format under the four principle management objectives of the World Heritage Convention: protection, conservation, rehabilitation and presentation of World Heritage values. Based on the analysis and categorisation of research and monitoring, indicators for each of the four objectives were identified and prioritised (Table 11). Essential indicators were defined as those allowing trends in the state of World Heritage values to be monitored over time.

Visitor Use Research and Assessment

Visitor research/assessment is currently conducted for a few Gondwana Rainforests of Australia reserves and comprises measuring direct impact of visitor use including damage from vehicles, human waste disposal, soil erosion, bush campsites, walking tracks and horse-riding. Visitor numbers are monitored at a limited number of sites using traffic and pedestrian counters (EA 2003, Chester and Bushnell 2005).

There are many studies and monitoring programs for indirect impacts of visitor use such as feral animals (foxes, cats), weed invasion, exotic fungal pathogens (Bell Miner disease associated with forest dieback), internal fragmentation and habitat clearance for provision of community infrastructure (e.g. powerlines).

The Monitoring Strategy developed by Chester and Bushnell (2005) proposes that visitor use will be assessed under the management goal of ‘presenting World Heritage values’. This differs to the approach used for the Tasmanian Wilderness, where visitor use was identified as a threat by the Parks and Wildlife Service and management of visitor use was evaluated relative to the goal of protecting World Heritage values (TPWS 2004).

Chester and Bushnell (2005) identified that visitor use monitoring currently being undertaken can provide information on the following essential indicators: number of visitors, number of sites visited, condition of tourism facilities and visitor satisfaction (Table 10. They recommend that current monitoring is continued with agencies attempting to secure long term commitment to measure the indicators. These indicators are also the broad scale indicators used in New South Wales State of Parks reporting for tourism and recreation management (Chester and Bushnell 2005).

Chester and Bushnell 2005 recognise weeds, feral animals, and fungal pathogens are threats and it is proposed these should be evaluated under the objective ‘rehabilitation of values’. They have not recognised that these processes are facilitated by tourism activities and infrastructure (Table 10).
Table 10: Summary of indicators relevant to management visitor use of Gondwana Rainforests of Australia that will be used to inform the 2009 World Heritage report on Conservation of World Heritage values and NSW State of Parks reporting

<table>
<thead>
<tr>
<th>Management objective</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conservation of values</strong></td>
<td></td>
</tr>
<tr>
<td>• Water quality</td>
<td>Monitoring effluent quality at key pollution sites (e.g. guest house sewage treatment). Monitor water quality in streams.</td>
</tr>
<tr>
<td><strong>Rehabilitation of values</strong></td>
<td></td>
</tr>
<tr>
<td>• Weed control</td>
<td>Species of weed per reserve Number of invasive species Scale of infestation or degree to which weeds have penetrated each reserve</td>
</tr>
<tr>
<td>• Feral animal control</td>
<td>Number of feral animals per reserve Number of invasive species</td>
</tr>
<tr>
<td>• Dieback (fungal pathogen)</td>
<td>Bell Miner associated dieback—ha affected Phytophthora associated dieback—ha affected.</td>
</tr>
<tr>
<td>• Erosion</td>
<td>Ha of erosion of erosion control within park</td>
</tr>
<tr>
<td><strong>Threatened species and threat management</strong></td>
<td>Threatened species recovery plans—Percent recovery plans/number of threatened species Number of threat abatement plans</td>
</tr>
<tr>
<td><strong>Presentation of values</strong></td>
<td></td>
</tr>
<tr>
<td>• Tourism supply and demand</td>
<td>Number of visitors Number of sites visited Condition of tourism facilities Visitor satisfaction</td>
</tr>
</tbody>
</table>

Source: Chester and Bushnell 2005

Limitations of the Evaluation of Visitor Use
- There is little strategic, qualitative measurement of the extent of visitor use.
- Visitor use is recognised a localised threat. However, clear statements and objectives for management of visit use as a threat are lacking. There are also few plans for attaining visitor use objectives.
- Visitor impact monitoring in Gondwana Rainforests of Australia is ad hoc and therefore managers cannot direct what monitoring occurs, nor maintain monitoring programs. There are no terrestrial ecological indicators of visitor use impacts from either activities or infrastructure (Chester and Bushnell 2005). Water quality is the only ecological indicator of tourism impacts and it is assessed under the objective of conservation of World Heritage values.
- No adaptive management for visitor use.
- There is no assessment and reporting the ecological sustainability of visitor use based on objective data.

Best Practices in the Evaluation of Visitor Use
- Visitor use is recognised a localised threat, however statements and objectives for management as a threat are lacking.
Chapter 9

DISCUSSION: WHAT DOES BEST PRACTICE MANAGEMENT OF ECOLOGICALLY SUSTAINABLE VISITOR USE INVOLVE?

Management agencies recognise the need to assess their performance in achieving the objectives for which World Heritage Areas were listed: to identify protect, conserve, present and where appropriate rehabilitate the natural World Heritage values. Agencies are required, under legislation, to regularly report on the extent to which they have achieved these objectives. To do this they have adopted a variety of approaches with some agencies relatively well established in terms of evidence based performance reporting while others are still developing capacity in this.

As visitor use is identified as a threat or pressure for nearly all World Heritage Areas, agencies should be assessing and reporting their performance in the management of visitor use in terms of protecting natural values as well as presenting natural values to the public.

Seven Step Process for Sustainable Visitor Use

For ecologically sustainable management of visitor use to occur in a park, management agencies should generally:

• Know what visitor use is occurring in the protected area (who, where and when, Hornback and Eagles 1999; Stolton and Dudley 1999; Eagles et al 2000; Buckley 2002b, 2004; Castley et al. 2008; Hadwen et al. 2007).
• Based on information of visitor use and general and specific recreational ecology research recognise the range of potential biophysical (ecological) impacts of visitor use (Stolton and Dudley 1999; Newsome et al. 2002; Brown et al. 2006, Castley et al. 2008)
• Formulate clear, concise statements or objectives for visitor use based on identifying that visitor use has biophysical (ecological) impacts which are threats or pressures to natural values (Jones 2005, Jones and Dunn 2000).
• Develop specific management plans and strategies for attaining the identified objectives of ecologically sustainable visitor use (Buckley 2004a; Moore et al. 2003).
• Implement systematic, strategic monitoring to provide data on condition and change in condition as a result of visitor use (Buckley 1998; Newsome et al. 2002; Castley et al. Under Review).
• Assess and report on the ecological sustainability of visitor use and on achievement of management objectives for visitor use based on information from monitoring (Hockings et al. 2000, 2006).
• Take corrective actions necessary to achieve planned results (Hockings et al. 2000, 2006; Jones 2005, Jones and Dunn 2000).

Based on the literature review (Ch 1–3) and this review of best practices in research monitoring and assessing visitor use (Ch 4–7) we have found that only one management agency (Tasmania Parks and Wildlife Service) currently undertakes all of the following seven steps for ecologically sustainable management of visitor use in Australia’s World Heritage Areas. Other management agencies are aware of the need but are still developing capacity (Table 11).

Step 1: Know what visitor use is occurring.

Effective management of protected areas depends upon information. Managers need to know how many visitors there are, when the come, where they go and what the do. Although all the World Heritage Areas had some estimate of total visitor loads (Table 2), and some had more detailed visitor information, few have reported on going monitoring of visitors at many sites.
**Step 2: Recognise the range of biophysical impacts.**

There is variation among agencies in the extent to which visitor impacts have been researched and reported (Table 3). Agencies with collaborative research arrangements with external bodies have been able to direct strategically research and monitoring. These arrangements affect the extent to which impacts are recognised and listed in reports. An additional issue is that even where agencies recognise the role of visitors in direct impacts (trampling, erosion etc) they are often failing to recognise/report on indirect impacts (Tables 2, 11). This occurs even when potential indirect impacts (spread of weeds feral animals and fungal pathogens) are listed as major threats for the natural values of the area (Table 2).

**Step 3: Management objectives for visitor use identify that visitor use has biophysical/ecological impacts and is a threat/pressure to natural values.**

All agencies recognise that a specific objective of World Heritage Convention is to provide a range of recreational experience in a range of setting in order to present World Heritage values to the public (EA 2003). Nearly all agencies recognise that visitor use has some type of negative biophysical impacts (Table 2). However, many agencies do not directly make the link in their reporting between visitor use and threats to natural values. For example, only the Parks and Wildlife Service of Tasmania reports visitor impacts under threats to natural values. Others report on visitor use objectives under visitor satisfaction type criteria but not under threats to natural values criteria as well.

**Step 4: Plans for attaining visitor use objectives have been developed.**

Agencies have developed specific plans to manage visitor use. These include tourism plans (e.g. the Wet Tropics Nature Based Tourism Strategy 2000), and Conservation Plans (e.g. the Wet Tropics Natural Resources Management Plan 2002 and the Wet Tropics Conservation Strategy 2004). In addition specific plans are often required for different visitor activities or infrastructure such as walking tracks (e.g. Tasmanian Wilderness Overland Track: Draft Recreation Zone Plan 2006).

Such plans often recognise that visitor activities and infrastructure have biophysical and social impacts. In some cases plans have been developed in collaboration with range of stakeholders. Specific plans are more detailed than overall management plans but lead from these – taking their direction from the overall management objectives for the area provided by the Management Plan.

**Step 5: Systematic, strategic monitoring of indicators to determine if management plans are effective.**

Agencies recognise that adequate scientific information from research and monitoring is required for effective management. Several agencies have developed relationships with external research organisations and are able to focus the direction of research. This provides information on impacts and effectiveness of strategies/plans/policies. Results are available for managers through development of effective scientific and technological systems and services. However, most agencies do not have resources to implement strategic monitoring of visitor use.

**Step 6: Assessing and reporting the ecological sustainability of visitor use.**

Few agencies evaluate and report their management in terms of protecting natural values from the threat of visitor use. Also, few agencies assess and report on the effectiveness of plans and policies developed to mitigate impacts of visitor use relative to identified management goal of protection of values based on qualitative data from monitoring and research.

**Step 7: Adaptive management.**

Although there is general recognition and agreement among managers and academics that visitor impact management can be improved by applying results of strategic monitoring programs this does not seem to happen consistently (EA 2003).
## ECOLOGICALLY SUSTAINABLE VISITOR USE OF AUSTRALIA’S WORLD HERITAGE AREAS

Table 11. Extent to which management agencies for four World Heritage Areas have implemented the seven steps process for ecologically sustainable management of visitor use

<table>
<thead>
<tr>
<th>#</th>
<th>Step</th>
<th>Tasmanian Wilderness</th>
<th>Great Barrier Reef World Heritage Area</th>
<th>Wet Tropics World Heritage Area</th>
<th>Gondwana Rainforests of Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Know what visitor use is occurring in the Area.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes, but limited</td>
<td>Ad Hoc</td>
</tr>
<tr>
<td>2.</td>
<td>Recognise the range of biophysical impacts.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Ad hoc</td>
</tr>
<tr>
<td>3.</td>
<td>Formulating clear, concise statements or objectives for visitor use</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes- Visitor use is recognised a localised threat – but clear statements and objectives for management as a threat are lacking.</td>
</tr>
<tr>
<td></td>
<td>based on identifying that visitor use has biophysical (ecological)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>impacts and is a threat/pressure to natural values.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Development of plans for attaining visitor use objectives</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Not clear</td>
</tr>
<tr>
<td>5.</td>
<td>Systematic, strategic monitoring to measure achievement of objectives</td>
<td>Yes - This is</td>
<td>Yes - This is recognised as a priority</td>
<td>Yes - Recognised as a need.</td>
<td>No - The monitoring strategy uses existing ad hoc monitoring and research to provide data for required reporting.</td>
</tr>
<tr>
<td></td>
<td>of visitor management plans</td>
<td>recognised as a priority need, with some long term priority monitoring and research underway.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Adaptive management (taking corrective actions necessary to achieve</td>
<td>Yes</td>
<td>No - But this is recognised as a</td>
<td>No - But this is recognised as</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>planned results).</td>
<td></td>
<td>priority.</td>
<td>a priority.</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Assessing and reporting the ecological sustainability of visitor use</td>
<td>Yes</td>
<td>No - Performance in managing visitor use is not reported or assessed in terms of managing a threat. Visitor use is reported as reported as an economic asset and as a way of achieving key objective of presenting WH values.</td>
<td>No – Performance in managing visitor use is not reported or assessed in terms of managing a threat. Visitor use is reported by though identifying plans/policies/and research and monitoring.</td>
<td>No</td>
</tr>
</tbody>
</table>
ECOLOGICALLY SUSTAINABLE VISITOR USE OF AUSTRALIA’S WORLD HERITAGE AREAS

Recommendations
We recommend that Australian protected area management agencies need to:
- develop a consistent approach to monitoring and reporting
- develop greater expertise in monitoring and evaluating visitor impacts or utilise external expertise such as in research organisations
- have monitoring and evaluation of visitor use integrated into overall management evaluation frameworks
- have clear funding arrangements for research and monitoring to identify threats/pressures, determine baseline condition and measure trends in condition over time at prioritised locations
- integrate information from monitoring programs into management actions (adaptive management).

Conclusion
- Visitor use is a key pressure or threat, so sustainable tourism is a target rather than a reality.
- Assessing the ecological impacts of visitors is still limited in all World Heritage Areas.
- Improved processes for collecting data, reviewing, data and reporting and applying results are needed as currently sustainable visitor use of World Heritage Areas is a work in progress.
- Greater investment in research on sustainable tourism development is needed. This was identified as a national priority in Australia’s first periodic report to the World Heritage Commission (EA 2003).
- Visitor assessment including of impacts are limited by inadequate financial and staff resources in most agencies.
REFERENCES


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ECOLOGICALLY SUSTAINABLE VISITOR USE OF AUSTRALIA’S WORLD HERITAGE AREAS


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• Travel and tourism industry
• Academic researchers
• Government policy makers

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The STCRC has grown to be the largest, dedicated tourism research organisation in the world, with $187 million invested in tourism research programs, commercialisation and education since 1997.

The STCRC was established in July 2003 under the Commonwealth Government’s CRC program and is an extension of the previous Tourism CRC, which operated from 1997 to 2003.

Role and responsibilities
The Commonwealth CRC program aims to turn research outcomes into successful new products, services and technologies. This enables Australian industries to be more efficient, productive and competitive.

The program emphasises collaboration between businesses and researchers to maximise the benefits of research through utilisation, commercialisation and technology transfer.

An education component focuses on producing graduates with skills relevant to industry needs.

STCRC’s objectives are to enhance:

- the contribution of long-term scientific and technological research and innovation to Australia’s sustainable economic and social development;
- the transfer of research outputs into outcomes of economic, environmental or social benefit to Australia;
- the value of graduate researchers to Australia;
- collaboration among researchers, between researchers and industry or other users; and efficiency in the use of intellectual and other research outcomes.